United States
Department of
Agriculture

Natural
Resources
Conservation
Service

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

Soil Survey of Muskingum County, Ohio

How To Use This Soil Survey

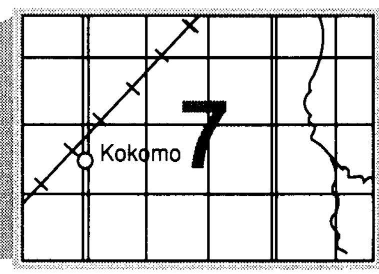
General Soil Map

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

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

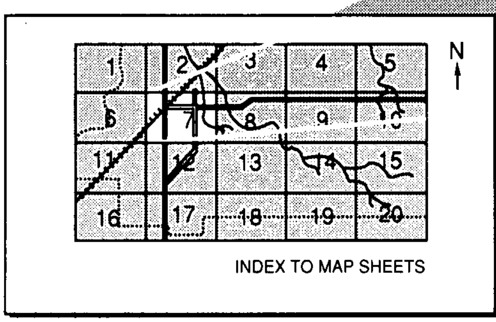
Detailed Soil Maps

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



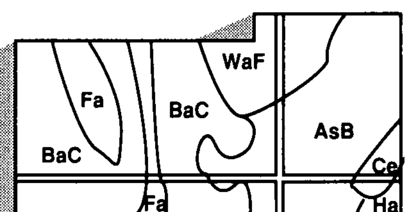
MAP SHEET

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



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

MAP SHEET



AREA OF INTEREST

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

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

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

Major fieldwork for this soil survey was completed in 1987. Soil names and descriptions were approved in 1988. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1987. This survey was made cooperatively by the Natural Resources Conservation Service and the Ohio Department of Natural Resources, Division of Soil and Water Conservation; the Ohio Agricultural Research and Development Center; and Ohio State University Extension. Funds were provided by the Muskingum County Commissioners. The survey is part of the technical assistance furnished to the Muskingum Soil and Water Conservation District.

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.

All programs and services of the Natural Resources Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: These contour strips of hay and corn on Keene soils slow runoff and help to control erosion.

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Issued June 1996

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Foreword

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

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

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

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

Lawrence E. Clark
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Soil Survey of
Muskingum County, Ohio

By Joseph R. Steiger, Natural Resources Conservation Service

Fieldwork by Dennis L. Brown, Thomas P. D'Avello, John A. Groves, Margaret G. Sams, Joseph R. Steiger, Daniel J. Crowner, Thomas E. Graham, Robert L. Hendershot, Paul C. Jenny, and Robert J. Parkinson, Natural Resources Conservation Service

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

MUSKINGUM COUNTY is in the east-central part of Ohio (fig. 1). It has a total area of about 416,640 acres, or 651 square miles. In 1980, the population was almost 83,000. Zanesville, which is near the center of the county, is the county seat.

Industry and farming are the major enterprises in Muskingum County, but pasture and woodland are the dominant land uses. Woodland and pastureland make up about 61 percent of the acreage in the county. Other land uses include cropland and residential and recreational development. Industry is highly diversified and includes the manufacturing of electrical components, glassware, concrete products, steel, iron castings, and food products. The production of coal, oil and gas, gravel, and limestone also are important industries in the county. Farm income is predominantly from dairy products, cash grain crops, and the sale of livestock. The major crops include corn, wheat, soybeans, oats, and hay. Specialty crops, such as vegetables, fruits, berries, and Christmas trees, are the most recent source of farm income.

Most of the soils on terraces, ridgetops, and shoulders are well suited to farming and residential development. If well managed, these soils are highly productive. Poor natural drainage is the major limitation affecting farming on the terrace soils that formed in lake sediments. The hazard of erosion, the slope, hillside slippage, a high shrink-swell potential, a moderate depth to bedrock, and slow permeability are the major management concerns on sloping to moderately steep soils. The steep or very steep soils are used mainly as woodland because they have severe limitations that affect other uses.

Figure 1.—Location of Muskingum County in Ohio.

This survey updates the soil surveys of Muskingum County published in 1930 *(27)* and in 1944 *(38)*. It provides additional information and has larger maps, which show the soils in greater detail.

General Nature of the County

This section provides some general information about Muskingum County. It describes climate; physiography, relief, geology, and drainage; natural resources; farming; and land ownership patterns.

Climate

Muskingum County is cold in the winter and quite hot in the summer. Winter precipitation, frequently in the form of snow, results in a good accumulation of soil moisture by spring and minimizes drought during summer in most areas. Normal annual precipitation is adequate for all of the crops that are adapted to the temperature and length of the growing season in the area.

Table 1 gives data on the temperature and precipitation in the survey area as recorded at Zanesville, Ohio, in the period 1951 to 1986. 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 21 degrees. The lowest temperature on record, which occurred at Zanesville on January 17, 1977, is -19 degrees. In summer, the average temperature is 71 degrees and the average daily maximum temperature is 82 degrees. The highest recorded temperature, which occurred on September 3, 1953, is 102 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.

Of the total annual precipitation, 22 inches, or 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 18 inches. The heaviest 1-day rainfall during the period of record was 4.37 inches at Zanesville on March 9, 1964. Thunderstorms occur on about 42 days each year.

The average seasonal snowfall is about 25 inches. The greatest snow depth at any one time during the period of record was 20 inches. On the average, 32 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 about 60 percent of the time possible in summer and 35 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 11 miles per hour, in spring.

Tornadoes and severe thunderstorms occur occasionally. These storms are usually local and of short duration and cause damage in a variable pattern.

Physiography, Relief, Geology, and Drainage

Muskingum County is on the unglaciated, dissected Allegheny Plateau. The underlying bedrock in the county is mainly sandstone, siltstone, clay shale, and limestone, all of which were derived from sediments laid down during the Late Mississippian, the Pennsylvanian, and the Early Permian periods *(32)*.

The oldest rock formations in the survey area formed approximately 330 million years ago during the Late Mississippian period. During that period, stratified layers of sandstone, coal, shale, and limestone developed. In Muskingum County, the Mississippian period is represented by the Logan Formation and the Maxville Limestone Formation. The Logan Formation is exposed primarily in the northwestern part of the county, and the Maxville Limestone Formation crops out in the southwestern part *(7)*.

During the Pennsylvanian period, sedimentary rocks belonging to the Pottsville and Allegheny Systems formed. These systems include deposits of sandstone, shale, clay, limestone, and coal. Outcrops of the Allegheny System are primarily in the central part of the county, but some are on the highest ridges and peaks in the western part. Outcrops of the Pottsville System are mostly in the western half of the county. Rocks of both systems are exposed in the deeper valleys of the east-central part of the county.

Also during the Pennsylvanian period, calcareous clay shales, well developed coals, and marly to well stratified beds of limestone developed from freshwater and marine sediments to form the Conemaugh and Monongahela Systems. Outcrops of the Conemaugh System are throughout the eastern part of the county. The Monongahela System is exposed mainly in the southeastern part of the county.

The final stages of preglacial deposition of freshwater sediments in the survey area occurred 275 million years ago. Remnants of Early Permian limestone, shale, and sandstone are on the highest knobs in Meigs Township. High Hill is the most notable remnant.

During the Pleistocene Epoch, huge continental glaciers formed at various times and moved southward over North America. The only ice sheet known to have entered the survey area was the Illinoian glacier. This glacier wound its way through the western part of the survey area, near the present village of Gratiot *(12)*. The glacier was not powerful enough to level the existing bedrock hills. It flowed around the hills and scoured the areas between the hills and the valleys but left the highest knobs and ridges of Mississippian age untouched. Evidence of the Illinoian glacier is along the western valleys and ravines, where thick deposits of glacial till have accumulated.

The Illinoian ice sheet and the more recent Wisconsinan ice sheets affected the survey area in other ways. Thick blocks of ice and accumulations of debris diverted the preglacial rivers and streams and created glacial lakes, which fingered into the survey area. The best evidence of this influence is found in the northern part of Muskingum County, where the Muskingum River diverts from its western course and flows south. The ancient Newark River once flowed westward through a wide valley in the northern part of the survey area. As the ice sheets advanced and retreated, the river channel became obstructed, which resulted in the formation of a huge lake at an elevation of about 850 feet. As the glacial lake filled with sediment and more water, an outlet formed to accommodate the overflow, thus creating the Muskingum River. The formation of other ancient streams followed a similar pattern.

As the last ice sheets retreated, new drainage systems formed. Meltwater from the glaciers formed meandering streams. These streams carried gravelly and sandy sediments, which were laid down to form glacial outwash terraces and alluvial flood plains. These terraces and flood plains are evident along the Muskingum and Licking River Valleys. Thick deposits of silt, clay, and fine sand remaining from the ancient glacial lakes were subjected to wind erosion, and thick deposits of loess accumulated on the nearby ridges and hills.

Over the course of geologic time, crustal uplifting, erosion, weathering, and deposition formed hills, ridges, and valleys. The eastern, or highest, part of the county is thoroughly and deeply dissected and consists of narrow ridges that spread in a dendritic pattern between the drainageways. The valleys are narrow and V-shaped and have steep slopes. Narrow flood plains are below the valley slopes. In this part of the county, the majority of the ridgetops are at least 1,000 feet above sea level and some reach an elevation of more than 1,100 feet. In the southeastern part of the county, the elevation ranges from 1,280 feet at High Hill, which is the highest point in the county, to 660 feet at the lowest point, which is where the Muskingum River leaves the county.

The central, western, and northern parts of the county are characterized by hilly or rolling relief. Ridges are wide, smooth, and rolling. Slopes are gentle, and valleys are wider than in the eastern part of the county. Ridgetops range from 900 to 1,000 feet in elevation.

The county is drained by the Muskingum River and its main tributaries, the Licking River and Wills, White Eyes, Wakatomika, Moxahala, Jonathan, Symmes, Brush, and Salt Creeks.

Natural Resources

Soil is the most valuable natural resource in Muskingum County. The soils in the county produce the crops that are marketed as grain or are fed to livestock *(9)*.

The supply of ground water is limited in most of the county. The flood plains along the Muskingum River are a source of ground water, and well fields for the city of Zanesville are on the flood plain north of the city. Wells in the fill of valleys generally are adequate for residential use, but in some areas they are unsuitable because of contamination from mine waste. In upland areas the water underlying sandstone layers of Pennsylvanian age is generally adequate for residential use. Most farms have one or more springs that are suitable for watering livestock or for domestic use. Runoff water also can be used if suitable ponds are available. The water quality of rivers and streams in some areas has been degraded by sediment and acid runoff from areas used for mining. Runoff carrying industrial waste, sediment from crop fields, animal waste, or fertilizer has also affected the quality of water in some areas.

Flooding in the Licking and Muskingum River Valleys has been partially controlled by flood-control projects of the U.S. Army Corps of Engineers and the Muskingum Watershed Conservancy District. Dillon Lake and Wills Creek Reservoir are the major flood-control projects in the county.

Bituminous coal is the most important mineral resource in the county and has been mined for many years. Prior to 1940, most of the coal mines in the survey area were deep mines. Since 1940, however, surface mining and strip mining have been used. Coal deposits of the Monongahela Formation are in the southeastern part of the county, which is a major coal-mining region. Coal deposits of the Allegheny Formation are mined throughout the county, but they are mainly west of the Muskingum River in the north-central part of the county, which is another major coal-mining area. Prior to the enactment of mine reclamation laws, mined areas were abandoned and were not reclaimed. Unreclaimed areas are severely eroded, barren, and unproductive, and acid runoff is common. Since the mine reclamation laws were enacted, mined areas have been reclaimed or are in the process of being reclaimed.

The county has a variety of other mineral and energy resources. Oil and natural gas have long been produced from strata of Silurian to Pennsylvanian age. Limestone of the Maxwell Formation is quarried in the county. The limestone has various uses, including crushed stone, concrete aggregate, and agricultural lime. A major limestone quarry that is used for producing cement is near Fultonham in the southwestern part of the county. Clay shale of the Allegheny Formation is mined in the southwest corner of the county near Roseville, which once had an important brick and pottery industry. Sand and gravel pits are scattered along the Muskingum River, in areas of glacial outwash.

Trees are a valuable but underdeveloped resource in the county. Timber is harvested, but most of it is transported outside the county to be processed into pulpwood, pallets, poles, lumber, and veneer products. Only a few sawmills in the county produce lumber products. Most of the harvested timber that remains in the county is used for fence posts or firewood.

Farming

Farming is an important source of income in Muskingum County. Most farms are a combined grain and livestock enterprise (fig. 2). General livestock farms and dairy farms are throughout the county. Intensive cash grain operations are concentrated in the northern part of the county, around Dresden and Frazeysburg.

Most of the farms in the county are owned by individuals or families *(37)*. The majority of the landowners are part-time farmers who receive income from sources other than farming. The average age of the farmers in the county is more than 50 years.

In 1982, there were 1,135 farms in Muskingum County and the average farm size was 185 acres *(10)*. Most of these farms ranged from 50 to 500 acres in size.

In 1982, the income from agricultural production in the county was about $22 million. About two-thirds of the total farm income was from livestock, mainly beef cattle, dairy cattle, and hogs. The remaining one-third of the total income was from cash crop production, mainly corn *(26)*.

Land Ownership Patterns

About 210,000 acres, or roughly half of the land in the county, is owned by farmers *(37)*. About 10,000 acres is owned by the State or is federally owned. About 100,000 acres is owned or leased by private mining companies. About 23,000 acres is urban land *(23)*. Most of the remaining 74,000 acres is idle land that is held by absentee landowners. Most of this idle land is used only for oil production or for hunting. Some of the land is held for investment purposes because of the possible presence of large energy reserves of coal, oil, and gas.

How This Survey Was Made

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

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

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations,

Figure 2.—Crops and pasture in an area of Glenford and Newark soils. The woodlands in the background are in steep areas of Coshocton and Westmoreland soils.

supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

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

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

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

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

Some of the boundaries on the soil maps of Muskingum County do not match those on the soil maps of adjacent counties, and some of the soil names and descriptions do not fully agree. The differences are the result of improvements in the classification of soils, particularly modifications or refinements in soil series concepts. Also, there may be differences in the intensity of mapping or in the extent of the soils within the survey area.

Map Unit Composition

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

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

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

Survey Procedures

The general procedures followed in making this survey are described in the "National Soil Survey Handbook" of the Natural Resources Conservation Service. The soil survey maps made for conservation planning on individual farms prior to the start of the project soil survey were among the references used. Previous soil surveys of the county were also used.

Before the actual fieldwork began, preliminary boundaries of slopes and landforms were plotted stereoscopically on aerial photographs that were taken in 1977 at a scale of 1:15,840. United States Geological Survey topographic maps at a scale of 1:24,000 were studied to relate land and image features.

Soil scientists traversed the landscape on foot to examine the soils. In areas where the land use is intensive, such as areas of the Glenford-Newark-Fitchville association, the intervals of the traverses were as close as 200 yards. In areas where the land use is less intensive, such as areas of the Westmoreland-Coshocton-Rigley association, traverses were about one-quarter mile apart.

As the traverses were made, the soil scientists divided the landscape into segments that reflected differences in the use and management of the soils. For example, a hillside would be separated from a swale and a gently sloping ridgetop would be separated from a very steep hillside. In most areas, soil examinations along the traverses were made at intervals of 100 to 800 yards, depending on the land use and the pattern of the soils. Observations of details, such as landforms, uprooted trees, vegetation, road banks, and animal burrows, were made consistently without regard to spacing. Soil boundaries were determined on the basis of soil examinations, observations, and photo interpretation. The soil material was examined to a depth of about 4 feet with the aid of a hand probe or an auger. The pedons described as typical were observed and studied to a depth of 5 or 6 feet in pits that were dug with shovels, mattocks, and digging bars.

At the beginning of the survey, sample blocks were selected to represent the major landscapes in the county. These areas were mapped at a rate that was roughly half that used in the rest of the county. Extensive notes were taken on the composition of map units in the sample blocks. These preliminary notes were modified as mapping progressed and were used to reach the final assessment of the composition of the individual map units.

Some transects were made to determine the composition of soil complexes, especially the Rigley-Coshocton, Westmoreland-Guernsey, and Lowell-Gilpin complexes.

Samples used 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 analysis of engineering properties was made by the Ohio Department of Transportation, Division of Highways, Bureau of Testing, Soil and Foundation Section, Columbus, Ohio. A description of the laboratory procedures can be obtained on request from these laboratories. The results of the laboratory analyses can be obtained from 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 Natural Resources Conservation Service, State Office, Columbus, Ohio.

After completion of the soil mapping on aerial photographs, map unit delineations were transferred to the publication atlas sheets, which are a set of aerial photographs taken in November 1981.

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

David T. Scott, soil scientist, Natural Resources Conservation Service, helped prepare this section.

1. Wellston-Zanesville-Alford Association

Deep, well drained and moderately well drained, gently sloping and strongly sloping soils that formed in loess and material weathered from sandstone and siltstone; on uplands

These soils are on some of the broader upland ridgetops that are covered by a mantle of loess. The loess varies in thickness, but commonly it is thickest at the center of the ridgetops. In areas where the loess is thick, the soils formed entirely in loess. In areas where the loess is thinner, the soils are underlain by sandstone and siltstone residuum or colluvium. The broad ridgetops consist of knolls and shoulders. Benches and saddles are between the knolls. Some of the ridgetops are slightly dissected by shallow drainage channels. Slopes range from 2 to 15 percent and are generally smooth and convex.

This association makes up about 8 percent of the county. It is about 25 percent Wellston soils, 20 percent Zanesville soils, 15 percent Alford soils, and 40 percent soils of minor extent.

The well drained Wellston soils are on broad ridgetops and shoulder slopes and in saddles between knolls. These soils formed in a mantle of loess and in the underlying sandstone and siltstone residuum. Permeability is moderate. Slopes are smooth and convex. The strongly sloping shoulder slopes are dissected by a few shallow drainageways.

The moderately well drained and well drained Zanesville soils are on benches and shoulders and in saddles on broad ridgetops. These soils formed in a mantle of loess and in the underlying sandstone and siltstone residuum or colluvium. They have a fragipan. A seasonal high water table is perched above the fragipan during extended wet periods. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan.

The well drained Alford soils are on knolls, in saddles, and on shoulder slopes of broad ridgetops and on shoulder slopes of dissected terraces at the margin of broad valleys. These soils formed in a thick mantle of loess. Permeability is moderate.

Of minor extent in this association are Coshocton, Gilpin, Glenford, and Rigley soils. The loamy Coshocton soils are on the concave side slopes of hills. The moderately deep Gilpin soils are on ridgetops and shoulders. Glenford soils are on terraces. They formed in lacustrine deposits. Rigley soils are on ridgetops and shoulders. They have more sand in the subsoil and substratum than the major soils.

Most areas of this association are used as cropland. Some areas near Zanesville are used for residential and commercial development. The Zanesville municipal airport is in an area of this association.

The soils in this association are well suited or moderately suited to crops and pasture. Erosion is the main management concern. About 25 percent of the acreage is prime farmland. Damage caused by surface crusting and frost heave is a management concern in areas used for alfalfa. Areas of this association are not used extensively as woodland, but the major soils are well suited to many upland tree species.

These soils are well suited or moderately well suited to use as sites for buildings and homes. Seasonal wetness is a limitation in areas of Zanesville soils. The slope is a management concern in strongly sloping areas. The Alford and Wellston soils are better suited to use as sites for septic tank absorption fields than the Zanesville soils. Restricted permeability in the lower part of the subsoil and seasonal wetness are limitations in areas of the Zanesville soils. The depth to bedrock is a limitation in areas of the Wellston soils. The slope is a management concern in strongly sloping areas.

2. Mertz-Keene-Frankstown Variant Association

Deep and moderately deep, gently sloping to steep, moderately well drained and well drained soils that formed in loess, colluvium, and material weathered from flint, siltstone, and shale; on uplands

These soils are on broad ridgetops and adjoining hillsides in an area known as Flint Ridge, which was a major prehistoric quarry site. Slopes range from 2 to 35 percent.

This association makes up less than 1 percent of the county. It is about 35 percent Mertz soils, 30 percent Keene and similar soils, 10 percent Frankstown Variant soils, and 25 percent soils of minor extent.

The deep, well drained Mertz soils are on gently sloping ridgetops and moderately steep and steep hillsides. These soils formed in flint and siltstone colluvium. Permeability is moderately slow. Slopes are convex and smooth.

The deep, moderately well drained, gently sloping and strongly sloping Keene soils are on broad ridgetops and shoulder slopes. These soils formed in a mantle of loess and in the underlying clay shale residuum. A seasonal high water table is perched in the lower part of the subsoil during extended wet periods. Permeability is moderately slow in the upper part of the profile and moderately slow or slow in the lower part. Slopes are smooth and convex.

The moderately deep, gently sloping, well drained Frankstown Variant soils are intermingled with Mertz soils on ridgetops. Frankstown Variant soils formed in a thin mantle of loess mixed with fragments of flint. Permeability is moderate.

Of minor extent in this association are the well drained Wellston, Rigley, and Westmoreland soils. Wellston soils are on ridgetops and shoulder slopes. They have more silt and less sand in the subsoil than the Mertz and Frankstown Variant soils. Rigley soils are on ridgetops. Westmoreland soils are on ridgetops and hillsides. Rigley and Westmoreland soils have fewer rock fragments in the subsoil than the Mertz soils, have more sand than the Keene soils, and are deeper over bedrock than the Frankstown Variant soils.

The gently sloping and strongly sloping areas of this association are generally used as farmland or pasture. The steeper areas are generally used as pasture or woodland.

The soils in gently sloping and strongly sloping areas are well suited or moderately suited to crops and pasture. About 20 percent of the acreage in this association is prime farmland. The hazard of erosion is the main management concern in areas used for farming. Hard flint fragments in some of the soils can interfere with cultivation, but the larger fragments have been removed in many of the areas used for crops. Frankstown Variant soils are droughty, and the droughtiness limits productivity. The soils in moderately steep and steep areas are well suited to woodland.

The soils in gently sloping and strongly sloping areas are better suited to use as sites for buildings and construction than soils in the steeper areas. In some gently sloping and sloping areas, however, the soils are only moderately deep over flint bedrock, and thus excavating for basements and utility lines is very difficult. Seasonal wetness is a management concern in areas of the Keene soils. The steeper areas are poorly suited to use as sites for buildings because erosion is a hazard during construction and the use of equipment is restricted.

The functioning of septic tank absorption fields is limited by flint bedrock at a depth of 20 to 40 inches in the Frankstown Variant soils, by seasonal wetness in the Keene soils, and by the restricted permeability in the Mertz and Keene soils. The gently sloping Mertz soils are the best suited of the major soils to use as sites for septic tank absorption fields, but suitability decreases as the slope increases.

3. Cincinnati-Coshocton-Homewood Association

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

These soils are on ridgetops and hillsides that have been smoothed by glaciation and partially dissected by erosion. The hillsides tend to be long and convex and are dissected by narrow ravines and concave slopes along drainageways. Slopes range from 2 to 25 percent.

This association makes up about 1 percent of the county. It is about 40 percent Cincinnati soils, 20 percent Coshocton soils, 10 percent Homewood soils, and 30 percent soils of minor extent.

The well drained, gently sloping and strongly sloping Cincinnati soils are on the lower ridgetops and on long, convex hill slopes. These soils formed in a mantle of loess and in the underlying glacial till, which is underlain by shale and siltstone. The soils have a fragipan. A seasonal high water table is perched in the lower part of the subsoil during extended wet periods. Permeability is moderate above the fragipan and moderately slow or slow in and below the fragipan.

The moderately well drained, strongly sloping and moderately steep Coshocton soils are on the higher ridgetops and hillsides. These soils formed in colluvium and residuum derived from sandstone, shale, and siltstone. A seasonal high water table is perched in the lower part of the subsoil during extended wet periods. Permeability is moderately slow or slow.

The moderately well drained, strongly sloping and moderately steep Homewood soils are on the lower concave slopes of hillsides and in narrow ravines. These soils formed in glacial till. They have a fragipan. A seasonal high water table is perched above the fragipan in the lower part of the subsoil during extended wet periods. Permeability is moderate above the fragipan and slow in the fragipan.

Of minor extent in this association are the well drained Alford, Gilpin, and Westmoreland soils on high ridgetops and hillsides. Also included are the somewhat poorly drained Newark and poorly drained Melvin soils on flood plains along small streams.

Most areas of this association are used as cropland or pasture. Areas along the steeper slopes and ravines are used as woodland. About 15 percent of the acreage is prime farmland, and a considerable acreage is recognized as locally important farmland.

Depending on the slope, these soils range from well suited to poorly suited to crops. Soils in gently sloping areas are best suited to cropland, and soils in moderately steep areas are poorly suited. The soils are well suited or moderately suited to hay and pasture. The hazard of erosion is the main management concern. The soils are well suited to woodland.

Cincinnati soils are better suited to building site development than the Coshocton and Homewood soils. The slope and seasonal wetness are the main management concerns. The shrink-swell potential is a limitation in the Coshocton and Homewood soils. The restricted permeability and wetness are limitations on sites for septic tank absorption fields. The slope is a management concern in moderately steep areas.

4. Coshocton-Westmoreland-Keene Association

Deep, moderately well drained and well drained, gently sloping to steep soils that formed in colluvium and residuum derived from sandstone, shale, and siltstone; on uplands

These soils are on narrow to broad, elongated ridgetops and hillsides that commonly have smooth, convex and concave slopes. The hillsides are dissected by steep, narrow, V-shaped ravines with drainageways that carry runoff water to small streams on narrow flood plains at the base of the hills. Slopes range from 2 to 40 percent.

This association makes up about 13 percent of the county. It is about 30 percent Coshocton soils, 30 percent Westmoreland soils, 10 percent Keene soils, and 30 percent soils of minor extent.

The moderately well drained, strongly sloping to steep Coshocton soils are in saddles and on the lower part of hill slopes and are in the coves of dissected hills. Some steeper areas are along narrow ridges and are on the slopes of V-shaped ravines. Coshocton soils formed in colluvium derived from sandstone, siltstone, and shale. A seasonal high water table is perched in the lower part of the subsoil during extended wet periods. Permeability is moderately slow or slow.

The well drained, strongly sloping to steep Westmoreland soils are on ridgetops and dissected hillsides. Some steeper areas are along narrow ridges and V-shaped ravines. Westmoreland soils formed in residuum and colluvium derived from sandstone, siltstone, and shale. Permeability is moderate.

The moderately well drained, gently sloping and strongly sloping Keene soils are on the broader ridgetops and benches. These soils formed in a mantle of loess and in the underlying clay shale residuum. Slopes are smooth and convex and are dissected by shallow drainageways. Keene soils in gently sloping areas are prime farmland. A seasonal high water table is perched in the lower part of the subsoil during extended wet periods. Permeability is moderate or moderately slow in the upper part of the profile and moderately slow or slow in the lower part.

Of minor extent in this association are Aaron, Berks, Newark, and Wellston soils. The moderately well drained Aaron soils are on ridgetops. They have more clay in the subsoil than the major soils. The moderately deep, well drained Berks soils are on steep hillsides and in ravines. The somewhat poorly drained Newark soils are on narrow flood plains. The well drained Wellston soils are on ridgetops. They have more silt and less sand than the Coshocton and Westmoreland soils and have fewer rock fragments in the solum.

Areas of this association are used as pasture, cropland, or woodland. About 10 percent of the acreage in this association is prime farmland.

Most of the cropland is on the gently sloping and strongly sloping ridgetops and benches. These areas are well suited or moderately suited to cultivated crops. Erosion is the main management concern. Areas on flood plains also are suitable for cropland if they are wide enough.

The steep hillsides are better suited to woodland than to crops or pasture. Productivity is generally higher in areas on north-facing slopes, which are cooler and wetter than south-facing slopes because of less exposure to the sun and wind. The steep slopes can restrict the use of logging equipment.

The gently sloping and strongly sloping ridgetops and benches are the best suited areas for building sites. Seasonal wetness and the hazard of erosion during construction are the main management concerns in these areas. The steeper slopes are poorly suited to use as sites for buildings because of the hazards of erosion and slippage.

The ridgetops also are the best suited areas for septic tank absorption fields, but seasonal wetness and the restricted permeability are limitations. Excessive downslope seepage of effluent is likely if septic tank absorption fields are installed on the steeper hillsides.

5. Westmoreland-Berks-Guernsey Association

Deep and moderately deep, well drained and moderately well drained, strongly sloping to very steep soils that formed in colluvium and residuum derived from siltstone and clay shale; on uplands

These soils are on dissected hillsides and narrow ridgetops. The hillsides commonly have a stairstep pattern, and narrow benches are between the slopes. Channels carrying surface runoff descend from the hillsides and carve out narrow ridges and V-shaped ravines. Bedrock is exposed along these ridges and ravines, creating bluffs on the ridges and waterfalls along the streams. Narrow flood plains and small streams are at the base of the hillsides. Relief along the valley slopes, from the ridgetops to the flood plain, is as much as 300 feet. Unstable soils are common along these slopes. Throughout the hills are old underground coal mines. Mine entrances, coal tailings, and acid drainage water are in some areas. Slopes range from 6 to 70 percent.

This association makes up about 25 percent of the county. It is about 30 percent Westmoreland soils, 10 percent Berks soils, 10 percent Guernsey soils, and 50 percent soils of minor extent.

The deep, well drained, strongly sloping to very steep Westmoreland soils are on the convex parts of benches and foot slopes and the less sloping parts of hillsides. They formed in residuum or colluvium derived from sandstone, siltstone, and shale. Permeability is moderate.

The moderately deep, well drained, moderately steep to very steep Berks soils are on steep and very steep hillsides. These soils formed in material weathered from shale, siltstone, and sandstone. Rock outcrops of sandstone and siltstone are common. Permeability is moderate or moderately rapid.

The deep, moderately well drained, strongly sloping to steep Guernsey soils are on shoulder slopes, benches, and foot slopes. These soils formed in clay shale residuum and colluvium. A seasonal high water table is perched in the lower part of the subsoil during extended wet periods. Permeability is moderately slow or slow.

Of minor extent in this association are the silt-mantled Alford, Keene, Wellston, and Zanesville soils on narrow ridgetops and the moderately well drained Lindside and Lobdell soils on narrow flood plains.

Most areas of this association are used as woodland or pasture. About 10 percent of the acreage in this association is prime farmland. Earlier in this century, much of the land in this association was used as pasture or cropland, which resulted in extensive erosion, the formation of gullies, and the loss of productivity. Most of the steeper areas are now used as woodland. Areas of this association are some of the most scenic areas in the county. Rugged terrain, small waterfalls, rock outcrops, and bluffs make these areas attractive and challenging sites for hikers and hunters.

Most of the cropland and pasture is on the narrow ridges, benches, and flood plains, which are the least sloping parts of the landscape. Controlling erosion is the main management concern in areas on the ridgetops and benches that are used for crops or pasture.

Most of the soils in this association are well suited to woodland. The steeper hillsides are better suited to woodland than to most other uses. Erosion is the main management concern. Productivity is higher on north- and east-facing slopes, which are cooler and wetter than south- and west-facing slopes because of less exposure to the sun and wind. Steep slopes restrict the use of logging equipment.

The best sites for buildings and septic tank absorption fields are on the ridgetops. Seasonal wetness is a problem in some ridgetop areas. Some areas on benches are subject to slippage.

6. Westmoreland-Coshocton-Rigley Association

Deep, well drained and moderately well drained, strongly sloping to very steep soils that formed in colluvium and residuum derived from siltstone, shale, and sandstone; on uplands

These steep and very steep soils are on highly dissected hillsides and ridgetops, on the upper part of convex hillsides, and in ravines. The hillsides have many intermittent drainage channels, which form dendritic drainage patterns. Siltstone and sandstone rock outcrops are common along streams. Most of the ravines descend into narrow flood plains, which have small streams. Terraces are on foot slopes along the margin of the flood plains. Slopes range from 8 to 70 percent.

This association makes up about 12 percent of the county. It is about 25 percent Westmoreland soils, 20 percent Coshocton soils, 15 percent Rigley soils, and 40 percent soils of minor extent.

The well drained, moderately steep to very steep Westmoreland soils are on ridgetops and dissected hillsides. These soils formed in colluvium and residuum derived from sandstone, siltstone, and shale. Permeability is moderate.

The moderately well drained, strongly sloping and moderately steep Coshocton soils are in saddles on ridgetops and in coves at the head of minor waterways on dissected hills. These soils formed in colluvium derived from sandstone, siltstone, and shale. Slopes are mostly concave. Seeps or springs are common. The seasonal high water table is in the lower part of the subsoil during extended wet periods. Permeability is moderately slow or slow.

The well drained, strongly sloping and moderately steep Rigley soils are on upland ridgetops, on shoulders of the broader ridgetops, and on the upper part of hillsides. These soils formed in loamy colluvium derived from sandstone. Ridgetop areas are generally long and narrow. Slopes are mainly convex. Bedrock outcrops are in some areas. Permeability is moderately rapid.

Of minor extent in this association are Aaron soils on shoulder slopes, benches, and ridgetops. Aaron soils are more clayey than the major soils. Also included are the somewhat poorly drained Newark and poorly drained Melvin soils on narrow flood plains.

Most areas are used as woodland or pasture. Earlier in this century, much of the land in this association was used as pasture or cropland, which resulted in extensive erosion, the formation of gullies, and the loss of productivity. Most of the steeper areas are now used as woodland. About 5 percent of the acreage in this association is prime farmland.

Most of the cropland is on the less sloping ridgetops or shoulder slopes. The hazard of erosion can be very severe in these areas if they are cultivated or plowed. Some narrow flood plains are well suited to cropland.

This association includes some of the most scenic areas in the county. These areas provide excellent habitat for wildlife, such as beaver, deer, fox, squirrel, turkey, grouse, and numerous species of song birds. Rugged terrain, small waterfalls, rock outcrops, and bluffs make these areas attractive and challenging sites for hikers and hunters.

Most areas of this association are moderately suited or poorly suited to pasture and moderately suited or well suited to woodland. The steeper hillsides are better suited to woodland than to pasture. Erosion is the main management concern. Productivity is higher on north-facing slopes, which are cooler and wetter than south-facing slopes because of less exposure to the sun and wind. Steep slopes restrict the use of logging equipment.

Areas on ridgetops are the best suited to use as building sites. Seasonal wetness is a limitation in areas of the Coshocton soils. The steeper hillsides are poorly suited or unsuited to building site development.

The best sites for septic tank absorption fields also are on the ridgetops. The steeper slopes are unsuited to use as sites for septic tank absorption fields because of excessive downslope seepage of effluent.

7. Lowell-Guernsey-Gilpin Association

Deep and moderately deep, gently sloping to very steep, well drained and moderately well drained soils that formed in colluvium and residuum derived from clay shale, limestone, and siltstone; on uplands

These soils are on smooth ridgetops, hillsides, and benches at the higher elevations in the county. Distinct benches on foot slopes are below the steeper hillsides and ridgetops. Limestone beds are present where the benches meet the hillsides. Seeps and springs are common on the benches. Narrow valleys of tributary streams are at the lower elevations. Slopes range from 2 to 70 percent.

This association makes up about 12 percent of the county. It is about 25 percent Lowell soils, 20 percent Guernsey and similar soils, 10 percent Gilpin soils, and 45 percent soils of minor extent.

The deep, well drained, strongly sloping to very steep Lowell soils are on ridgetops and hillsides. Some areas are on benches or foot slopes. Lowell soils formed in residuum derived from clay shale, limestone, and sandstone. Slopes are long and smooth and are commonly convex. A seasonal high water table is perched in the lower part of the subsoil during extended wet periods. Permeability is moderately slow.

The deep, moderately well drained, strongly sloping to steep Guernsey soils are on foot slopes, benches, and dissected hillsides. These soils formed in colluvium derived from clay shale. The surface is hummocky in many areas because of gullies and scars from landslides. A seasonal high water table is perched in the lower part of the subsoil during extended wet periods. Permeability is moderately slow or slow.

The moderately deep, well drained, gently sloping to very steep Gilpin soils are on ridgetops and hillsides in dissected uplands. These soils formed in residuum derived from sandstone and siltstone. Slopes are smooth and slightly convex. Permeability is moderate.

Of minor extent in this association are the reddish Upshur soils. These soils are in landscape positions similar to those of the Guernsey and Lowell soils. Also included are Berks, Westgate, Zanesville, and Lobdell soils. The stony Berks soils are in landscape positions similar to those of the Gilpin soils. Westgate and Zanesville soils are on the wider benches. They have a subsoil that is silty in the upper part. The moderately well drained Lobdell soils are on narrow flood plains.

Most areas of this association are used as pasture or woodland. About 5 percent of the acreage in this association is prime farmland. Gently sloping benches and some of the wider areas on flood plains are used as cropland. Erosion is the main management concern in areas on benches. The strongly sloping ridgetops and benches are suited to pasture.

The steeper hillsides are better suited to woodland than to cropland or pasture. Woodland productivity is usually higher on north- and east-facing slopes, which are cooler and wetter than south- and west-facing slopes because of less exposure to the sun and wind. Steep slopes can restrict the use of logging equipment.

The best building sites are on the strongly sloping ridgetops. Wetness is a problem in some ridgetop areas. The steeper hillsides are generally unsuited to building site development because of slippage and landslides in areas of the Lowell and Guernsey soils.

Most areas of this association are poorly suited to septic tank absorption fields. The depth to bedrock is a limitation in areas of the Gilpin soils, and restricted permeability and seasonal wetness are limitations in areas of the Guernsey and Lowell soils. The steeper hillsides are unsuited to use as sites for septic tank absorption fields because of excessive downslope seepage of effluent.

8. Morristown-Fairpoint-Bethesda Association

Deep, well drained, gently sloping to very steep soils that formed in reclaimed and unreclaimed coal mine spoil; on uplands

These soils are in areas that have been excavated for surface coal mining over the past 50 years and are on undisturbed hillsides and ridgetops in surrounding areas. Some of the mined areas have been reclaimed (fig. 3). Reclaimed areas have been graded to approximately the original contour. Unreclaimed areas consist of long, sinuous, irregular, steep and very steep ridges and trenches and the high vertical walls of abandoned mines. In the surface-mined areas, the original drainage patterns have been altered and ponds or lakes have been created. Slopes range from 1 to 70 percent.

This association makes up about 10 percent of the county. It is about 30 percent Morristown soils, 30 percent Fairpoint soils, 10 percent Bethesda soils, and 30 percent soils of minor extent.

Morristown, Fairpoint, and Bethesda soils are in areas that have been surface-mined for coal. They have moderately slow permeability. These soils differ mainly in acidity. Morristown soils are the least acid, and Bethesda soils are the most acid. Acidity is affected by the relative amounts of limestone, siltstone, sandstone, and shale in the spoil.

Of minor extent in this association are Westmoreland, Lowell, Berks, Rigley, Aaron, Guernsey, Coshocton, Keene, Newark, and Lobdell soils. The well drained Westmoreland, Lowell, Berks, and Rigley soils are in isolated unmined areas on ridges. The moderately well drained Aaron, Guernsey, Coshocton, and Keene soils are in unmined areas on ridgetops, in coves, and on benches. The somewhat poorly drained Newark and moderately well drained Lobdell soils are on flood plains. Also included are areas of mine dumps and pits, which contain very toxic materials, and areas of Udorthents in active mining areas.

Most of the areas of reclaimed mine spoil have been revegetated with grasses and legumes. Because the surface layer has been mixed with subsoil material, the content of organic matter is very low. Most of the soils have a low available water capacity because of the high content of rock fragments and the high density of the underlying material. Less than 2 percent of the acreage in this association is prime farmland.

Most areas of this association are poorly suited to crops, pasture, and woodland because of the limited available water capacity and the poor conditions for root development.

Most areas are poorly suited or unsuited to use as

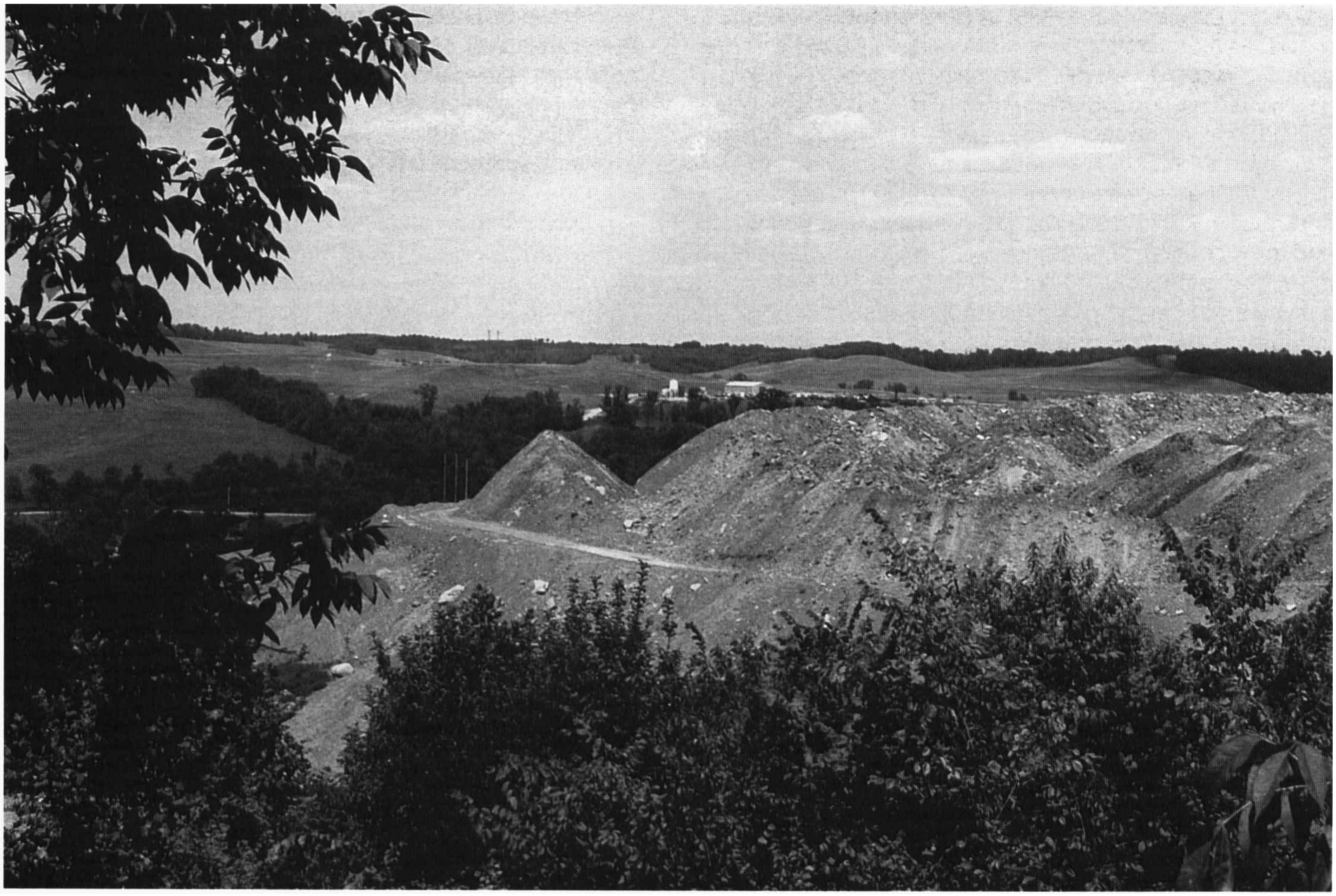

Figure 3.—Surface mining for coal produces massive piles of spoil, which are later graded and reclaimed. Active mine spoil is in the foreground, and a reclaimed area of Fairpoint soils is in the background.

sites for buildings or septic tank absorption fields. Uneven settlement and occasional landslides are hazards on sites for buildings. The suitability of some areas can be improved by reclamation after settling has occurred. The less sloping areas have the most potential as sites for buildings.

9. Glenford-Newark-Fitchville Association

Deep, moderately well drained and somewhat poorly drained, nearly level to strongly sloping soils that formed in lacustrine deposits and alluvium; on terraces and flood plains along minor streams

These soils are on flood plains and terraces in valleys that once held glacial lakes. The valleys range from ¼ mile to 1½ miles in width. The broader valleys are basinlike and are surrounded by uplands. Sloping, dissected terraces and flood plains are along the tributary streams in the narrower glacial lake valleys. Slopes range from 0 to 15 percent.

This association makes up about 11 percent of the county. It is about 25 percent Glenford soils, 15 percent Newark soils, 10 percent Fitchville soils, and 50 percent soils of minor extent.

The moderately well drained, nearly level to strongly sloping Glenford soils are on terraces in valleys. A seasonal high water table is perched in the lower part of the subsoil during extended wet periods. Permeability is moderately slow.

The somewhat poorly drained, nearly level Newark soils are on flood plains along the smaller streams that drain the former lake beds. These soils are occasionally flooded. A seasonal high water table is perched in the upper part of the subsoil during wet periods. Permeability is moderate.

The somewhat poorly drained, nearly level and gently sloping Fitchville soils are on slightly dissected terraces in valleys. A seasonal high water table is perched in the upper part of the subsoil during wet periods. Permeability is moderately slow.

Of minor extent in this association are Lorain, Luray, Sebring, Nolin, Markland, and Alford soils. The very poorly drained Lorain and Luray soils and the poorly drained Sebring soils are in depressions and are on flats in lake beds. The well drained Nolin soils are on the higher parts of flood plains. Markland soils are on gently sloping to strongly sloping terraces. They are more clayey than the major soils. The well drained Alford soils are at the margin of lake plains.

The soils in this association are well suited or moderately suited to cropland. Most areas are used for farming. About 60 percent of the acreage in this association is prime farmland if the soils are drained. In the broader valleys, areas on terraces and flood plains are used as farmland. In the narrower valleys, the flood plains are used as pasture and the terraces are used for crop production. Undrained areas of Newark and Fitchville soils also are used as pasture. Erosion is a hazard in sloping areas used for crops. Wetness is a problem in areas of the Newark and Fitchville soils. Flooding delays planting in areas of the Newark soils.

These soils are well suited to woodland. In areas of the Newark and Fitchville soils, tree species that can tolerate wetness are the best suited.

The seasonal high water table, the shrink-swell potential, and low strength are limitations on sites for buildings in areas of the Glenford and Fitchville soils. Seasonal wetness and restricted permeability are limitations on sites for septic tank absorption fields. Newark soils are generally unsuited to use as sites for buildings or septic tank absorption fields because of the flooding.

10. Watertown-Chili-Glenford Association

Deep, well drained and moderately well drained, nearly level to strongly sloping soils that formed in glacial outwash and lacustrine sediments; on terraces along major river valleys

These soils are on a series of glacial outwash terraces in the major stream valleys. The terrace surfaces are separated from each other and from the flood plain by short, steep slopes. Alluvial fans have formed where intermittent streams from the uplands drain onto the terraces. Slopes range from 0 to 35 percent.

This association makes up about 3 percent of the county. It is about 20 percent Watertown soils, 15 percent Chili soils, 15 percent Glenford soils, and 50 percent soils of minor extent.

The well drained, nearly level to strongly sloping Watertown soils are on glacial outwash terraces. These soils formed in sandy and gravelly outwash material. The steeper areas are on short slopes between benches. Permeability is moderately rapid.

The well drained, nearly level to strongly sloping Chili soils are on glacial outwash terraces. These soils formed in loamy and gravelly outwash material. The steeper areas are on knolls and dissected margins of the outwash terraces. Permeability is moderately rapid.

The moderately well drained, nearly level to strongly sloping Glenford soils are on lacustrine terraces. These soils are along the margins of outwash terraces. A seasonal high water table is perched in the lower part of the subsoil during extended wet periods. Permeability is moderately slow.

Of minor extent in this association are Rodman, Markland, Nolin, and Tioga soils. The excessively drained Rodman soils are on steep dissected hillsides and very steep escarpments on glacial outwash terraces. Markland soils are mapped as a complex with Glenford soils on moderately steep and steep dissected terraces. They are more clayey than the major soils. Nolin and Tioga soils are on flood plains and are subject to flooding.

Areas of this association are used for a variety of purposes. Most areas are used as cropland. Specialty crops, truck crops, and nursery crops are grown in some areas. Many areas have been developed for residential housing and other urban uses, especially near Zanesville. Some areas are used for surface mining of sand and gravel. Very few areas are wooded.

About 40 percent of the acreage in this association is prime farmland. Nearly level and gently sloping soils are well suited to crops and pasture. Controlling erosion and conserving moisture are the main management concerns. Soils in the more strongly sloping areas are better suited to pasture than to cropland because of the hazard of erosion.

The soils in this association are well suited to use as sites for buildings, but seasonal wetness is a limitation in areas of the Glenford soils.

The nearly level and gently sloping areas of Watertown and Chili soils are well suited to septic tank absorption fields. Glenford soils are only moderately suited because of the restricted permeability.

11. Tioga-Nolin-Newark Association

Deep, well drained and somewhat poorly drained, nearly level soils that formed in alluvium; on flood plains along the major streams and river valleys

These soils are on the wider parts of flood plains along the major rivers and their tributaries. The flood plains consist of a series of levels that vary in elevation by only a few feet. The higher levels are subject to rare flooding, and the lower levels are subject to occasional flooding. Flooding is partially controlled by upstream dams of the Muskingum Watershed Conservancy District and by the Dillon Lake dam. Slopes range from 0 to 3 percent.

This association makes up about 5 percent of the county. It is about 30 percent Tioga and similar soils, 20 percent Nolin soils, 10 percent Newark soils, and 30 percent soils of minor extent. The remaining 10 percent consists of areas of water, mainly the Muskingum River.

Tioga soils are well drained. The seasonal high water table is affected by the level of the stream flow, but it is usually at a depth of more than 4 feet. Permeability is moderate or moderately rapid.

Nolin soils are well drained. They are occasionally flooded. The seasonal high water table is controlled by the level of the stream flow. Permeability is moderate.

Newark soils are on the lower parts of the flood plains and are somewhat poorly drained. Flooding is frequent, usually occurring during the growing season in the form of flash floods after intense local thunderstorms. A seasonal high water table is in the upper part of the subsoil during wet periods. Permeability is moderate.

Of minor extent in this association are Glenford, Fitchville, Cidermill, Chavies, Chili, and Watertown soils. The moderately well drained Glenford and somewhat poorly drained Fitchville soils are on lacustrine terraces. The well drained Cidermill soils are on broad glacial outwash terraces and deltas. They have a mantle of windblown silt. The well drained Chavies, Chili, and Watertown soils are on glacial outwash terraces.

About 60 percent of the acreage in this association is prime farmland. Most areas are used as cropland. Very few areas are wooded.

The soils in this association are well suited to intensive production of row crops, forage plants, or specialty crops. Flooding is the major management concern. The seasonal high water table in the Newark soils also is a limitation. Tioga and Nolin soils can be irrigated. Flooding may limit or delay crop production.

Most areas of this association are unsuited to building site development because of the hazard of flooding. Only well drained areas that are rarely flooded are suited to use as sites for septic tank absorption fields. The contamination of ground water is possible, however, in areas that have sandy or gravelly underlying material because this material does not adequately filter the effluent.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, 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, Chili gravelly loam, 0 to 3 percent slopes, is a phase of the Chili 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. Berks-Westmoreland complex, 40 to 70 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 and Pits, 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

AaB—Aaron silt loam, 2 to 8 percent slopes. This deep, gently sloping, moderately well drained soil is on knolls or is in saddles on upland ridgetops. Most areas are oval and range from 3 to 20 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The upper part of the subsoil is yellowish brown, firm silty clay loam about 12 inches thick. The lower part of the subsoil is yellowish brown, firm silty clay and light olive brown, firm clay and silty clay loam about 29 inches thick. Grayish brown, soft clay shale bedrock is at a depth of about 50 inches. A few areas are eroded. Some areas on the crests of small knolls are well drained. In some areas the subsoil is more acid. Some areas are on foot slopes.

Included with this soil in mapping are small areas of Westgate, Westmoreland, and Claysville soils. Westgate soils are in saddles and are near the center of the wider ridgetops. Westmoreland soils are in the more sloping areas. They have less clay and more channers in the subsoil than the Aaron soil. The somewhat poorly drained Claysville soils are near seep zones and springs. Also included are areas of soils that have slightly less clay in the subsoil than the Aaron soil. Included soils make up about 20 percent of most delineations.

Permeability is slow in the Aaron soil. Runoff is medium. Available water capacity is moderate. The content of organic matter in the surface layer also is moderate. The root zone is deep. A seasonal high water table is perched in the lower part of the subsoil during extended wet periods. The potential for frost action is high. The shrink-swell potential is high in the subsoil.

Most areas are used as cropland or pasture. Some areas are used as woodland.

This soil is well suited to cultivated crops. Erosion is the main management concern. The hazard of erosion is moderate in cultivated areas. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, and establishing grassed waterways can reduce the hazard of erosion. The clayey subsoil dries slowly and warms up slowly in the spring. Subsurface drains reduce wetness in scattered low-lying areas, but they must be closely spaced because of the slow permeability in the subsoil. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction.

This soil is well suited to pasture. Wetness and the clayey subsoil restrict the root development of some legumes. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover on the surface in the fall or seeding a grass-legume mixture can minimize the damage caused by frost heave. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion.

This soil is well suited to timber production. No major limitations affect the planting or growth of most species, but the clayey subsoil restricts the root development of some species. Because of low strength, the soil cannot support heavy equipment during wet periods. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is only moderately suited to use as a site for buildings. The seasonal wetness and the high shrink-swell potential are limitations on sites for dwellings, especially dwellings with basements. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. Reinforcing walls with concrete, supporting the walls with a large spread footing, and backfilling around foundations with material that has a low shrink-swell potential help to minimize the damage caused by shrinking and swelling.

This soil is poorly suited to use as a site for septic tank absorption fields. Specially designed absorption fields are needed because of the seasonal wetness and the slow permeability. Perimeter drains are only moderately effective in lowering the water table because of the slow permeability. Elevating the field with more permeable fill material helps to overcome the restricted permeability. An aerator or an alternative system should be considered.

Because of the ridgetop landscape position of the soil, the watershed area for ponds is limited. Ponds excavated into the clayey subsoil are likely to hold water, but layers of porous or shattered rock below the clay beds can permit excessive seepage if they are exposed.

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

AaC2—Aaron silt loam, 8 to 15 percent slopes, eroded. This deep, strongly sloping, moderately well drained soil is on the shoulder slopes of dissected ridgetops and on benches. A few areas are on knolls. Sheet and rill erosion has removed part of the original surface layer. Most areas are irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The upper part of the subsoil is yellowish brown, firm silty clay loam about 9 inches thick. The lower part of the subsoil is yellowish brown, firm silty clay and light olive brown, firm clay and silty clay loam about 30 inches thick. It is mottled. Grayish brown, soft clay shale bedrock is at a depth of about 46 inches. Some areas are more acid. Small areas on ridgetops are gently sloping. Some small areas on the crest of knolls are well drained. In some areas the subsoil has yellowish red colors. In a few severely eroded areas, the surface layer is silty clay loam.

Included with this soil in mapping are areas of Keene and Westmoreland soils. Keene soils are in saddles and are near the center of ridgetops. The upper part of the subsoil in the Keene soils is thicker than that of the Aaron soil. It is silt loam or silty clay loam. In some areas the Keene soils have a subsoil of channery clay loam. Westmoreland soils have more sand and channers and less clay in the subsoil than the Aaron soil. Also included are a few areas of somewhat poorly drained soils near seep zones and springs. Included soils make up about 20 percent of most delineations.

Permeability is slow in the Aaron soil. Runoff is rapid. Available water capacity is moderate. The content of organic matter in the surface layer is moderately low. The root zone is deep. A seasonal high water table is perched in the lower part of the subsoil during extended wet periods. The potential for frost action is high. The shrink-swell potential is high in the subsoil.

Many areas of this soil are used as pasture or cropland. Some areas are used as woodland.

This soil is only moderately suited to cultivated crops. Many areas are significantly eroded, and controlling further erosion is the main management concern. The hazard of erosion is severe in cultivated areas. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways can reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Subsurface drains reduce wetness in scattered seepy areas, but they should be closely spaced because of the slow permeability.

This soil is well suited to hay and pasture. The clayey subsoil restricts the root development of some forage plants. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover on the surface in the fall or seeding a grass-legume mixture can minimize the damage caused by frost heave. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion.

This soil is well suited to timber production. No major limitations affect the planting or growth of most tree species, but the clayey subsoil restricts the root development of some species. Because of low strength, the soil cannot support heavy equipment during wet periods. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is only moderately suited to use as a site for buildings. Seasonal wetness and the high shrink-swell potential are limitations, especially on sites for buildings with basements. Designing buildings so that they conform to the natural slope of the land reduces the need for grading. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. Reinforcing walls with concrete, supporting the walls with a large spread footing, and backfilling around foundations with material that has a low shrink-swell potential minimize the damage caused by shrinking and swelling. The hazard of hillside slippage is increased by cutting and filling, but installing artificial drains in seepy areas reduces this hazard. Removing as little vegetation as possible, mulching, establishing a temporary plant cover, building local roads and streets on the contour, and seeding road cuts can minimize erosion during construction.

This soil is poorly suited to use as a site for septic tank absorption fields because of the slow permeability and seasonal wetness. Installing leach lines on the contour helps to prevent the surfacing of effluent. Perimeter drains can be used to lower the water table. Elevating the field with more permeable fill material helps to overcome the slow permeability. An aerator or an alternative system should be considered.

Some areas of this soil in shallow drainageways have potential as sites for ponds. Ponds excavated into the clayey material are likely to hold water, but layers of more porous rock are below the clay in some areas. Onsite investigation is needed.

This soil is recognized as farmland of local importance. The land capability classification is IIIe. The pasture and hayland suitability group is A-6. The woodland ordination symbol is 4C.

AaD2—Aaron silt loam, 15 to 25 percent slopes, eroded. This deep, moderately steep, moderately well drained soil is on dissected hillsides and benches. Sheet and rill erosion has removed part of the original surface layer. Gullies and soil-creep scars are common. Most areas are long and narrow and range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 5 inches thick. The upper part of the subsoil is yellowish brown, firm silty clay loam about 10 inches thick. The lower part is yellowish brown, mottled, firm silty clay and light olive brown, firm clay and silty clay loam about 29 inches thick. Grayish brown, soft clay shale bedrock is at a depth of about 44 inches. In some areas the subsoil is silty clay. Small areas on the crests of knolls are well drained. In places the subsoil has reddish brown colors. In some severely eroded areas, the surface layer is silty clay loam.

Included with this soil in mapping are small areas of the well drained Westmoreland soils. These soils contain more sand and channers and less clay in the subsoil than the Aaron soil. Also included are soils near seep zones and along drainageways that are wetter than the Aaron soil. Included soils make up about 20 percent of most delineations.

Permeability is slow in the Aaron soil. Runoff is very rapid. Available water capacity is moderate. The content of organic matter in the surface layer is moderately low.

Figure 4.—Contour stripcropping in an area of Aaron silt loam, 15 to 25 percent slopes, eroded.

The root zone is deep. A seasonal high water table is perched in the lower part of the subsoil during extended wet periods. The potential for frost action is high. The shrink-swell potential is high in the subsoil.

Most areas of this soil are used as pasture. Many areas are wooded. A few areas are used for hay.

This soil is poorly suited to cultivated crops. Most areas are significantly eroded, and controlling further erosion is the main management concern. The hazard of erosion is very severe in cultivated areas. Maintaining a permanent plant cover is the best means of controlling erosion. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways can reduce the hazard of erosion (fig. 4). Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Using subsurface drains in seepy areas can increase crop production in most years, but the drains should be closely spaced because of the slow permeability.

This soil is only moderately suited to hay and pasture. The clayey subsoil restricts the root development of some forage plants. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover on the surface in the fall and including grasses in the seeding mixture can minimize the damage caused by frost heave. If the soil is plowed, the hazard of erosion is severe. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion. Restricting grazing during wet periods helps to prevent surface compaction and damage to plant roots. Erosion can be severe in overgrazed pastures.

This soil is only moderately suited to timber production. The aspect of the soil affects the growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. The slope limits the use of some planting and logging equipment. Establishing roads and skid trails on the contour, establishing water bars, and maintaining a vegetative cover help to control erosion. Where roads and trails cross channels, adding stones helps to prevent gullying. Using planting techniques that spread the roots of seedlings and increase soil-root contact reduces the seedling mortality rate. Using seedlings that have been transplanted once or adding mulch reduces the seedling mortality rate on south-facing slopes. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is poorly suited to use as a site for buildings. The slope, the seasonal wetness, the high shrink-swell potential, and the hazard of slippage are management concerns. Designing buildings so that they conform to the natural slope of the land reduces the need for cutting, filling, and land shaping. Cutting and filling increase the hazard of hillside slippage, but installing drains in seepy areas reduces this hazard. Backfilling basement walls with porous material can minimize the damage caused by shrinking and swelling. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. Removing as little vegetation as possible during construction, mulching, establishing a temporary plant cover on construction sites, building local roads and streets on the contour, and seeding road cuts reduce the hazard of erosion.

This soil is generally unsuited to use as a site for septic tank absorption fields because of the seasonal wetness, the slow permeability, and the slope. These problems are difficult to overcome.

Ponds can be developed in some of the draws in areas of this soil. The soil material packs well only if it has the right moisture content. Layers of shattered or porous rock, which can permit excessive seepage, are on the sides of some draws. Onsite investigation is needed to locate these layers.

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

AcB—Aaron-Upshur complex, 2 to 6 percent slopes. These deep, gently sloping soils are on ridgetops and benches. Slopes are smooth and convex. Most areas are long and oval and range from 5 to 30 acres in size. They are about 45 percent Aaron soil and 30 percent Upshur soil. The two soils occur as areas so closely intermingled that it is impractical to map them separately.

The Aaron soil is moderately well drained. Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 37 inches thick. The upper part is yellowish brown, friable silty clay loam. The lower part is dark yellowish brown, mottled, firm silty clay. Light brownish gray, weathered clay shale bedrock is at a depth of about 44 inches. Some areas are well drained.

The Upshur soil is well drained. Typically, the surface layer is reddish brown, friable silty clay loam about 7 inches thick. The subsoil is reddish brown and dark reddish brown, firm silty clay about 43 inches thick. The underlying material to a depth of 72 inches or more is dark reddish brown, firm shaly silty clay. In some areas the surface layer is silt loam.

Included with these soils in mapping are small areas of the moderately deep Gilpin soils. These included soils are on shoulder slopes and the higher parts of ridgetops. Also included are areas of the silty Westgate soils and areas of somewhat poorly drained soils on the flatter part of ridgetops. Included soils make up about 25 percent of most delineations.

Permeability is slow in the Aaron and Upshur soils. Runoff is medium. Available water capacity is moderate, and the root zone is deep. The content of organic matter is moderately low in the surface layer of the Aaron soil and moderately low or low in the surface layer of the Upshur soil. A seasonal high water table is perched in the lower part of the subsoil of the Aaron soil in late winter and in spring and during other extended wet periods. In both soils the shrink-swell potential is high in the lower part of the subsoil and in the underlying material.

Most areas are used as cropland or pasture. Some areas are wooded.

These soils are well suited to cultivated crops. Erosion is the main management concern. The hazard of erosion is moderate in cultivated areas. If the soils are cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, and establishing grassed waterways can reduce the hazard of erosion. The clayey subsoil dries slowly and warms up slowly in the spring. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Using subsurface drains can reduce wetness in scattered low areas, but the drains should be closely spaced because of the slow permeability in the subsoil.

These soils are well suited to hay and pasture. The clayey subsoil restricts the root development of some plant species. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover on the surface in the fall or seeding a grass-legume mixture can minimize the damage caused by frost heave. If the soils are plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion.

These soils are well suited to timber production. No major limitations affect the planting or growth of most species, but the clayey subsoil restricts the root development of some species. Because of low strength, the soils cannot support heavy equipment during wet periods. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

These soils are only moderately suited to building site development. The seasonal wetness is a limitation in areas of the Aaron soil. The high shrink-swell potential of both soils is a limitation on sites for dwellings, especially dwellings with basements. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. Reinforcing walls with pilasters and concrete, supporting the walls with a large spread footing, and backfilling around foundations with material that has a low shrink-swell potential help to minimize the damage caused by shrinking and swelling. Using sedimentation basins and maintaining a continuous plant cover help to control erosion and runoff on construction sites.

Because of the seasonal wetness in the Aaron soil and the slow permeability in both soils, areas of this map unit are poorly suited to septic tank absorption fields. Perimeter drains can be used to reduce the wetness, but they are only moderately effective because of the slow permeability. Elevating the field with more permeable fill helps to overcome the slow permeability.

The watershed area for ponds is limited because of the ridgetop landscape position of the soils. Excavated ponds can hold water unless porous or shattered rock layers below the clay beds are exposed. Onsite investigation is needed to determine the thickness of the clayey soil material.

The land capability classification is IIe. The pasture and hayland suitability group is A-6 for the Aaron soil and F-5 for the Upshur soil. The woodland ordination symbol is 4C for the Aaron soil and 3C for the Upshur soil.

AfB—Alford silt loam, 2 to 8 percent slopes. This deep, gently sloping, well drained soil is on knolls and in saddles on ridgetops and terraces in areas of thick, silty windblown deposits. Most areas are long and narrow and range from 5 to 30 acres in size.

Typically, the surface layer is brown, friable silt loam about 10 inches thick. The subsoil is about 40 inches thick. It is yellowish brown, friable silt loam and is mottled in the lower part. The underlying material to a depth of 80 inches or more is yellowish brown, mottled, friable silt loam. In some areas the soil is moderately well drained. In a few areas the soil is eroded. In places the underlying material is loam or fine sandy loam.

Included with this soil in mapping are Zanesville soils on the wider parts of ridgetops. These soils have a fragipan. Also included are somewhat poorly drained soils in drainageways and a few areas that have bedrock within a depth of 6 feet. Included areas make up about 15 percent of most delineations.

Permeability is moderate in the Alford soil. Runoff is medium. Available water capacity is high. The content of organic matter in the surface layer is moderately low. The capacity to store and release plant nutrients is moderate. The potential for frost action is high.

Most areas are used as cropland. Some areas are used as pasture or as sites for homes. A few areas are wooded.

This soil is well suited to cultivated crops, including specialty crops. In cultivated areas the hazard of erosion is moderate. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and hinders the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, and tilling on the contour can reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction.

This soil is well suited to hay and pasture. A wide variety of forage plants can be planted. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover on the surface in the fall or including grasses in the seeding mixture can minimize the damage caused by frost heave. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

This soil is well suited to timber production, but only a small acreage is used as woodland. The native trees are mostly white oak, red oak, black cherry, yellow-poplar, and shagbark hickory. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface.

This soil is well suited to use as a site for buildings. Shrinking and swelling of the subsoil is the main limitation. Damage to walls and foundations can be minimized by backfilling with granular soil material.

Maintaining a plant cover during construction helps to control erosion. The soil is well suited to septic tank absorption fields, and few limitations affect this use.

There are few natural pond sites. Excavated ponds are likely to have an excessive seepage rate.

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

AfC2—Alford silt loam, 8 to 15 percent slopes, eroded. This deep, strongly sloping, well drained soil is on the shoulder slopes of ridgetops or on dissected terraces along broad valleys. Erosion has removed part of the original surface layer, and the present surface layer contains some subsoil material. Most areas are oblong or are irregular in shape and range from 15 to 40 acres in size.

Typically, the surface layer is yellowish brown, friable silt loam about 10 inches thick. The subsoil is about 38 inches thick. It is yellowish brown, friable silt loam. The underlying material to a depth of 60 inches or more is yellowish brown, firm silt loam. In some areas the soil is moderately well drained. In a few areas the surface is not eroded. Other areas have gullies. In places the underlying material is loam, fine sandy loam, or silty clay loam at a depth of more than 40 inches.

Included with this soil in mapping are small areas of Zanesville soils on narrow benches. These soils have a fragipan. Also included are somewhat poorly drained soils in drainageways and a few areas that have bedrock within a depth of 6 feet. Included areas make up about 20 percent of most delineations.

Permeability is moderate in the Alford soil. Runoff is rapid. Available water capacity is high. The content of organic matter is low in the surface layer. The root zone is deep. The capacity to retain and release plant nutrients is moderate. The potential for frost action is high.

Most areas are used as cropland or pasture. Some areas are wooded.

This soil is only moderately suited to cultivated crops. Many areas are significantly eroded, and controlling further erosion is the main management concern. The hazard of erosion is severe in cultivated areas. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways can reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction.

This soil is well suited to hay and pasture. A wide variety of forage plants can be used. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover on the surface in the fall and seeding a grass-legume mixture can reduce the damage caused by frost heave. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

This soil is well suited to timber production, but only a small acreage is used as woodland. The native trees are mostly white oak, red oak, black cherry, yellow-poplar, and shagbark hickory. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface.

This soil is well suited to building site development. The slope, the shrink-swell potential, and low strength are the main management concerns. Low strength can be overcome by using reinforced foundations and a suitable base material. Maintaining as much cover as possible on the site during construction reduces the hazard of erosion. The damage to walls and foundations caused by shrinking and swelling can be minimized by backfilling with granular soil material.

This soil is only moderately suited to septic tank absorption fields. The slope is a management concern. Installing the distribution lines across the slope can minimize the downslope seepage of effluent.

The potential for ponds is poor on this soil. The soil material does not pack well, and it is poor fill. Excavated ponds are likely to have excessive seepage.

This soil is recognized as farmland of local importance. The land capability classification is IIIe. The pasture and hayland suitability group is A-6. The woodland ordination symbol is 5A.

BeB—Berks channery silt loam, 2 to 8 percent slopes. This moderately deep, gently sloping, well drained soil is on upland shoulder slopes and narrow ridgetops. Stones are common on the surface. Most areas are long and narrow and range from 5 to 15 acres in size.

Typically, the surface layer is dark grayish brown, friable channery silt loam about 8 inches thick. The subsoil is yellowish brown, friable very channery and extremely channery silt loam about 21 inches thick. Weathered, fine grained sandstone or siltstone bedrock is at a depth of about 29 inches. Some areas are strongly sloping. In places the surface layer is sandy loam or loam or is very channery.

Included with this soil in mapping are areas of Rigley soils. These soils are deep and are less stony than the Berks soil. They are underlain by coarse grained sandstone bedrock. Also included are areas where bedrock is at a depth of less than 20 inches. Included areas make up about 20 percent of most delineations.

Permeability is moderate or moderately rapid in the Berks soil. Runoff from cultivated areas is medium. Available water capacity is very low. The root zone is restricted by the moderate depth to bedrock. The content of organic matter in the surface layer and the capacity to store and release plant nutrients are low.

Most areas are used as pasture. Only a few areas are used as cropland. Some areas are wooded.

This soil is only moderately suited to cultivated crops. In cultivated areas the hazard of erosion is moderate. The soil is droughty, and crops suffer from insufficient moisture. Droughtiness, erosion, tilth, and the content of organic matter are management concerns. Using no-till farming methods or a system of conservation tillage that leaves crop residue on the surface conserves moisture and helps to control erosion, improves tilth, and increases the content of organic matter. Including grasses and legumes in the cropping system, stripcropping on the contour, and planting cover crops also reduce the hazard of erosion. The channers in the surface layer restrict the use of some tilling and harvesting machinery and interfere with the emergence of seedlings.

This soil is well suited to hay and pasture. The root zone of some species is restricted by bedrock. The soil warms up early in spring and is well suited to early season pasture. Droughtiness reduces the production of forage plants later in the growing season. Drought-resistant species are the most suitable for planting. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion. Companion crops, however, compete with forage plants for the limited supply of moisture.

This soil is only moderately suited to timber production. The growth rate of trees is slowed by droughtiness. Coarse fragments in the soil affect the planting and growth of trees. Using seedlings that have been transplanted once and mulching around the seedlings can reduce the seedling mortality rate.

This soil is only moderately suited to use as a site for buildings and is poorly suited to septic tank absorption fields because of the depth to bedrock. The bedrock is at a depth of 20 to 40 inches and is a limitation on sites for buildings with basements. The siltstone bedrock commonly is rippable to a depth of a few feet. Maintaining a vegetative cover on the surface helps to minimize runoff and erosion on construction sites. Because of the limited depth to bedrock, the soil does not adequately filter the effluent in septic tank absorption fields. The effluent enters cracks in the underlying bedrock. It can move considerable distances and pollute ground water. Filtration can be increased by placing the lines on the surface and covering them with soil from another area. An aerator or an alternative system can be used.

There are few natural pond sites. Excavated ponds are very unlikely to hold water.

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

BeD2—Berks channery silt loam, 15 to 25 percent slopes, eroded. This moderately deep, moderately steep, well drained soil is on bluffs, in ravines, or on dissected hillsides on uplands. Sandstone and siltstone stones and boulders are common on the surface. Erosion has removed part of the original surface layer. Individual areas are long and narrow and range from 5 to 80 acres in size.

Typically, the surface layer is brown, friable channery silt loam about 8 inches thick. The subsoil is yellowish brown, firm very channery silt loam about 27 inches thick. Fractured, soft siltstone bedrock is at a depth of about 35 inches. In severely eroded areas, the surface layer is very channery. In some areas the soil is deeper over bedrock.

Included with this soil in mapping are small areas of the deep, moderately well drained Guernsey and Coshocton soils. These soils are in slightly concave landscape positions. Also included are a few seeps and springs and a few bedrock outcrops. Included areas make up about 20 percent of most delineations.

Permeability is moderate or moderately rapid in the Berks soil. Runoff is rapid. Available water capacity is very low. The content of organic matter is moderately low in the surface layer. The root zone generally is restricted by bedrock. The capacity to store and release plant nutrients is low.

This soil is used as pasture or woodland. The native trees are mostly drought-tolerant chestnut oak, black oak, and hickory.

This soil is poorly suited to cultivated crops and hay. Erosion and droughtiness are the major management concerns. The hazard of erosion is very severe in cultivated areas. Using no-till farming methods or a system of conservation tillage that leaves crop residue on the surface helps to control erosion and conserves moisture. Including grasses and legumes in the cropping system, stripcropping on the contour, and planting cover crops also help to control erosion. The channers in the surface layer restrict the use of some tilling and harvesting machinery. Maintaining a permanent plant cover is the best means of controlling erosion. Drought-resistant forage plants are the best suited. More moisture is available for seed germination in the spring than later in the growing season.

This soil is only moderately suited to pasture. The root zone is restricted by bedrock. The soil warms up early in spring and produces good early season pasture. Forage production is reduced by droughtiness later in the growing season. If the soil is plowed, the hazard of erosion is severe. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion. Erosion can be severe in overgrazed pastures.

This soil is only moderately suited to timber production. The aspect of the slope and the coarse fragments in the soil affect the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The slope limits the use of planting and logging equipment. Establishing roads and skid trails on the contour, establishing water bars, and maintaining a vegetative cover help to control erosion. Where roads and trails cross channels, adding stones helps to prevent gullying. Using seedlings that have been transplanted once and mulching around the seedlings can reduce the seedling mortality rate, especially on south-facing slopes.

This soil is poorly suited to use as a site for buildings. The slope is the main concern on building sites. Designing buildings so that they conform to the natural slope of the land commonly reduces the need for excavation. Generally, the underlying bedrock is rippable to a depth of a few feet. Maintaining a vegetative cover on the surface helps to control runoff and erosion during construction.

This soil is generally unsuited to septic tank absorption fields because of the depth to bedrock and the slope. Because of the limited depth to bedrock, the soil does not adequately filter the effluent in septic tank absorption fields. The effluent that enters the fractured bedrock can pollute ground water.

Ponds developed in areas of this soil are very likely to have an excessive seepage rate.

The land capability classification is IVe. The pasture and hayland suitability group is F-1. The woodland ordination symbol is 4R on north aspects and 3R on south aspects.

BeE—Berks channery silt loam, 25 to 40 percent slopes. This moderately deep, steep, well drained soil is on bluffs, in ravines, or on the dissected parts of hillsides. In many areas the soil forms a bluff at the top of a long hillside. Stones and rock outcrops of sandstone and siltstone are common. Slopes are irregular, and benches and spurs are in some areas. Most areas occur as thin bands that range from 5 to 45 acres in size.

Typically, the surface layer is very dark grayish brown, friable channery silt loam about 6 inches thick. The subsoil is about 21 inches thick. It is brown and yellowish brown, firm channery and very channery silt loam. Below this to a depth of 60 inches or more is grayish brown, very firm, weathered siltstone and hard siltstone bedrock. In some areas the subsoil contains more clay and fewer coarse fragments. In other areas the bedrock is at a depth of less than 20 inches. Rock outcrops are common along streams.

Included with this soil in mapping are small areas of Guernsey, Coshocton, Lowell, Westmoreland, and Rigley soils. The deep, moderately well drained Guernsey and Coshocton soils are in slightly concave landscape positions. A few seeps, springs, and slips are associated with these soils. The deep Lowell, Westmoreland, and Rigley soils are in the less sloping areas. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 20 percent of most delineations.

Permeability is moderate or moderately rapid in the Berks soil. Runoff is very rapid. Available water capacity is very low. The content of organic matter is moderately low in the surface layer. Generally, the root zone is restricted by bedrock at a depth of 20 to 40 inches.

Most areas are used as woodland. Some areas are used as pasture.

This soil is generally unsuited to cultivated crops and hay because of the steep slopes and a very severe hazard of erosion. Maintaining a permanent plant cover is the best means of controlling erosion.

This soil is poorly suited to pasture. The roots of some species are restricted by bedrock. The soil warms up early in spring and is well suited to early season pasture. Forage production is reduced by droughtiness later in the growing season. Adding mulch or using no-till seeding methods reduces the hazard of erosion.

This soil is moderately suited to timber production. The aspect of the slope and the coarse fragments in the soil affect the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The slope limits the use of planting and logging equipment. Establishing roads and skid trails on the contour, establishing water bars, and maintaining a vegetative cover help to control erosion. Where roads and trails cross channels, adding stones helps to prevent gullying. Using seedlings that have been transplanted once and mulching around the seedlings can reduce the seedling mortality rate, especially on south-facing slopes.

This soil generally is unsuited to use as a site for buildings or septic tank absorption fields because of the slope and the depth to bedrock. Ponds developed in areas of this soil are likely to have excessive seepage.

The land capability classification is VIe. The pasture and hayland suitability group is F-2. The woodland ordination symbol is 4R on north aspects and 3R on south aspects.

BkF—Berks-Westmoreland complex, 40 to 70 percent slopes. These moderately deep and deep, well drained soils are on dissected, very steep hillsides along the larger stream valleys. Areas of this unit have the most rugged terrain in the county. Some areas form the side slopes of narrow hollows or ravines along the smaller streams or tributaries. Some slopes are benched. Springs at the upper edge of some of the benches cause seepage downslope. Stones and massive outcrops of sandstone form bluffs or ledges in some areas. Most areas are long and narrow and range from 20 to 500 acres in size. They are about 40 percent Berks soil and 35 percent Westmoreland soil. The Berks soil is on the steeper, upper parts of hillsides, and the Westmoreland soil is on the less sloping, lower parts. The two soils are so closely intermingled that it is impractical to map them separately.

Typically, the surface layer and subsurface layer of the Berks soil are very dark gray and brown, friable channery silt loam about 10 inches thick. The subsoil is about 12 inches thick. It is yellowish brown, firm very channery silt loam. Fractured, fine grained sandstone bedrock is at a depth of about 22 inches.

Typically, the surface layer of the Westmoreland soil is brown, friable silt loam about 4 inches thick. The subsoil is about 40 inches thick. It is yellowish brown channery silty clay loam. Fractured, weathered, fine grained sandstone and siltstone bedrock is at a depth of about 44 inches. In some areas, stones and boulders are on the surface and the surface layer and subsoil are sandy loam.

Included with these soils in mapping are areas of the moderately well drained Brookside, Coshocton, and Guernsey soils and areas of Lobdell soils. Brookside, Coshocton, and Guernsey soils are on the less sloping benches. Gullies, landslides, and soil-creep zones are common. Lobdell soils are on narrow flood plains along streams. Also included are areas in the flood pools of the Dillon Lake or Wills Creek dam that are subject to controlled flooding and areas of severely eroded soils that are shallow over bedrock and are very channery throughout. Included areas make up about 25 percent of most delineations.

Permeability is moderate or moderately rapid in the Berks soil and moderate in the Westmoreland soil. Runoff is very rapid on both soils. Available water capacity is very low in the Berks soil and moderate in the Westmoreland soil. The content of organic matter is low in the Berks soil and moderately low in the Westmoreland soil. The depth of the root zone is determined by the depth to bedrock. It ranges from 20 inches in the Berks soil to more than 40 inches in the Westmoreland soil. The capacity to retain and release plant nutrients is low in the Berks soil and moderate in the Westmoreland soil.

Most areas of these soils are wooded. Native trees are mostly drought-tolerant chestnut oak, black oak, and hickory in areas of the Berks soil and red oak, yellow-poplar, and maple in areas of the Westmoreland soil.

These soils are generally unsuited to cropland and pasture because of the slope and a very severe hazard of erosion. Slopes are too steep for the safe operation of farm machinery. Maintaining a permanent cover of plants is the best means of controlling erosion.

These soils are moderately suited to timber production. The aspect of the slope and the coarse fragments in the soils affect the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The slope limits the use of planting and logging equipment. Downslope slippage of mature trees is a problem in some areas. Establishing roads and skid trails on the contour, establishing water bars, and maintaining a vegetative cover help to control erosion. Where roads and trails cross channels, adding stones helps to prevent gullying. Using seedlings that have been transplanted once and mulching around the seedlings can reduce the seedling mortality rate, especially on south-facing slopes. Plant competition on the Westmoreland soil can be controlled by removing vines and the less desirable trees and shrubs.

These soils are generally unsuited to use as sites for buildings or for septic tank absorption fields because of the very steep slopes. The use of equipment is unsafe because of the slope. Cuts made in areas used as building sites may cause landslips. Excessive downslope seepage of effluent is likely in areas used for septic tank absorption fields.

Some areas of these soils have scenic ravines, rock ledges, and bluffs. The potential for ponds is poor because shattered rock is close to the surface on the side slopes of small valleys. The valley bottoms are steep, and a high fill is needed to create a water impoundment of any size.

The land capability classification is VIIe. The pasture and hayland suitability group is H-1. The woodland ordination symbol for the Berks soil is 4R on north aspects and 3R on south aspects. It is 4R for the Westmoreland soil.

BoB—Bethesda shaly silt loam, 1 to 15 percent slopes. This deep, nearly level to strongly sloping, well drained soil is on excavated mine spoil in areas that have been surface-mined for coal. The mine spoil has been graded. The surface commonly is a leveled ridgetop or bench below the former highwall. Rills and gullies are common. The soil is a mixture of rock fragments and partially weathered fine earth material that was in or below the profile of the original soil. The rock fragments are mainly shale, siltstone, and sandstone but include small amounts of coal and carbonaceous shale. There are few stones on the surface. Most areas are irregular in shape and range from 10 to 140 acres in size.

Typically, the surface layer is dark grayish brown, friable shaly silt loam about 1 inch thick. The underlying material to a depth of 60 inches or more is multicolored, friable very shaly silty clay loam, extremely channery clay loam, very channery clay loam, very channery loam, and very channery silty clay loam. In some areas the soil is less acid and has a thin surface layer that is not shaly. The soil is ultra acid in areas where coal fragments are abundant. These areas are toxic to vegetation and are severely eroded.

Included with this soil in mapping are narrow strips of Gilpin, Rigley, and Westmoreland soils. These soils are in unmined areas. They make up about 20 percent of most delineations.

Permeability is moderately slow in the Bethesda soil. Runoff is medium. Available water capacity is low. The content of organic matter is very low. Tilth is poor. The root zone ranges from very shallow to moderately deep, depending on the density of the underlying material.

Most areas are abandoned or are used as wildlife habitat. Some areas are used as pasture. In most areas that were formerly mined, black locust, European alder, and other acid-tolerant trees and shrubs have been planted or a mixture of grasses has been established.

This soil is generally unsuited to row crops and small grain and is poorly suited to hay because of the acidity and the restricted root zone. It is droughty and low in fertility. The surface layer is shaly, has weak structure, and crusts easily. The hazard of erosion is very severe if the soil is cultivated. Maintaining a permanent plant cover is the best means of controlling erosion. Because of uneven grading and settling, surface drainage may be needed in some areas.

This soil is poorly suited to pasture. Extreme acidity and droughtiness limit the number of suitable plants. The soil remains soft until late spring. Grazing when the soil is soft can damage plant roots. If the soil is cultivated, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

This soil is poorly suited to timber production. It supports planted black locust and pine and some volunteer hardwoods in a few areas. Species that can tolerate acidity, droughtiness, and a restricted root zone should be selected for planting. Rock fragments throughout the soil interfere with the use of mechanical tree planters. Maintaining a cover of grasses and legumes helps to control erosion before trees are established.

This soil is poorly suited to building site development. Uneven settling of the mine spoil can occur for several years after mining and grading and can cause extensive damage to foundations. Steel and concrete structures in the soil may deteriorate because of the acidity. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover can minimize erosion during construction. Sites for lawns should be blanketed with soil material from another area.

After it has settled, this soil is only poorly suited to septic tank absorption fields. Enlarging the leach field or using a double field can help to overcome the restricted permeability. The larger rock fragments should be excluded from backfill over the leach lines. The acid soil may cause the deterioration of cement tanks.

Ponds can be excavated in some natural depressions. The ability of the ponds to hold water is variable. In some places, water for ponds is too acid for fish and may irritate the skin.

The land capability classification is VIs. The pasture and hayland suitability group is E-3. No woodland ordination symbol is assigned.

BoD—Bethesda shaly silt loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is on the ridgetops and benches of excavated mine spoil in areas that have been surface-mined for coal. It is a mixture of rock fragments and partially weathered fine earth material. There are a few channers on the surface in most areas. The channers are mostly flat and are 1 to 5 inches long. They are mainly shale, siltstone, and fine grained sandstone but include a small amount of coal and carbonaceous shale. Slopes are dissected by gullies. Some areas have a highwall remaining at the upper edge. Areas range from 5 to 50 acres in size.

Typically, the surface layer is dark grayish brown, friable shaly silt loam about 5 inches thick. The underlying material to a depth of 60 inches or more is yellowish brown and brown, firm and very firm very channery loam, very channery silty clay loam, and extremely channery clay loam. The content of shale, sandstone, siltstone, and coal in the underlying material ranges from about 35 to 70 percent. In some areas the soil is ultra acid and is toxic to plants.

Included with this soil in mapping are narrow strips of Gilpin, Rigley, and Westmoreland soils. These soils are in unmined areas. Also included are a few extremely stony and bouldery areas and narrow, very steep escarpments. Included areas make up about 20 percent of most delineations.

Permeability is moderately slow in the Bethesda soil. Runoff from unprotected areas is rapid or very rapid. Available water capacity is low because of the high content of coarse fragments and the high density of the underlying material. The content of organic matter is very low. The root zone ranges from very shallow to moderately deep, depending on the density of the underlying material.

Most areas are abandoned or are used as wildlife habitat. A few areas are used as pasture. In most areas that were formerly mined, black locust, European alder, and other acid-tolerant trees and shrubs have been planted. Grasses have been established in some areas.

This soil is unsuited to the commonly grown field crops and hay because it is a poor medium for root development. It is droughty, is low in fertility, and has a very low content of organic matter. The surface layer is shaly, has weak structure, and crusts easily. Much of the rainfall runs off because of the poor soil structure and a lack of plant cover. The hazard of erosion is severe or very severe in areas that are not protected by a vegetative cover. The rock fragments in the surface layer interfere with tillage.

This soil is poorly suited to pasture. Droughtiness and acidity limit the number of suitable forage species. Production is very low during dry periods. The soil remains soft until late spring. Grazing when the soil is soft can damage plant roots. If the soil is cultivated, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion. Areas that have not had regular applications of lime and fertilizer support only thin stands of grasses and have many barren spots in which rills and gullies can form. Generally, the content of nitrogen and phosphorus is low and the content of potassium is medium. Water for livestock is not available in many areas.

This soil is poorly suited to timber production, but maintaining a cover of trees helps to prevent erosion. The soil supports planted black locust and pine and some volunteer hardwoods in a few areas. Species that can tolerate acidity, droughtiness, and a restricted root zone should be selected for planting. The slope and the rock fragments throughout the profile interfere with the use of planting and logging equipment. Maintaining a cover of grasses and legumes helps to control erosion before trees are established. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds.

This soil is generally unsuited to use as a site for buildings because of uneven settlement, susceptibility to slippage, and a very severe hazard of erosion. The soil also is unsuited to septic tank absorption fields because of the moderately slow permeability, the slope, and uneven settlement.

Ponds can be developed in some natural depressions, but the ability of the ponds to hold water varies considerably.

The land capability classification is VIs. The pasture and hayland suitability group is E-3. No woodland ordination symbol is assigned.

BpF—Bethesda flaggy silt loam, 25 to 70 percent slopes. This deep, steep and very steep, well drained soil is in areas that have been surface-mined for coal. It consists of ungraded mine spoil on ridges and in trenches that follow the contour of the land. The soil material is a mixture of rock fragments and partially weathered fine earth material that was in or below the profile of the original soil. Many flagstones, boulders, and coarse, mostly flat fragments are on the surface. They are mainly shale, siltstone, and sandstone but include small amounts of coal and carbonaceous shale. Erosion is severe, and rills and gullies are common. Slopes are irregular. Individual areas of this soil are long and narrow and range from 20 to 200 acres in size.

Typically, the surface layer is dark grayish brown, friable flaggy silt loam about 10 inches thick. The underlying material to a depth of 60 inches or more is variegated dark grayish brown, grayish brown, and gray. The upper part is firm channery silty clay loam, and the lower part is firm very channery silty clay loam. Some areas are less sloping, have been graded, and are not so susceptible to erosion.

Included with this soil in mapping are Morristown soils and a few areas of the loamy Udorthents. Morristown soils are in areas where the mine spoil is alkaline. Udorthents have fewer coarse fragments and a higher available water capacity than the Bethesda soil. Also included are some small areas of mine dumps and pits that are toxic to plants and pools of shallow water between ridges and along vertical rock highwalls. Included areas make up about 20 percent of most delineations.

Permeability is moderately slow in the underlying material of the Bethesda soil. Runoff is very rapid. Available water capacity is low. The content of organic matter is very low in the surface layer. The root zone ranges from very shallow to moderately deep, depending on the density of the underlying material. The capacity to store and release nutrients is very low.

This soil is generally unsuited to crops, hay, and pasture because of the slope, droughtiness, and extrème acidity. In most areas, black locust trees have been planted or other trees and briers have been naturally reseeded. Some areas are barren or are sparsely vegetated.

This soil is poorly suited to timber production. It is best suited to trees that can tolerate acidity, droughtiness, and a restricted root zone. The use of equipment is restricted because of the slope.

This soil is unsuited to building site development and septic tank absorption fields because of the slope, the moderately slow permeability, and uneven settlement. Cutting and filling increase the hazard of slippage.

Areas of this soil are poorly suited to use as sites for ponds. Water in the ponds is acid and has a high content of sediment.

The land capability classification is VIIe. The pasture and hayland suitability group is H-1. No woodland ordination symbol is assigned.

BsC2—Brookside silty clay loam, 8 to 15 percent slopes, eroded. This deep, strongly sloping, moderately well drained soil is on benches and foot slopes on and below steep and very steep, dissected hillsides. Erosion has removed part of the original surface layer, and the present surface layer is a mixture of material from the original surface layer and the subsoil. Gullies, landslides, and seeps are common. Most areas are long and narrow and range from 10 to 90 acres in size.

Typically, the surface layer is brown, friable silty clay loam about 7 inches thick. The subsoil is about 32 inches thick. The upper part is light olive brown, firm silty clay and brown, firm clay. The lower part is weak red and olive gray, mottled, firm clay. The underlying material to a depth of 78 inches or more is light olive brown and light olive gray, firm silty clay. In some severely eroded areas, the surface layer is silty clay and mottles are closer to the surface. In some places the subsoil is thinner and is underlain by weathered clay shale.

Included with this soil in mapping are small areas of Upshur, Gilpin, Claysville, and Westgate soils. The well drained Upshur soils have a reddish brown subsoil. The moderately deep Gilpin soils are on the shoulders of slopes. The somewhat poorly drained Claysville soils are at the head of drainageways. Westgate soils are in the less sloping areas. They are less clayey than the Brookside soil. Included soils make up about 20 percent of most delineations.

Permeability is moderately slow in the Brookside soil. Runoff is rapid. Available water capacity is moderate. The content of organic matter is moderately low in the surface layer. The root zone is deep. The shrink-swell potential is high. A seasonal high water table is perched in the lower part of the subsoil during extended wet periods.

Most areas are used for hay or pasture. Some areas that were formerly farmed are sites for active oil or gas wells. Access roads are in these areas.

This soil is moderately suited to cultivated crops. The hazard of erosion is severe in cultivated areas. Tilth is generally poor in eroded areas. Many areas are eroded, and controlling further erosion is the main management concern. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and hinders the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways can reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. In some areas the uneven slopes limit the use of equipment. Subsurface drains are needed in scattered seepy areas of the included Claysville soils and in other wet or seepy areas.

This soil is well suited to hay and pasture. It is suited to a wide variety of forage plants. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion. Restricting grazing during wet periods helps to prevent compaction of the surface layer. Springs in seepy areas of the included Claysville soils can provide water for livestock.

This soil is well suited to timber production. No major limitations affect the planting or growth of trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Establishing roads and skid trails on the contour, establishing water bars, and maintaining a vegetative cover help to control erosion.

This soil is poorly suited to use as a site for buildings because of the high shrink-swell potential and the hazard of slippage. The hazard of erosion can be reduced by removing as little vegetation as possible, by mulching, and by establishing a temporary plant cover on construction sites. Shrinking and swelling, slippage, and low strength can cause damage to foundations. The damage caused by shrinking and swelling can be minimized by reinforcing concrete walls and foundations and by backfilling with granular soil material. The damage caused by landslides can be prevented by building on more stable soils. The soil is less likely to slide if saturated layers are drained. Tree roots help to stabilize the soil. Drains around footings can reduce the wetness.

This soil is poorly suited to septic tank absorption fields because of seasonal wetness and the moderately slow permeability. Enlarging the absorption field or using a double field can help to overcome the restricted permeability. Perimeter drains can be used to lower the seasonal high water table.

Areas that have distinct seeps and slips should not be used as sites for buildings or septic tank absorption fields.

The potential for ponds is good in areas of this soil. Water generally is plentiful. The soil material is suitable for dam fill if used at the right moisture content.

This soil is recognized as farmland of local importance. The land capability classification is IIIe. The pasture and hayland suitability group is A-1. The woodland ordination symbol is 5A.

BsE—Brookside silty clay loam, 15 to 40 percent slopes. This deep, moderately steep and steep, moderately well drained soil is on benched foot slopes below steep and very steep, dissected hillsides along river valleys. Gullies, landslides, and seeps are common. The microrelief is hummocky in many areas. Boulders and stones are common on the upper part of slopes. Most areas are long and narrow and range from 15 to 80 acres in size.

Typically, the surface layer is dark brown, friable silty clay loam about 3 inches thick. The subsurface layer is brown, friable silty clay loam about 7 inches thick. The subsoil is about 53 inches thick. It is yellowish brown, firm silty clay loam, gravelly silty clay, channery silty clay, and channery silty clay loam. It is mottled in the lower part. The underlying material to a depth of 70 inches or more is very dark grayish brown, mottled, very firm channery silty clay loam. In some areas the soil has reddish brown colors. In places layers of clay shale are at a depth of less than 5 feet. Some areas are eroded.

Included with this soil in mapping are Westmoreland and Westgate soils. Westmoreland soils are in areas of loamy colluvium. Westgate soils are on the narrow, less sloping benches. Also included are many areas where the subsoil has dark reddish brown layers and some areas below sandstone outcrops that have many stones and boulders on the surface. Included areas make up about 25 percent of most delineations.

Permeability is moderately slow in the Brookside soil. Runoff is very rapid. Available water capacity is moderate. The content of organic matter is moderately low or moderate in the surface layer. The root zone is deep. A seasonal high water table is perched in the lower part of the subsoil during extended wet periods. The shrink-swell potential is high in the subsoil. The soil is subject to slippage.

Most areas are used as woodland or pasture.

This soil is generally unsuited to cultivated crops and hay because of the steep, irregular slopes and a very severe hazard of erosion. Maintaining a permanent plant cover is the best means of controlling erosion.

This soil is poorly suited to pasture. It is suited to most of the commonly grown forage plants, but the slope limits seeding and improvement practices. If the soil is plowed, the hazard of erosion is very severe. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

This soil is moderately suited to timber production. The aspect of the slope affects the planting and growth of trees. North- and east-facing slopes are the best woodland sites. They are cooler and moister than south- and west-facing slopes because they are less exposed to the sun and wind. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Establishing roads and skid trails on the contour, establishing water bars, and maintaining a vegetative cover help to control erosion. Using planting techniques that spread the roots of seedlings and that increase soil-root contact reduces the seedling mortality rate.

This soil is generally unsuited to use as a site for buildings or septic tank absorption fields because of the slope, the moderately slow permeability, the seasonal wetness, the high shrink-swell potential, and the hazard of slippage. The soil is less likely to slide if saturated zones are drained. Tree roots help to stabilize the soil.

This soil is poorly suited to use as a site for ponds. Slips and landslides are likely to cause shifting and cracking of embankments.

The land capability classification is VIe. The pasture and hayland suitability group is A-3. The woodland ordination symbol is 5R on north aspects and 4R on south aspects.

Cb—Chagrin loam, rarely flooded. This deep, nearly level, well drained soil is in the higher areas on flood plains along rivers. It is subject to rare flooding. The flooding is partially controlled by dams on upstream reservoirs of the Muskingum Conservancy District. Slopes range from 0 to 3 percent. Most areas are crescent shaped and range from 20 to 80 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 12 inches thick. The subsoil is dark yellowish brown, friable silt loam and brown, friable loam and fine sandy loam about 31 inches thick. The underlying material to a depth of 83 inches or more is yellowish brown, loose loamy fine sand and fine sand and very friable sandy loam. In some areas the subsoil has less sand. A few areas are occasionally flooded. In places the soil is moderately well drained. In low areas the surface layer is darker colored and has more organic matter. In some areas the underlying material is moderately rapidly permeable.

Included with this soil in mapping are small areas of Newark, Melvin, Watertown, and Chavies soils. Newark and Melvin soils are on the lower flood plains. Watertown and Chavies soils are on outwash terraces. Included soils make up less than 20 percent of most delineations.

Permeability is moderate in the Chagrin soil. Runoff is slow. Available water capacity is high. On rare occasions, floodwater covers the soil for a few days, usually during the dormant season. Ice jams or other obstructions in stream channels are commonly the cause of the flooding. The content of organic matter is moderate in the surface layer. The root zone is deep. The soil has a moderate capacity to store and release plant nutrients. The water table is usually at a depth of more than 4 feet but is affected by the level of stream flow. The shrink-swell potential is low, and the potential for frost action is moderate.

Most areas are cultivated. A few areas are used as pasture or woodland. The woodland consists mainly of native bottom-land hardwoods.

This soil is well suited to corn, soybeans, and wheat and to specialty crops, such as melons, tomatoes, cucumbers, and potatoes. The soil dries early in the spring and is well suited to irrigation. Conserving soil moisture is the main management concern. The soil is better suited to crops that mature early in the growing season than to late-season crops. Using no-till farming methods or a system of conservation tillage that leaves crop residue on the surface conserves moisture and increases the rate of water infiltration. Banded or split applications of fertilizer minimize the loss of nutrients, especially nitrogen, and help to prevent the pollution of ground water. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. In a few areas, land grading allows surface water to drain faster. Keeping stream channels free of obstructions, such as logjams, helps to prevent flooding.

This soil is well suited to hay and pasture. It is suited to a wide variety of forage plants. Most of the hay is grown as part of a rotation that includes cultivated crops. Including legumes in the rotation provides nitrogen for subsequent row crops. Flooding can damage hay seedlings during the winter months. The quality of forage is reduced if flooding occurs during the growing season.

This soil is well suited to timber production, but only a small acreage is used as woodland. No major limitations affect the planting, growth, or harvesting of trees. Native bottom-land hardwoods grow well on this soil. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is generally not suited to use as a site for buildings because of the flooding. It is well suited to septic tank absorption fields. The flooding, the restricted permeability, and the seasonal high water table are management concerns. Installing perimeter drains can lower the seasonal high water table. Elevating the field can reduce the hazard of flood damage and increase the depth to the water table. Increasing the size of the absorption field helps to overcome the restricted permeability. Elevating roads, bridges, and sites for recreational facilities above the high water level can minimize the damage caused by flooding. Fill for roads and other structures should not block the flow of floodwater. Levees are used to protect the soil in a few areas, but the levees tend to increase flood damage on nearby unprotected land. Excavated ponds are unlikely to hold water and are subject to flood damage.

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

CcA—Chavies loam, 0 to 2 percent slopes. This deep, nearly level, well drained soil is on glacial outwash terraces. Most areas are round or oblong and range from 10 to 200 acres in size.

Typically, the surface layer is brown, friable loam about 12 inches thick. The subsoil is about 36 inches thick. The upper part is yellowish brown, firm loam and strong brown, very friable sandy loam. The lower part is strong brown, friable gravelly sandy loam. The underlying material to a depth of 80 inches or more is brown, loose gravelly loamy sand. In places the surface layer is sandy loam or silt loam. Some areas are more gravelly and have a subsoil that contains more clay.

Included with this soil in mapping are areas of Cidermill, Glenford, and Chagrin soils. Cidermill soils are in areas where the surface layer and the upper part of the subsoil are silt loam. The moderately well drained Glenford soils are in areas that receive runoff from adjoining hillsides. Chagrin soils are in low areas that are subject to rare flooding. Also included are areas in the flood pool of the Wills Creek dam that are subject to controlled flooding. Included areas make up about 20 percent of most delineations.

Permeability is moderately rapid in the Chavies soil.

Runoff is slow. Available water capacity is moderate. The content of organic matter is moderate in the surface layer. The root zone is deep. The capacity to store and release plant nutrients is low.

Most areas are used for crops. Some areas are used as pasture or for suburban housing.

This soil is well suited to cultivated crops, including specialty crops. The soil dries early in the spring and is well suited to irrigation. Conserving soil moisture is the main management concern. The soil is better suited to crops that mature early in the growing season than to full-season crops. Using no-till farming methods or a system of conservation tillage that leaves crop residue on the surface conserves moisture and increases the rate of water infiltration. Banded or split applications of fertilizer minimize the loss of nutrients, especially nitrogen, and help to prevent the pollution of ground water. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction.

This soil is well suited to hay and pasture. It is suited to a wide variety of forage plants. Deep-rooted species that can tolerate droughtiness are the best suited. The soil warms up early in the spring and produces good spring pasture, but droughtiness later in the growing season reduces production. More moisture is available for seed germination in the spring than in the summer.

This soil is well suited to woodland plants, including woody ornamentals. No major limitations affect planting, management, or harvesting.

This soil is well suited to use as a site for buildings or for septic tank absorption fields. There are no natural pond sites, and excavated ponds are very unlikely to hold water.

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

CcB—Chavies loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is on outwash terraces. Most areas are round or oblong and range from 10 to 200 acres in size.

Typically, the surface layer is brown, friable loam about 9 inches thick. The subsoil is about 39 inches thick. The upper part is yellowish brown, friable loam and sandy loam, and the lower part is yellowish brown, very friable gravelly loam and gravelly sandy loam. The underlying material to a depth of 80 inches or more is dark yellowish brown, loose gravelly loamy sand. In places the surface layer is sandy loam or silt loam. Some areas are more gravelly and have a subsoil that contains more clay.

Included with this soil in mapping are small areas of Watertown, Cidermill, and Chagrin soils. Watertown soils are in the strongly sloping areas. They are more sandy than the Chavies soil. Cidermill soils are silt loam in the surface layer and the upper part of the subsoil. Chagrin soils are in the lower areas that are rarely flooded. Also included are areas in the flood pool of the Wills Creek dam that are subject to controlled flooding. Included areas make up about 20 percent of most delineations.

Permeability is moderately rapid in the Chavies soil. Runoff is slow. Available water capacity is moderate. The content of organic matter is moderate in the surface layer, and tilth is good. The root zone is deep. The capacity to store and release plant nutrients is low.

Most areas are used for crops. Some areas are used as pasture or for suburban housing.

This soil is well suited to cultivated crops, including specialty crops. The soil dries early in the spring and is well suited to irrigation. Conserving soil moisture is the main management concern. The soil is better suited to crops that mature early in the growing season than to full-season crops. Erosion is a hazard in cultivated areas. Using no-till farming methods or a system of conservation tillage that leaves crop residue on the surface conserves moisture, helps to control erosion, and increases the rate of water infiltration. Banded or split applications of fertilizer minimize the loss of nutrients, especially nitrogen, and help to prevent the pollution of ground water. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction.

This soil is well suited to hay and pasture (fig. 5). It is suited to a wide variety of forage plants. Deep-rooted species that can tolerate droughtiness are the best suited. The early warming of the soil results in good spring pasture, but droughtiness limits production later in the growing season. More moisture is available for seed germination in the spring than later in the growing season.

This soil is well suited to woodland. No limitations interfere with planting, management, or harvesting.

This soil is well suited to use as a site for buildings or for septic tank absorption fields. There are few natural pond sites, and excavated ponds are very unlikely to hold water.

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

CeA—Chili loam, 0 to 3 percent slopes. This deep, nearly level, well drained soil is on glacial outwash terraces. Most areas are round or oblong and range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 12 inches thick. The subsoil is about 36 inches thick. The upper part is dark yellowish brown,

Figure 5.—Hay being harvested in an area of Chavies loam, 2 to 6 percent slopes. An area of Markland-Glenford complex, 15 to 35 percent slopes, eroded, is in the background.

friable loam, and the lower part is brown, friable gravelly coarse sandy loam. The underlying material to a depth of 70 inches or more is grayish brown, loose gravelly loamy sand and gravelly sand. In some areas the surface layer is silt loam or sandy loam.

Included with this soil in mapping are areas of the moderately well drained Rawson soils and areas of Cidermill and Watertown soils. Cidermill soils are less sandy than the Chili soil, and Watertown soils are more sandy. Also included are areas in the flood pool of the Dillon Lake dam that are subject to controlled flooding. Included areas make up about 15 percent of most delineations.

Permeability is moderately rapid in the Chili soil. Runoff is slow. Available water capacity is moderate. The content of organic matter is moderate in the surface layer. The root zone is deep, but roots do not penetrate the more gravelly layers during dry periods. The capacity to store and release plant nutrients is moderate.

Most areas are used for cultivated crops, especially corn. Some areas are used for soybeans, small grain, or hay. A few areas are wooded.

This soil is well suited to cultivated crops, including specialty crops. It dries early in the spring and is well suited to irrigation. Conserving moisture is the main management concern. Using no-till farming methods or a system of conservation tillage that leaves crop residue on the surface conserves moisture and increases the rate of water infiltration. Banded applications of fertilizer minimize the loss of nutrients, especially nitrogen, and help to prevent the pollution of ground water. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction.

This soil is well suited to hay and pasture. It is well suited to many forage species. Deep-rooted species that can tolerate droughtiness are the best suited. The soil warms up early and produces good spring pasture, but droughtiness limits production later in the growing season.

This soil is well suited to timber production, but only a small acreage is used as woodland. No major limitations affect the planting, growth, or harvesting of trees.

This soil is well suited to use as a site for buildings or for septic tank absorption fields. Safety precautions are needed to prevent the caving of cutbanks in excavations. There are few natural pond sites, and excavated ponds are unlikely to hold water.

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

CeB—Chili loam, 3 to 8 percent slopes. This deep, gently sloping, well drained soil is on glacial outwash terraces. Most areas are round or oblong and range from 10 to 100 acres in size.

Typically, the surface layer is dark brown, friable loam about 9 inches thick. The subsoil is about 45 inches thick. The upper part is brown, friable loam, and the lower part is brown and dark yellowish brown, friable gravelly clay loam. The underlying material to a depth of 60 inches or more is yellowish brown, very friable gravelly loamy sand. In some areas the surface layer is silt loam or sandy loam.

Included with this soil in mapping are areas of the moderately well drained Rawson soils and areas of Cidermill and Watertown soils. Cidermill soils are less sandy than the Chili soil, and Watertown soils are more sandy. Also included are areas in the flood pool of the Dillon Lake dam that are subject to controlled flooding. Included areas make up about 15 percent of most delineations.

Permeability is moderately rapid in the Chili soil. Runoff is slow. Available water capacity is moderate. The content of organic matter is moderate in the surface layer. The capacity to retain and release plant nutrients is moderate. The root zone is deep, but roots do not penetrate the more gravelly layers during dry periods.

Most areas are used for corn. Some areas are used for soybeans, small grain, or hay. A few areas are wooded.

This soil is well suited to cultivated crops, including specialty crops. The soil dries early in the spring and is well suited to irrigation. Controlling erosion and conserving soil moisture are the main management concerns. The soil is better suited to crops that mature early in the growing season than to late-season crops. Using no-till farming methods or a system of conservation tillage that leaves crop residue on the surface helps to control erosion, conserves moisture, and increases the rate of water infiltration. Banded or split applications of fertilizer minimize the loss of nutrients, especially nitrogen, and help to prevent the pollution of ground water. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction.

This soil is well suited to hay and pasture. It is suited to many forage species, but deep-rooted species that can withstand droughtiness are the best suited. The soil warms up early and produces good spring pasture, but droughtiness limits production later in the growing season.

This soil is well suited to timber production, but only a small acreage is used as woodland. No major limitations affect the planting, growth, or harvesting of trees.

This soil is well suited to building site development and to septic tank absorption fields. Safety precautions are needed to prevent the caving of cutbanks in excavations. There are few natural pond sites, and excavated ponds are unlikely to hold water.

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

ChA—Chili gravelly loam, 0 to 3 percent slopes. This deep, nearly level, well drained soil is on glacial outwash terraces. Most areas are round or oblong and range from 5 to 80 acres in size.

Typically, the surface layer is dark brown, friable gravelly loam about 9 inches thick. The subsoil is about 34 inches thick. It is dark yellowish brown, very friable gravelly loam and friable gravelly clay loam and brown, friable gravelly sandy loam. The underlying material to a depth of 60 inches or more is dark grayish brown, loose very gravelly sand. In some places, the surface layer is sandy loam and the soil has less gravel throughout. In a few areas the surface soil is silt loam or loam and retains more moisture. Some areas at the base of sloping hillsides have a seasonal high water table at a depth of 3 to 6 feet.

Included with this soil in mapping are small areas of Cidermill soils. These soils have a subsoil that is more silty than that of the Chili soil. Also included are areas of soils on low ridges that are more droughty than the Chili soil and that have a more gravelly subsoil and areas in the flood pool of the Dillon Lake dam that are subject to controlled flooding. Included areas make up about 15 percent of most delineations.

Permeability is moderately rapid in the Chili soil. Runoff is slow. Available water capacity is moderate. The content of organic matter is moderately low in the plow layer. The rate of water infiltration is good. The root zone is deep, but roots do not penetrate the more gravelly layers during dry periods. The capacity to store and release plant nutrients is low.

This soil is suited to a wide variety of uses because it is well drained and nearly level. Most areas are used for crops, but some areas are used as building sites. A few areas are wooded.

This soil is well suited to cultivated crops, including specialty crops. It dries early in the spring and is well suited to irrigation. Conserving soil moisture is the main management concern. Using no-till farming methods or a system of conservation tillage that leaves crop residue on the surface conserves moisture and increases the rate of water infiltration. Banded or split applications of fertilizer minimize the loss of nutrients, especially nitrogen, and help to prevent the pollution of ground water. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction.

This soil is well suited to hay and pasture. It is well suited to many forage species. The soil warms up early and produces good spring pasture, but droughtiness limits production later in the growing season. Rotating the pasture with cultivated crops helps to establish the plants and control weeds.

This soil is well suited to timber production, but only a small acreage is used as woodland. No major limitations affect the planting, growth, or harvesting of trees. Species that can tolerate drought should be selected for planting.

This soil is well suited to building site development and septic tank absorption fields. Safety precautions are needed to prevent the caving of cutbanks in excavated areas. There are few natural pond sites, and excavated ponds are very unlikely to hold water.

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

ChB—Chili gravelly loam, 3 to 8 percent slopes. This deep, gently sloping, well drained soil is on slight rises on glacial outwash terraces. Most areas are round, oblong, or long and narrow and range from 5 to 50 acres in size.

Typically, the surface layer is dark brown, friable gravelly loam about 9 inches thick. The subsoil is about 34 inches thick. It is dark yellowish brown, friable gravelly loam, gravelly clay loam, and gravelly sandy loam. The underlying material to a depth of about 60 inches is brown and dark grayish brown, loose very gravelly loamy sand and gravelly sand.

Included with this soil in mapping are areas of very gravelly soils on low ridges that are more droughty than the Chili soil. Also included are areas in the flood pool of the Dillon Lake dam that are subject to controlled flooding. Included areas make up about 15 percent of most delineations.

Permeability is moderately rapid in the Chili soil. Runoff is medium. Available water capacity is moderate. The content of organic matter is moderately low in the surface layer. The root zone is deep, but roots do not penetrate the more gravelly layers during dry periods. The capacity to store and release plant nutrients is low.

Most areas are used as cropland. A few areas are used as pasture or woodland.

This soil is well suited to cultivated crops, including specialty crops. The hazard of erosion is moderate. Conserving soil moisture is a management concern. The soil dries early in the spring and is well suited to irrigation. It is better suited to crops that mature early in the growing season than to crops that mature late in summer. Using no-till farming methods or a system of conservation tillage that leaves crop residue on the surface conserves moisture, increases the rate of water infiltration, and reduces the hazard of erosion. Banded or split applications of fertilizer minimize the loss of nutrients, especially nitrogen, and help to prevent the pollution of ground water. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction.

This soil is well suited to hay and pasture. It is suited to many forage species, but deep-rooted species that can tolerate droughtiness are the best suited. The soil warms up early and produces good spring pasture, but droughtiness limits production later in the growing season. Rotating pastures with cultivated crops helps to control weeds and establish the forage plants.

This soil is well suited to timber production, but only a small acreage is used as woodland. No major limitations affect the planting, growth, or harvesting of trees. Drought-tolerant species should be selected for planting.

This soil is well suited to building site development and septic tank absorption fields. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion on construction sites. Safety precautions are needed to prevent the caving of cutbanks in excavated areas. There are few natural pond sites, and excavated ponds are unlikely to hold water.

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

ChC—Chili gravelly loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on knolls and the dissected margins of glacial outwash terraces. Most areas are oblong and range from 5 to 20 acres in size.

Typically, the surface layer is dark brown, friable gravelly loam about 6 inches thick. The subsoil is about 31 inches thick. It is dark yellowish brown, friable gravelly loam, gravelly clay loam, and gravelly sandy loam. The underlying material to a depth of 60 inches or more is brown and dark grayish brown, loose very gravelly loamy sand and gravelly sand.

Included with this soil in mapping are small areas of soils on the upper part of slopes. These soils have a subsoil that is more gravelly than that of the Chili soil. Also included are areas in the flood pool of the Dillon Lake dam that are subject to controlled flooding. Included areas make up about 15 percent of most delineations.

Permeability is moderately rapid in the Chili soil. Runoff is medium or rapid. Available water capacity is low or moderate. The content of organic matter is moderately low in the surface layer. The root zone is deep, but roots do not penetrate the more gravelly layers during dry periods. The capacity to store and release plant nutrients is low.

Most areas are used as cropland. Some areas are used as pasture.

This soil is moderately suited to cultivated crops. If the soil is cultivated, the hazard of erosion is severe. The soil warms up and dries early in the spring but is droughty in summer. Crops that mature early in the growing season are better suited than full-season crops. Controlling erosion and conserving moisture are the major management concerns. Using no-till farming methods or a system of conservation tillage that leaves crop residue on the surface helps to control erosion and conserves moisture. The soil is well suited to no-till farming methods. Including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways reduce the hazard of erosion. Banded or split applications of fertilizer minimize the loss of nutrients, especially nitrogen, and help to prevent the pollution of ground water.

This soil is well suited to hay and pasture. It is suited to many forage species, but deep-rooted species that can tolerate droughtiness are the best suited. The soil warms up early and produces good spring pasture, but droughtiness limits production later in the growing season. If the soil is plowed, the hazard of erosion is moderate. Using no-till seeding methods reduces this hazard.

This soil is well suited to timber production, but only a small acreage is used as woodland. No major limitations affect the planting, growth, or harvesting of trees. Species that can tolerate drought should be selected for planting.

This soil is moderately suited to use as a site for buildings or for septic tank absorption fields. The slope is a management concern. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover in exposed areas reduce the hazard of erosion on construction sites. Designing buildings so that they conform to the natural slope of the land reduces the need for excavation and grading. Installing leach lines on the contour helps to prevent the surfacing of effluent. Safety precautions are needed to prevent the caving of cutbanks in excavated areas. Excavated ponds are unlikely to hold water.

This soil is recognized as farmland of local importance. The land capability classification is IIIe. The pasture and hayland suitability group is A-1. The woodland ordination symbol is 4A.

CkA—Cidermill silt loam, 0 to 3 percent slopes. This deep, nearly level, well drained soil is on broad terraces and glacial outwash plains that have a mantle of windblown silt. Most areas are irregular in shape and range from 10 to 300 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 48 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is yellowish brown, friable loam and very friable fine sandy loam. The underlying material to a depth of 80 inches or more is yellowish brown, loose loamy fine sand and loose, stratified sand and gravelly sand. In some areas the silty material is more than 4 feet thick. In other areas the subsoil has more sand and less silt. A few areas are gently sloping. In places the underlying material is more gravelly.

Included with this soil in mapping are small areas of Glenford, Fitchville, Watertown, and Chavies soils. The moderately well drained Glenford and somewhat poorly drained Fitchville soils are in slight depressions and drainageways. Watertown and Chavies soils are on small knolls and ridges. Also included are a few areas of urban land and areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up less than 20 percent of most delineations.

Permeability is moderate in the subsoil of the Cidermill soil and rapid in the underlying material. Runoff is slow. Available water capacity is high or moderate. The content of organic matter is moderately low in the surface layer. The soil crusts after periods of heavy rainfall, especially in tilled areas. The root zone is deep. The capacity to store and release plant nutrients is moderate.

Most areas are used for corn, soybeans, small grain, or hay. A small acreage is used for specialty crops, such as strawberries and potatoes.

This soil is well suited to cultivated crops, including specialty crops. The soil dries early in the spring and is well suited to irrigation. It is better suited to crops that mature early in the growing season than to full-season crops. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and hinders the emergence of seedlings. Shallow cultivation of intertilled crops, however, breaks up the crust. Using no-till farming methods or a system of conservation tillage that leaves crop residue on the surface conserves moisture and increases the rate of water infiltration. Banded applications of fertilizer minimize the loss of nutrients, especially nitrogen, and help to prevent the pollution of ground water. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction.

This soil is well suited to pasture. A wide variety of adapted forage plants can be used. The soil warms up early and produces good spring pasture.

This soil is well suited to timber production, but only a small acreage is used as woodland. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is well suited to use as a site for buildings or for septic tank absorption fields. Safety precautions are needed to prevent the caving of cutbanks in excavations. Suitable base material is needed to minimize the damage to roads and streets caused by low strength and by frost action.

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

CnB—Cincinnati silt loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is on broad ridgetops or on the mildly dissected parts of glaciated hillsides that have been covered by windblown silt. Most areas are oblong or are irregular in shape and range from 10 to 80 acres in size.

Typically, the surface layer is dark grayish brown, very friable and friable silt loam about 8 inches thick. The subsoil is about 61 inches thick. The upper part is brown and yellowish brown, friable silt loam; the next part is a fragipan of yellowish brown, dense, very firm silty clay loam and clay loam; and the lower part is yellowish brown, firm silty clay loam. The underlying material is dark yellowish brown and olive brown, soft, interbedded shale and siltstone. Some areas do not have a dense fragipan. In places the subsoil has more sand and pebbles. Many areas on concave slopes are moderately well drained.

Included with this soil in mapping are small areas of the moderately deep Gilpin soils on the crests of hills. Also included are small areas of somewhat poorly drained soils along drainageways and seepage zones. Included soils make up about 15 percent of most delineations.

Permeability is moderate above the fragipan in the Cincinnati soil and moderately slow or slow in the fragipan. Runoff is medium. Roots are generally restricted by the fragipan. Available water capacity is moderate. The content of organic matter is moderately low in the surface layer. A seasonal high water table is perched in or above the fragipan during extended wet periods. The capacity to store and release plant nutrients is moderate. The potential for frost action is high. The shrink-swell potential is moderate in the lower part of the subsoil.

Most areas are used for cultivated crops or for hay. Some areas are used as pasture or grazed woodland.

This soil is well suited to cultivated crops, including specialty crops. The hazard of erosion is moderate in cultivated areas. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, and tilling on the contour reduce the hazard of erosion (fig. 6). Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction.

This soil is well suited to hay and pasture. The roots of some forage plants are restricted by the fragipan. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover on the surface in the fall or seeding a mixture of grasses and legumes can minimize the damage caused by frost heave. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

This soil is well suited to timber production. No major limitations affect the planting or growth of trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Controlling vines and removing undesirable trees help to increase the long-term production of sawlogs and provide firewood.

This soil is well suited to use as a site for buildings, but wetness is a management concern. Installing drains around footings and coating exterior walls help to prevent wet basements. The soil is only moderately suited to septic tank absorption fields because of the wetness and the restricted permeability in the fragipan. Enlarging the leaching area or installing a double leach field can help to overcome the restricted permeability. Perimeter drains can be used to lower the water table in areas used for septic tank absorption fields.

There are few natural pond sites. Excavated ponds may be able to hold water, provided the excavation does not extend into the weathered bedrock. Onsite investigation is needed.

The land capability classification is IIe. The pasture

Figure 6.—No-till farming methods used for corn in an area of Cincinnati silt loam, 2 to 6 percent slopes.

and hayland suitability group is F-3. The woodland ordination symbol is 4A.

CnC2—Cincinnati silt loam, 6 to 15 percent slopes, eroded. This deep, strongly sloping, well drained soil is on shoulder slopes and the dissected parts of glaciated hillsides that have been covered by windblown silt. Erosion has removed part of the original surface layer and reduced the thickness of the subsoil layers above the fragipan. Most areas are oblong or are irregular in shape and range from 10 to 80 acres in size.

Typically, the surface layer is dark grayish brown and brown, friable silt loam about 8 inches thick. The subsoil is about 61 inches thick. The upper part is brown and yellowish brown, friable silt loam. The next part is a fragipan of yellowish brown, dense, very firm silty clay loam and clay loam. The lower part is yellowish brown, firm silty clay loam. The underlying material is dark yellowish brown, soft, interbedded shale and siltstone. In places the subsoil has more sand and pebbles. A few areas do not have a dense layer in the subsoil.

Included with this soil in mapping are a few areas of the moderately deep Gilpin soils and areas of somewhat poorly drained soils along drainageways and seepage zones. Also included are severely eroded areas of soils that are moderately well drained. Included areas make up about 20 percent of most delineations.

Permeability is moderate above the fragipan in the Cincinnati soil and moderately slow or slow in the fragipan. Runoff is rapid. The root zone is limited mainly to the layers above the fragipan. Available water capacity is moderate. Because the plow layer is a mixture of material from the surface layer and the subsoil, the content of organic matter is low. A seasonal high water table is in or above the fragipan during wet periods. The capacity to store and release plant nutrients is low or moderate. The potential for frost action is high.

Most areas are used as cropland or pasture. Some areas are wooded and have been grazed.

This soil is only moderately suited to cultivated crops. Many areas are significantly eroded, and controlling further erosion is the main management concern. The hazard of erosion is severe in cultivated areas. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways can reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction.

This soil is well suited to hay and pasture. The roots of some forage species are restricted by the fragipan. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover on the surface in the fall or including grasses in the seeding mixture can minimize frost damage. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

This soil is well suited to timber production. No major limitations affect the planting or growth of trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Controlling vines and removing undesirable trees increase the long-term production of sawlogs and provide firewood.

This soil is well suited to use as a site for buildings. The slope and the seasonal wetness are limitations. Maintaining a cover of plants during construction helps to control erosion. Installing drains around footings and coating exterior basement walls help to prevent wet basements. The soil is only moderately suited to septic tank absorption fields. The seasonal wetness and the restricted permeability in the fragipan are limitations. Enlarging the leaching area or using a double field helps to overcome the restricted permeability. Establishing lines across the slope can prevent the surfacing of effluent. Perimeter drains can be used to lower the seasonal high water table.

Ponds can be developed by damming some of the natural drainageways. The upper part of the soil packs poorly and is poor fill, but the fragipan and the lower part of the subsoil commonly are good fill. If ponds are excavated, care should be taken to prevent the exposure of rock layers. Onsite investigation is needed to determine the depth to bedrock.

This soil is recognized as farmland of local importance. The land capability classification is IIIe. The pasture and hayland suitability group is F-3. The woodland ordination symbol is 4A.

CpC2—Clarksburg silt loam, 8 to 15 percent slopes, eroded. This deep, strongly sloping, moderately well drained soil is on slightly concave foot slopes or benches below the steeper hillsides. Erosion has removed part of the original surface layer, and tillage has mixed the subsoil with the surface layer. Most areas are long and narrow and range from 5 to 20 acres in size.

Typically, the surface layer is brown and yellowish brown, friable silt loam about 9 inches thick. The upper part of the subsoil, to a depth of about 25 inches, is yellowish brown, friable silt loam, firm silty clay loam, and channery clay loam. The next part, to a depth of about 44 inches, is a fragipan of yellowish brown, mottled, very firm, brittle channery clay loam and clay loam. The lower part of the subsoil, to a depth of about 56 inches, is yellowish brown, mottled, firm silty clay loam. The underlying material to a depth of 80 inches or more is dark brown and yellowish brown, firm clay loam and channery clay loam. A few areas have moderately steep slopes. In some places, the subsoil has less sand and fewer coarse fragments and the underlying material is stratified. In other places the soil does not have a fragipan but has restrictive clayey layers in the lower part of the subsoil.

Included with this soil in mapping are small areas of the well drained Alford soils at the base of slopes. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 15 percent of most delineations.

Permeability is moderate in the upper part of the subsoil in the Clarksburg soil and moderately slow or slow in the lower part of the subsoil and in the underlying material. Runoff from cultivated areas is rapid. The root zone is limited mainly to the layers above the dense fragipan. Available water capacity is low in the root zone. The content of organic matter is moderate in the surface layer. The capacity to retain and release plant nutrients is moderate. A seasonal high water table is perched above the fragipan in winter and spring and during other extended wet periods. The potential for frost action is moderate. Hillside seepage is common in areas of this soil, especially on the lower parts of slopes.

Most areas are used as pasture or woodland. A few areas are used as cropland.

This soil is only moderately suited to cultivated crops. Many areas are significantly eroded, and controlling further erosion is the main management concern. The hazard of erosion is severe in cultivated areas. Improving soil fertility and conserving moisture also are management concerns. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways can reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Subsurface drains are needed in seepy areas.

This soil is well suited to hay and pasture. The roots of some forage plants are restricted by the fragipan. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover on the surface in the fall and seeding a mixture of grasses and legumes can minimize the damage caused by frost heave. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

This soil is well suited to timber production. No major limitations affect the planting or growth of trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface.

This soil is only moderately suited to use as a site for buildings or for septic tank absorption fields because of the slope, the shrink-swell potential, the wetness, and the restricted permeability. Increased runoff and erosion are management concerns on construction sites. Replacing or maintaining the vegetative cover can minimize runoff and reduce the hazard of erosion. Drains around footings can lower the water table. Backfilling with gravel around foundations helps to intercept water seeping along the top of the fragipan and helps to prevent the damage caused by shrinking and swelling. Enlarging the leaching area for absorption fields helps to overcome the restricted permeability in the fragipan. Perimeter drains can be used to lower the water table. Installing leaching lines on the contour helps to prevent the surfacing of effluent. Water seeping or flowing out of adjacent hillsides should be diverted away from building sites and septic tank absorption fields.

This soil has good potential for ponds. Springs at the base of hills are a good water source. The soil material packs well and generally makes good fill. Onsite investigation is needed to determine the depth to bedrock.

This soil is recognized as farmland of local importance. The land capability classification is IIIe. The pasture and hayland suitability group is F-3. The woodland ordination symbol is 4A.

CrC—Claysville-Guernsey silty clay loams, 8 to 15 percent slopes. These deep, strongly sloping soils are on foot slopes and benches in areas where ground water seeps to the surface at the headwaters of small drainageways. The microrelief is hummocky because of common landslides and gullies. The somewhat poorly drained Claysville soil is on concave slopes, and the moderately well drained Guernsey soil is on convex slopes. The two soils occur as areas so closely intermingled that it is impractical to map them separately. Most areas are about 50 percent Claysville soil and 30 percent Guernsey soil. Individual areas are funnel shaped and range from 2 to 10 acres in size.

Typically, the surface layer of the Claysville soil is very dark grayish brown, friable silty clay loam about 13 inches thick. The subsoil is about 41 inches thick. It is dark grayish brown, light olive brown, and light brownish gray, mottled, firm silty clay loam, silty clay, and shaly silty clay. The underlying material to a depth of 84 inches or more is light brownish gray and yellowish brown, mottled, firm silty clay loam and shaly silty clay loam. In eroded areas the dark surface layer is less than 10 inches thick.

Typically, the surface layer of the Guernsey soil is brown, friable silty clay loam about 7 inches thick. The subsoil is about 32 inches thick. The upper part is light olive brown and brown, mottled silty clay and clay. The lower part is weak red and olive gray clay. The underlying material to a depth of 60 inches or more is light olive brown and light olive gray silty clay. In severely eroded areas the surface layer is silty clay and consists mostly of subsoil material. Some areas are well drained.

Included with these soils in mapping are areas of Upshur soils. Upshur soils are in convex areas and are better drained than the Claysville and Guernsey soils. Also included, in the wetter areas that have a high water table near the surface most of the year, are soils that have a surface layer of black silty clay that is as much as 30 inches thick. In some areas where landslides have occurred, the soils have no continuous horizons but are dominated by clayey subsoil material. A few areas on alluvial fans along flood plains are better drained than the Claysville and Guernsey soils. Included areas make up about 20 percent of most delineations.

Permeability is slow in the Claysville soil and moderately slow or slow in the Guernsey soil. Runoff is medium or rapid on both soils, but seepage commonly keeps the surface wet for long periods. The rate of water infiltration is commonly reduced by a compacted surface layer. Available water capacity is moderate. The content of organic matter is high in the surface layer of

Figure 7.—Landslide damage in an area of Claysville-Guernsey silty clay loams, 8 to 15 percent slopes.

the Claysville soil and moderately low in the surface layer of the Guernsey soil. The rooting depth in the Claysville soil varies, depending on the depth to the seasonal high water table. It is deep in the Guernsey soil. A seasonal high water table is perched in the upper part of the subsoil in the Claysville soil and in the lower part of the Guernsey soil during extended wet periods. Both soils have a high capacity to store and release plant nutrients. They are generally unstable when wet and are subject to landslides or slippage (fig. 7).

Most areas are used as pasture. A few areas are cultivated. Some areas that were used for mining or as oil fields support native plant cover consisting of species that can survive in wet or swampy conditions. A few areas are wooded. Native trees that can tolerate wetness include elm, ash, pin oak, and red maple.

These soils are only moderately suited to cultivated crops. Wetness and the hazard of erosion are management concerns. Deep-rooted plants do not grow well in undrained areas of the Claysville soil. The Claysville soil is suited to crops if adequate subsurface drainage is provided. It is likely to be more stable if the water table is lowered. Subsurface drains should be closely spaced because of the slow permeability in the subsoil. Natural drainage generally is adequate in the Guernsey soil. Tilling on the contour, establishing grassed waterways, and leaving crop residue on the surface help to control runoff and erosion. In some areas the use of machinery is limited because of the hummocky terrain.

These soils are only moderately suited to hay and pasture. They are not well suited to deep-rooted legumes, such as alfalfa, even if they are drained. The Claysville soil is suited only to forage plants that can tolerate considerable wetness. The Guernsey soil is suited to a wider range of forage species. The high pH of the Claysville soil is favorable for bluegrass pasture. Grazing when the soils are soft and wet can damage the sod and results in excessive surface compaction. Springs for livestock water can be developed in many areas.

These soils are only moderately suited to woodland. Species that are tolerant of wetness grow best on the Claysville soil. The Guernsey soil is suited to a wider variety of species. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

These soils are generally unsuited to use as sites for buildings because of the seasonal wetness, the shrink-swell potential, and unstable slopes. The Claysville soil is generally unsuited to septic tank absorption fields because of the restricted permeability, land slips, and the wetness. The Guernsey soil is poorly suited because of the wetness and the restricted permeability. Most areas of the Guernsey soil are too small for a large septic tank absorption field. A perimeter drain helps to lower the seasonal high water table. An aerator or other alternative system should be considered.

Ponds can be developed below some of the springs. Fills are subject to cracking because of slippage. The soil material packs well only when it is at the proper moisture content.

The land capability classification is IIIw. The pasture and hayland suitability group is C-2 for the Claysville soil and A-6 for the Guernsey soil. No woodland ordination symbol is assigned for the Claysville soil. The woodland ordination symbol for the Guernsey soil is 4A.

CsC2—Coshocton silt loam, 8 to 15 percent slopes, eroded. This deep, strongly sloping, moderately well drained soil is in saddles on ridgetops. Slopes are mostly concave, and seeps or springs are common. Erosion has removed part of the original surface layer and reduced the depth to the more clayey subsoil. Most areas are oblong or are irregular in shape and range from 5 to 30 acres in size.

Typically, the surface layer and subsurface layer are dark grayish brown and brown, friable silt loam about 7 inches thick. The subsoil is about 39 inches thick. The upper part, to a depth of about 20 inches, is brown and yellowish brown, firm channery clay loam. The lower part, to a depth of about 46 inches, is brown, mottled, firm silty clay loam. The underlying material to a depth of 60 inches or more is brown and yellowish brown, firm silty clay loam and silty clay. In the less sloping areas, the soil contains fewer rock fragments. In some areas the subsoil has more clay. In a few areas the surface layer has more stones. Soils that have a fragipan are on some benches or foot slopes.

Included with this soil in mapping are the well drained Gilpin, Rigley, and Westmoreland soils. Gilpin soils are in areas that are moderately deep over soft siltstone bedrock. Rigley and Westmoreland soils are on the steeper convex slopes. Also included, near seep zones and drainageways, are soils that are wetter than the Coshocton soil. Included soils make up about 20 percent of most delineations.

Permeability is moderately slow or slow in the Coshocton soil. Runoff is rapid. Available water capacity is moderate. The content of organic matter is moderately low in the eroded surface layer. The root zone is deep. The capacity to store and release plant nutrients is moderate. A seasonal high water table is in the subsoil during extended wet periods. The potential for frost action is high. The shrink-swell potential is moderate in the subsoil.

This soil is used mainly as cropland or pasture. Some areas are wooded (fig. 8). The trees in wooded areas are mostly second-growth native hardwoods, such as aspen, yellow-poplar, maple, and dogwood. Plantations of white pine and red pine are common.

This soil is only moderately suited to cultivated crops. Many areas are significantly eroded, and controlling further erosion is the main management concern. The hazard of erosion is severe in cultivated areas. Improving soil fertility and conserving moisture also are management concerns. Surface crusting after rains reduces infiltration and retards seedling emergence if the soil is cultivated. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways can reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Wetness around seeps and springs often delays spring planting. Crops can be planted earlier and crop production is improved if a subsurface drainage system is used.

This soil is well suited to hay and pasture. It is suited to a wide variety of forage plants. Acidity in the root

Figure 8.—Native trees, shrubs, and grasses in an area of Coshocton silt loam, 8 to 15 percent slopes, eroded. Wooded areas near ponds provide habitat for wildlife.

zone and wetness are limitations that affect some legumes. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover on the surface in the fall or seeding a grass-legume mixture can minimize the damage caused by frost heave. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion. Springs that can provide water for livestock are common.

This soil is well suited to timber production. No major limitations affect the planting or growth of trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Improving timber stands by controlling vines and thinning undesirable trees greatly increases the long-term production of sawlogs and provides firewood.

This soil is only moderately suited to use as a site for buildings. The seasonal high water table, the slope, and the shrink-swell potential are management concerns. Extra footings and reinforced walls are needed because of low strength and the moderate shrink-swell potential. Using a drainage system around foundations and waterproofing walls can reduce seepage into basements. The hazard of erosion on construction sites can be reduced by removing as little vegetation as possible, by seeding a temporary cover, and by providing stable channels for the flow of storm water.

This soil is poorly suited to conventional septic tank absorption fields. The restricted permeability in the lower part of the subsoil and the seasonal high water table are limitations. Using perimeter drains around absorption fields can lower the seasonal high water table and intercept lateral seepage from the higher areas. Enlarging the absorption field increases the absorption of effluent. Installing distribution lines on the contour helps to prevent the surfacing of effluent. An aerator or an alternative system should be considered.

Good sites for ponds are in draws that cross areas of this soil. The soil material is good fill and commonly packs well, but layers that permit excessive seepage are in some areas. Onsite investigation is needed.

This soil is recognized as farmland of local importance. The land capability classification is IIIe. The pasture and hayland suitability group is A-6. The woodland ordination symbol is 4A.

CsD—Coshocton silt loam, 15 to 25 percent slopes. This deep, moderately steep, moderately well drained soil is on the lower parts of hillsides and in coves at the head of minor drainageways on dissected hillsides. Gullies and soil-creep scars are common. Most areas are crescent shaped or long and narrow and range from 5 to 35 acres in size.

Typically, the surface layer is very dark gray and dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 32 inches thick. The upper part, to a depth of about 20 inches, is yellowish brown, firm silt loam and clay loam. The lower part, to a depth of about 40 inches, is yellowish brown, mottled, firm silty clay loam. The underlying material is dark yellowish brown, mottled, very firm silty clay loam about 25 inches thick. Dark gray and very dark grayish brown, soft shale bedrock is at a depth of about 65 inches. In some of the less sloping areas, the upper part of the soil is very silty and does not contain pebbles. In places the subsoil has more clay. In some severely eroded areas, the surface layer has more rock fragments.

Included with this soil in mapping are areas of the well drained Gilpin, Berks, and Westmoreland soils and areas of Rigley and Clarksburg soils. Gilpin and Berks soils are moderately deep over soft siltstone bedrock. Westmoreland soils are mainly on convex slopes. Rigley soils are near areas that have sandstone. Clarksburg soils have a fragipan. They are on some of the lower slopes. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding and somewhat poorly drained soils near seeps and springs. Included areas make up about 25 percent of most delineations.

Permeability is moderately slow or slow in the Coshocton soil. Runoff is very rapid. Available water capacity is moderate. The content of organic matter is moderately low in the surface layer. The root zone is deep. The capacity to store and release plant nutrients is moderate. A seasonal high water table is in the lower part of the subsoil during extended wet periods. The shrink-swell potential is moderate in the subsoil. The potential for frost action is high.

This soil is used mainly as pasture or woodland. A few areas are used as cropland. The wooded areas support second-growth stands of native hardwoods, such as yellow-poplar, maple, aspen, dogwood, and oak. Plantations of white pine, red pine, and spruce are common.

This soil is poorly suited to cultivated crops. Erosion is the main management concern. The hazard of erosion is very severe in cultivated areas. Maintaining a permanent plant cover is the best means of controlling erosion. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways can reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Randomly spaced subsurface drains are needed in seep spots.

This soil is only moderately suited to hay and pasture. A wide variety of forage plants can be used. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover on the surface in the fall or seeding a grass-legume mixture can minimize the damage caused by frost heave. If the soil is plowed, the hazard of erosion is severe. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion. Restricting grazing during wet periods helps to prevent compaction of the surface layer and damage to plant roots. Springs that can provide water for livestock throughout the year are common.

This soil is only moderately suited to timber production. The aspect of the slope affects the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. The slope restricts the use of planting and logging equipment. Establishing roads and skid trails on the contour, establishing water bars, and maintaining a vegetative cover help to control erosion. Where roads and trails cross channels, adding stones helps to prevent gullying. Using seedlings that have been transplanted once or adding mulch reduces the seedling mortality rate on south-facing slopes. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is poorly suited to use as a site for buildings because of the slope and the seasonal wetness. Soil creep is common, especially when the soil is wet. Using extra footings and reinforcing walls help to prevent the damage to foundations caused by soil creep. Using perimeter drains around foundations and waterproofing walls help to prevent seepage in basements. The hazard of erosion during construction can be reduced by limiting the excavated area, by seeding temporary grasses on the construction site, and by providing sediment basins to collect runoff.

This soil is generally unsuited to conventional septic tank absorption fields because of the restricted permeability, the seasonal wetness, and the slope.

Ponds can be developed in many of the small draws in areas of this soil. The soil material commonly packs well and is good fill for dams, but layers of porous or shattered rock that permit excessive seepage are in some areas. Onsite investigation is needed.

The land capability classification is IVe. The pasture and hayland suitability group is A-2. The woodland ordination symbol is 4R on north aspects and 3R on south aspects.

CtE—Coshocton-Westmoreland silt loams, 25 to 40 percent slopes. These deep, steep soils are on bluffs or are in ravines or hollows on dissected hillsides. The moderately well drained Coshocton soil is in the concave, less sloping landscape positions. The well drained Westmoreland soil is on the middle and upper parts of convex shoulder slopes or on the nose slopes of hillsides. Areas of these soils occur as alternating bands, which are associated with different bedrock strata. They commonly are 150 to 500 feet wide and are 10 to 300 acres in size. Most areas are about 45 percent Coshocton soil and 35 percent Westmoreland soil. The two soils occur as areas so intricately mixed or so small that it is impractical to map them separately.

Typically, the surface layer of the Coshocton soil is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 32 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is yellowish brown, mottled, firm silty clay loam. The underlying material is yellowish brown, firm silty clay about 20 inches thick. Soft, weathered siltstone and shale bedrock is at a depth of about 60 inches. In some areas the surface layer is channery loam or loam.

Typically, the surface layer of the Westmoreland soil is dark grayish brown, very friable silt loam about 5 inches thick. The subsoil is about 32 inches thick. The upper part is yellowish brown, friable silty clay loam, and the lower part is brown and yellowish brown, friable and firm shaly silty clay loam. The underlying material is brown, firm very shaly silty clay loam about 28 inches thick. Soft, weathered shale bedrock is at a depth of about 65 inches. In places the subsoil contains more sand and less clay. In some areas on convex slopes, the soil is moderately deep over bedrock.

Included with these soils in mapping are small areas of Berks, Clarksburg, Guernsey, Lobdell, Newark, Omulga, and Rigley soils. The moderately deep, channery Berks soils and the Rigley soils are in very steep areas on the upper part of hillsides. Rigley soils are more sandy than the major soils. Guernsey soils are on moderately steep benches. They are more clayey than the major soils. Also, they are susceptible to slippage. Omulga and Clarksburg soils are on foot slopes. They have a fragipan. Lobdell and Newark soils are on very narrow flood plains along small streams. They are subject to flooding. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 25 percent of most delineations.

Permeability is moderately slow or slow in the Coshocton soil and moderate in the Westmoreland soil. Runoff is rapid on both soils. Available water capacity is moderate. The content of organic matter is moderately low in the surface layer. The root zone is deep. A seasonal high water table is perched in the subsoil of the Coshocton soil in late winter and in spring and during other extended wet periods. The potential for frost action is moderate in the Westmoreland soil and high in the Coshocton soil. The shrink-swell potential is moderate in the subsoil of the Coshocton soil.

Most areas are wooded. A few areas are used as pasture.

These soils are generally unsuited to cultivated crops and to hay because of the slope and a very severe hazard of erosion. Maintaining a permanent plant cover is the best means of controlling erosion.

These soils are poorly suited to pasture. The slope limits the use of farm equipment. A wide variety of forage plants can grow on these soils, but seeding and management are difficult. Frost heave in areas of the Coshocton soil can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover on the surface in the fall or including grasses in the seeding mixture can minimize the damage caused by frost heave. If the soils are tilled, the hazard of erosion is very severe. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion. Established pastures should be maintained for as long as possible. In overgrazed areas the hazard of erosion can be very severe.

These soils are only moderately suited to timber production. The slope limits the use of many types of equipment. The hazard of erosion during harvesting can be reduced by building logging roads and skid trails on the contour and by establishing water bars. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Mechanical tree planters and mowers used for weed control cannot be operated safely on these soils. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate, especially on south aspects. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds.

These soils are generally unsuited to use as sites for buildings because of the slope. Building roads and driveways on the contour and seeding road cuts can reduce the hazard of erosion.

These soils are generally unsuited to septic tank absorption fields because of the slope. The seasonal wetness and the restricted permeability in the Coshocton soil also are limitations.

Areas of these soils in the upper reaches of drainageways have some potential as sites for ponds. The drainageways have a considerable grade, and a high fill is needed to create an impoundment of any size. The soil material is generally a good source of fill. Rock layers that permit excessive seepage are in some areas. Onsite investigation is needed.

The land capability classification is VIe. The pasture and hayland suitability group is A-3. The woodland ordination symbol for the Coshocton soil is 4R on north aspects and 3R on south aspects. The woodland ordination symbol for the Westmoreland soil is 4R.

Ds—Dumps and Pits, mine. This map unit consists of mine dumps and mine pits that remain in areas that were used for surface and underground coal mining.

Mine dumps are gently sloping to very steep ridges or cone-shaped piles of waste material from coal mining. They are in unreclaimed strip-mine pits, at the opening of drift mines, and around coal loading areas (fig. 9). The waste material is mostly soft, impure coal and black, carbonaceous roof shale that originally had a relatively high content of sulfur compounds. It is referred to locally as "mine gob," "gob," or "gob piles." Some areas have burned or oxidized over time and consist of hard, red to gray, shaly or gravelly material. This material is referred to locally as "red dog." A few areas have been graded.

Mine pits are nearly level to sloping areas of exposed underclay that remain in areas that were strip-mined for coal. They are most common in unreclaimed mine areas. The surface in these areas is barren and has many rills and gullies. Residue of coal and red dog is commonly on the surface. Most areas are sinuous and follow the approximate path of the last mining activities.

Included in mapping are many shallow ponds in which surface water collects. The water in many of these ponds is too acid for fish and wildlife. At the margin of some areas are very steep areas of Fairpoint soils or sloping areas of Bethesda soils, which have not been reclaimed after surface mining. A few areas have been covered with soil material and support plants. Sediments from toxic spoil are in a few areas along streams. Also included are areas near Philo that contain industrial waste, such as fly ash and foundry sand.

Mine pits and mine dumps have poor physical properties for plant growth, and most areas are barren. The surface layer is very acid because it contains weathering pyrite, which releases sulfuric acid. Runoff is slow to rapid. Plants are unable to survive because of the extreme acidity and the accompanying toxic levels of elements, such as iron, aluminum, and manganese. Mine gob has a high content of organic carbon but has a very low content of humus, which is commonly in unmined soils. The oxidized material has a very low content of organic carbon and does not contain organic matter. Available water capacity is low or very low in both materials. Water percolating through the acid material is a source of acid stream pollution in many areas.

Most areas of mine dumps and pits are now abandoned or are used as wildlife habitat. The absence of cover in these areas makes them very susceptible to erosion. Sediment and runoff from these areas contribute directly to acid drainage problems in nearby streams.

Areas of this map unit can be reclaimed. Grading helps to control runoff and provides a surface where machinery can be used. The graded surface can be blanketed with less acid spoil, fly ash, or surface soil material. Applications of lime can temporarily reduce acidity, but the further release of sulfuric acid causes the soil material to become extremely acid within a few years.

In their present condition, areas of this map unit are unsuited to crops or pasture. With proper reclamation, these areas can support some vegetation but are not likely to produce enough forage for pasture. Reclaimed areas could support trees. Trees would grow very slowly, and some would be likely to die as their root systems reached the toxic materials.

Areas of this map unit are not suited to building site development or septic tank absorption fields because of uneven settlement and the extreme acidity, which damage building materials and injure landscape plantings. The suitability of some areas can improve following complete settling and reclamation.

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

FaB—Fairpoint silty clay loam, 1 to 15 percent slopes. This deep, nearly level to strongly sloping, well drained soil is on mine spoil ridgetops and benches in

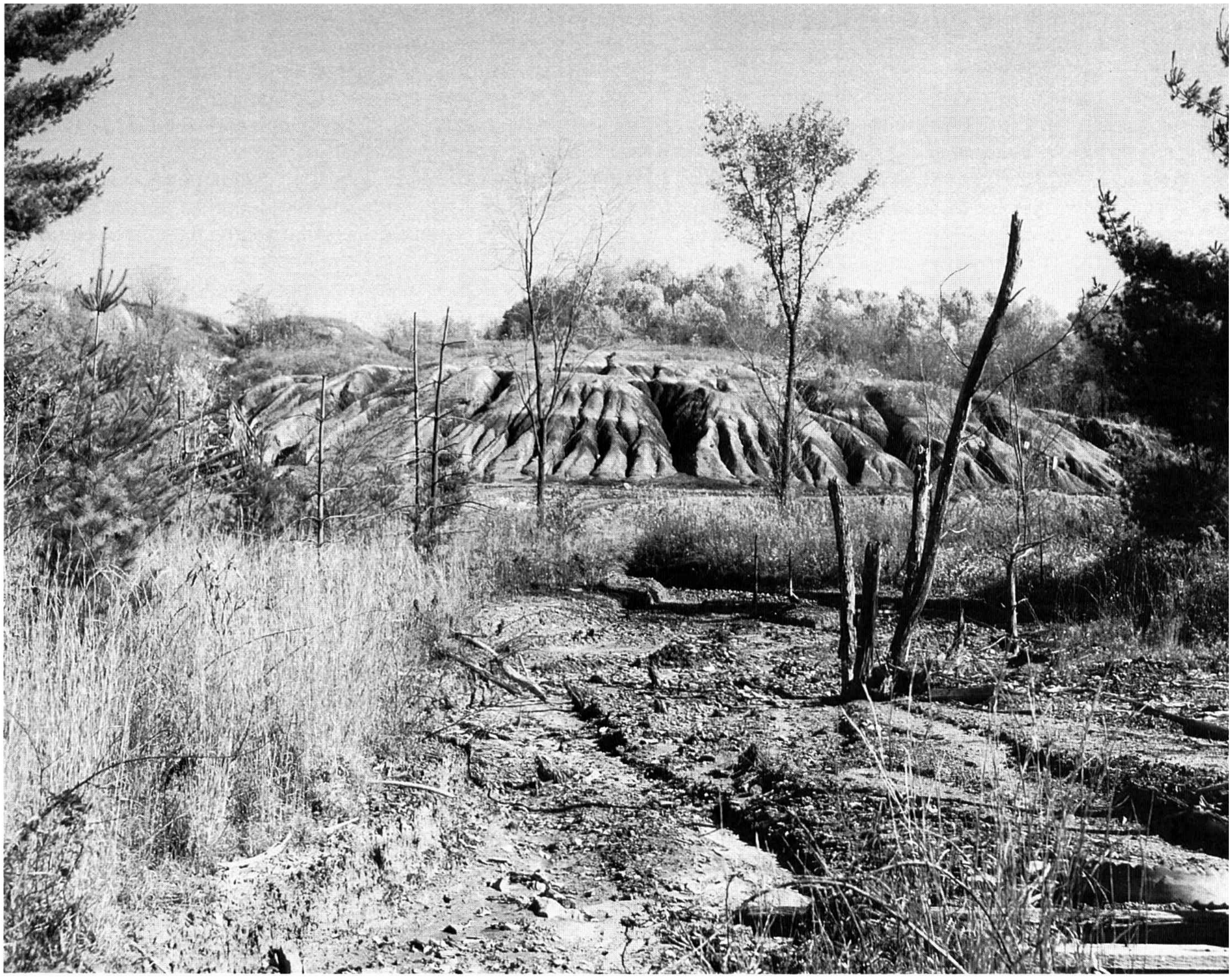

Figure 9.—Barren, eroding areas of mine spoil in a former coal loading area. Mine pits and dumps produce large volumes of sediment and acid mine drainage.

reclaimed areas that were formerly surface-mined for coal. Areas of this soil have been graded to the approximate contour of the original soil, and the surface layer has been blanketed with a layer of natural soil material. The underlying material is a mixture of rock fragments and partially weathered fine earth material that was in or below the profile of the original soil. The rock fragments are mostly siltstone, shale, and sandstone, but they include some limestone, carbonaceous shale, and coal. Gullies have formed in a few areas. Slopes are mostly smooth and convex. Individual areas are oval and range from 3 to 50 acres in size.

Typically, the surface layer is mixed dark brown and yellowish brown, firm silty clay loam about 7 inches thick. The underlying material extends to a depth of 60 inches or more. The upper part, to a depth of about 16 inches, is mixed yellowish brown and dark grayish brown, firm shaly silty clay loam. The lower part is dark gray and brown, firm very shaly silty clay loam. Some areas are more acid, and other areas are more alkaline. In some areas the surface layer is channery silty clay loam. The channers in these areas interfere with tillage.

Included with this soil in mapping are some areas where the surface has been covered with 18 to 30 inches of natural soil material. These areas have a higher available water capacity than the Fairpoint soil and are more productive. They make up about 20 percent of most delineations.

Permeability is moderately slow in the underlying material of the Fairpoint soil. Runoff is slow or medium. Available water capacity is low because of the high content of coarse fragments and the density of the underlying material. The surface layer is sticky when wet and has a low content of organic matter. The root zone is shallow or moderately deep, depending on the density of the underlying material.

Most areas are used for hay.

This soil is only moderately suited to cultivated crops. It is droughty, and erosion is a hazard. The droughtiness, erosion, tilth, and the content of organic matter are management concerns. The hazard of erosion is moderate in cultivated areas. Using no-till farming methods or a system of conservation tillage that leaves crop residue on the surface conserves moisture, helps to control erosion, improves tilth, and increases the content of organic matter. Cover crops, a cropping system that includes grasses and legumes, and contour stripcropping also reduce the hazard of erosion. The dense underlying material restricts water movement and slows the drying and warming of the soil in the spring. Limiting fieldwork when the soil is too wet helps to prevent compaction of the surface layer. Surface and subsurface drains are moderately effective in reducing wetness in scattered low areas.

This soil is only moderately suited to hay and pasture. Species that can tolerate droughtiness are the best suited. The soil remains soft until it dries in late spring. Grazing when the surface layer is wet can damage plant roots. If the soil is cultivated, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion.

This soil is only moderately suited to timber production. The coarse fragments in the soil affect the planting and growth of trees. Using inoculated seedlings that have been transplanted once and mulching around the seedlings reduce the seedling mortality rate.

This soil is subject to uneven settlement for several years after reclamation. After it has settled, the soil is moderately suited to use as a site for buildings. The depth to bedrock and the control of storm-water runoff are management concerns. Large stones in the soil can hinder excavation. Onsite investigation is needed to determine the suitability of individual areas for building site development. Removing as little vegetation as possible and reseeding exposed areas can help to control erosion on construction sites.

After it has settled, this soil is only poorly suited to septic tank absorption fields. The restricted permeability and the content of coarse fragments are limitations. Enlarging the absorption field or using a double field improves the filtering capacity of the soil. Establishing the lines across the slope can prevent the surfacing of effluent. Large rocks should be excluded from the material used to cover the lines.

Ponds can be excavated in low areas. Onsite investigation is needed to determine the nature of the underlying material. Ridgetops have a limited watershed area.

The land capability classification is IIIs. The pasture and hayland suitability group is B-4. No woodland ordination symbol is assigned.

FaD—Fairpoint silty clay loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is on hillsides of graded mine spoil in reclaimed areas that were formerly surface-mined for coal. It has been graded to the approximate contour of the original soil, and the surface has been blanketed with a layer of natural soil material (fig. 10). Slopes are convex, long, and smooth. The underlying material is a mixture of rock fragments and partially weathered fine earth material that was in or below the profile of the original soil. The rock fragments are mostly siltstone, shale, and sandstone but include limestone, carbonaceous shale, and coal. Most areas range from 10 to 100 acres in size.

Typically, the surface layer is brown and yellowish brown, firm silty clay loam about 6 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray, brown, and gray, firm very shaly silty clay loam. In some places the surface layer is channery silty clay loam. In other places the soil is very acid. In a few areas the underlying material is alkaline. A few eroded areas have gullies that are 1 or 2 feet deep.

Included with this soil in mapping are some areas where the surface has been covered with 18 to 30 inches of natural soil material. These areas have a higher available water capacity than the Fairpoint soil and are more productive. They make up about 20 percent of most delineations.

Permeability is moderately slow in the Fairpoint soil. Runoff is rapid or very rapid. Available water capacity is low. The surface layer is sticky when wet and has a low content of organic matter. The root zone is shallow or moderately deep, depending on the density of the underlying material.

Most of the acreage supports grasses and legumes, but only a small acreage is grazed or harvested for hay.

This soil is poorly suited to cultivated crops. Droughtiness, erosion, tilth, and the content of organic matter are management concerns. The hazard of

Figure 10.—Spoil material in an area of Fairpoint silty clay loam, 15 to 25 percent slopes, that has been graded and pushed back against the highwall. In the final stage of reclamation, the topsoil, which is stockpiled above the highwall, will be reseeded with grasses and legumes after it has been spread over the spoil.

erosion is very severe in cultivated areas. Using no-till farming methods or a system of conservation tillage that leaves crop residue on the surface conserves moisture, helps to control erosion, improves tilth, and increases the content of organic matter. Cover crops, a cropping system that includes grasses and legumes, and contour stripcropping also help to control erosion. The dense underlying material restricts water movement and slows the drying and warming of the soil in the spring. Limiting fieldwork when the soil is too wet minimizes surface compaction.

This soil is only moderately suited to hay and pasture. Droughtiness is a management concern. Forage species that can tolerate droughtiness are the most suitable for planting. Production is low during dry periods. The soil remains soft until it dries out in late spring. Grazing when the soil is soft can damage plant roots. If the soil is cultivated, the hazard of erosion is severe. Seeding cover crops or companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion. The hazard of erosion can be severe in pastures where bare spots have developed because of overgrazing.

This soil is only moderately suited to timber production. The aspect of the slope and the coarse fragments in the soil affect the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. Species that can tolerate droughty conditions should be selected for planting. Maintaining a cover of grasses and legumes helps to control erosion until the trees become established. Using inoculated seedlings that have been transplanted once and mulching around the seedlings reduce the seedling mortality rate, especially on south-facing slopes. The slope limits the use of some planting and logging equipment. Establishing roads and skid trails on the contour, establishing water bars, and maintaining a vegetative cover help to control erosion.

This soil is subject to uneven settlement for several years after reclamation. After it has settled, the soil is poorly suited to use as a site for buildings because of the slope. Designing buildings so that they conform to the natural slope of the land reduces the need for excavation. Maintaining a vegetative cover can minimize runoff and erosion on construction sites.

This soil is generally unsuited to septic tank absorption fields because of the slope and the restricted permeability.

The suitability of this soil for ponds varies because of the mixed nature of the underlying material. Onsite investigation is needed. Water in excavated ponds is likely to have a high content of sediment.

The land capability classification is IVs. The pasture and hayland suitability group is B-4. No woodland ordination symbol is assigned.

FaE—Fairpoint silty clay loam, 25 to 50 percent slopes. This deep, steep and very steep, well drained soil is on hillsides of graded mine spoil in reclaimed areas that were formerly surface-mined for coal. It has been graded to the approximate contour of the original soil, and the surface has been blanketed with a layer of natural soil material. The underlying material is a mixture of rock fragments and partially weathered fine earth material that was in or below the profile of the original soil. Rock fragments are mostly subrounded siltstone, sandstone, and shale but include small amounts of limestone and carbonaceous shale. In some areas the highwalls have been covered. Slopes are long and smooth. Most areas are fan shaped and range from 3 to 50 acres in size.

Typically, the surface layer is mixed brown, dark brown, yellowish brown, and dark yellowish brown, firm silty clay loam about 6 inches thick. The underlying material to a depth of 60 inches or more is mixed yellowish brown and dark gray, firm very channery silt loam, clay loam, and loam. The content of siltstone, sandstone, and shale fragments in the underlying material ranges from 25 to 70 percent. In some areas the soil is extremely acid, and in other areas it is mildly alkaline.

Included with this soil in mapping are small areas of soils that have a surface layer of channery silty clay loam and eroded areas that have numerous rills, small gullies, or landslides. Included areas make up about 20 percent of most delineations.

Permeability is moderately slow in the underlying material of the Fairpoint soil. Runoff is very rapid. Available water capacity is low because of the content of coarse fragments. The surface layer is sticky when wet and has a low content of organic matter. Roots are restricted by dense layers in the underlying material, and the rooting depth is variable.

Most of the acreage supports grasses and legumes, but only a small acreage is grazed. In some areas, shrubs have been planted to provide habitat for wildlife.

This soil is generally unsuited to cultivated crops because of droughtiness, the slope, and a very severe hazard of erosion.

This soil is poorly suited to hay and pasture. Droughtiness is a management concern. Forage plants that can tolerate droughtiness are the most suitable for planting. Production is very low during dry periods. The soil remains soft until late spring. Grazing when the soil is soft can damage plant roots. Seeding cover crops or companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion. After forage crops are established, a dense sod should be maintained. Erosion can be severe in areas where bare spots have developed.

This soil is only moderately suited to timber production. The aspect of the slope and the coarse fragments in the soil affect the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. Species that can tolerate droughty conditions should be selected for planting. Maintaining a cover of grasses and legumes helps to control erosion until the trees become established. Using inoculated seedlings that have been transplanted once and mulching around the seedlings reduce the seedling mortality rate, especially on south-facing slopes. The slope limits the use of planting and logging equipment. Establishing roads and skid trails on the contour helps to control erosion. Establishing water bars also helps to control erosion.

This soil is generally unsuited to use as a site for buildings or for septic tank absorption fields because of the slope, uneven settlement, and the moderately slow permeability.

Most areas of this soil are unsuited to the development of ponds because they are underlain by rock or porous spoil material.

The land capability classification is VIe. The pasture and hayland suitability group is E-2. No woodland ordination symbol is assigned.

FbF—Fairpoint channery silty clay loam, 25 to 70 percent slopes. This deep, steep and very steep, well drained soil is on ungraded ridges and trenches of mine spoil in areas that have been surface-mined for coal or limestone. In most areas the ridges are continuous and very steep and are about 40 to 60 feet high. The soil is a mixture of rock fragments and partially weathered fine earth material that was in or below the profile of the original soil. Most of the rock fragments are flat and are less than 10 inches long. Stones and boulders are common on the surface. Individual areas of this soil are crescent shaped and range from 10 to 250 acres in size.

Typically, the surface layer is dark grayish brown, friable channery silty clay loam about 4 inches thick. The underlying material to a depth of 60 inches or more is yellowish brown, brown, and grayish brown, mottled, friable very channery and extremely channery silty clay loam. In some areas the soil is extremely acid, and in other areas it is moderately alkaline. In some places the surface layer is shaly. A few places have slopes of only 8 to 25 percent.

Included with this soil in mapping are a few areas of the loamy Udorthents. These soils have fewer coarse fragments and a higher available water capacity than the Fairpoint soil. Also included are small areas of mine dumps and pits that are toxic to plants and pools of shallow water between ridges and along highwalls. Included areas make up less than 20 percent of most delineations.

Permeability is moderately slow in the underlying material of the Fairpoint soil. Runoff is very rapid. Available water capacity is low. The content of organic matter also is low. Roots are restricted by dense layers in the underlying material. The potential for frost action and the shrink-swell potential are moderate.

Most areas support plantations of native hardwoods, such as black locust, yellow-poplar, oak, and aspen.

This soil is unsuited to row crops, small grain, hay, or pasture because of the slope, droughtiness, and a very severe hazard of erosion.

This soil is only moderately suited to timber production. The aspect of the slope and the coarse fragments in the soil affect the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. Species that can tolerate droughty conditions should be selected for planting. Maintaining a cover of grasses and legumes helps to control erosion until the trees become established. Using inoculated seedlings that have been transplanted once and mulching around the seedlings reduce the seedling mortality rate, especially on south-facing slopes. The slope and the stones on the surface restrict the use of planting and logging equipment. Establishing roads and skid trails on the contour and establishing water bars help to control erosion.

This soil is generally unsuited to use as a site for buildings or for septic tank absorption fields because of the slope, uneven settlement, and the moderately slow permeability.

Ponds and wildlife marshes can be developed in some of the trenches between the spoil ridges. Onsite investigation is needed to determine the nature of the underlying material. Water in the ponds is likely to have a high content of sediment.

The land capability classification is VIIe. The pasture and hayland suitability group is H-1. No woodland ordination symbol is assigned.

FcA—Fitchville silt loam, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil is on terraces in the valleys of former glacial lakes. Most areas are irregular in shape and range from 10 to 150 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 48 inches thick. It is mottled. The upper part is brown, friable silty clay loam, and the lower part is brown and pale brown, firm silty clay loam. The underlying material to a depth of 70 inches or more is yellowish brown, mottled, firm silty clay loam. Some areas are poorly drained. In some places the subsoil and underlying material have more clay. In a few areas the underlying material is sandy loam or loam.

Included with this soil in mapping are areas of Luray, Lorain, Glenford, Newark, and Killbuck soils. The very poorly drained Luray and Lorain soils are in depressions. They have a very dark surface layer. The moderately well drained Glenford soils are in the more sloping landscape positions. Newark and Killbuck soils are on small alluvial fans. They are subject to occasional flooding. Also included are a few areas that have a subsoil of sandy loam or loam and areas in the flood pool of the Dillon Lake dam that are subject to controlled flooding. Included areas make up about 20 percent of most delineations.

Permeability is moderately slow in the Fitchville soil. Runoff is slow. Available water capacity is high. The content of organic matter is moderate in the surface layer. A seasonal high water table is perched in the upper part of the subsoil during extended wet periods. The rooting depth is restricted by the high water table. The potential for frost action is high.

Most areas are used as cropland or pasture.

If drained, this soil is well suited to cultivated crops.

Subsurface drains can lower the seasonal high water table. Commonly, a complete drainage system is needed. Grassed waterways and open ditches can divert runoff from adjacent soils on uplands to natural drainageways or to other ditches. The hazard of erosion is slight in cultivated areas. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, and planting cover crops increase the content of organic matter and improve tilth. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction.

If drained, this soil is well suited to hay. Few areas are drained sufficiently for the sustained production of alfalfa. Species that can tolerate seasonal wetness are the best suited. In areas that have not been drained, the soil is moderately suited to pasture. Production can be improved by seeding a mixture of grasses and legumes that can tolerate wetness. Deferred grazing during wet seasons helps to prevent compaction of the surface layer and damage to plant roots.

This soil is well suited to timber production. No major limitations affect the planting or growth of trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Species that can tolerate wetness should be selected for planting. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is poorly suited to building site development. The seasonal wetness is the main limitation. It can be reduced by using surface and subsurface drains. Waterproofing basement walls, installing drains at the base of footings, and using sump pumps help to keep basements dry. Surface water should be diverted away from building sites.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and the moderately slow permeability. Perimeter drains can reduce the wetness if suitable drainage outlets are available. Enlarging the absorption area or installing a double absorption field system helps to overcome the restricted permeability.

There are very few natural pond sites. The ability of excavated ponds to hold water varies considerably. Careful onsite investigation is needed.

In areas that have not been drained, this soil is recognized as farmland of local importance. The land capability classification is IIw. The pasture and hayland suitability group is C-1. The woodland ordination symbol is 5A.

FcB—Fitchville silt loam, 2 to 6 percent slopes. This deep, gently sloping, somewhat poorly drained soil is on slightly dissected terraces in the valleys of former glacial lakes. Some areas at the margin of the filled valleys are on alluvial fans. Most areas are irregular in shape and range from 5 to 40 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 14 inches thick. The subsoil is brown and pale brown, firm silt loam about 36 inches thick. The underlying material to a depth of 70 inches or more is yellowish brown, firm silty clay loam. Some areas where intermittent streams emerge from upland ravines are subject to rare flooding and have a surface layer of silt loam or clay loam alluvium that is 6 to 24 inches thick. In a few areas the subsoil is sandy loam or loam. In a few places the underlying material is sandy loam, loam, or silty clay.

Included with this soil in mapping are areas of Luray, Glenford, and McGary soils. The very poorly drained Luray soils are in drainageways and depressions. They have a very dark surface layer. The moderately well drained Glenford soils are on the crest of small knolls. McGary soils have more clay in the subsoil and underlying material than the Fitchville soil. Also included are areas in the flood pools of the Wills Creek dam and the Dillon Lake dam that are subject to controlled flooding. Included soils make up about 20 percent of most delineations.

Permeability is moderately slow in the Fitchville soil. Runoff is medium. Available water capacity is high. The content of organic matter is moderate in the surface layer. Tilth is good. The capacity to store and release plant nutrients is moderate. A seasonal high water table is perched in the upper part of the subsoil during extended wet periods. It restricts the rooting depth. The potential for frost action is high.

Most areas are used as cropland. Some areas are used as pasture. A few areas are used as second-growth woodland.

If drained, this soil is well suited to cultivated crops. The hazard of erosion is moderate in cultivated areas. Using a system of conservation tillage that leaves crop residue on the surface, cultivating across the slope, and planting cover crops help to control erosion. Channeling intermittent streams into grassed waterways helps to prevent gullying. If outlets are available, properly installed subsurface drains can lower the water table. Commonly, a complete drainage system is needed. Large amounts of surface water cross areas of this soil. Commonly, overloaded natural channels fill with sediment and new channels form. Diversions or retention basins can be used to control surface water and trap sediment (fig. 11). The root zone can be increased and crops can be planted earlier if channels

Figure 11.—A gully that formed during a rainstorm in an area of Fitchville silt loam, 2 to 6 percent slopes. Sediment-control basins help to control runoff from upland areas and thus help to prevent this kind of erosion.

are stabilized with a permanent cover of grasses and if seep flow is routed through subsurface drains. The surface layer crusts after heavy rains. Working the soil when it is soft and wet can result in excessive compaction of the surface layer.

If drained, this soil is well suited to hay. Few areas are drained sufficiently for the sustained production of alfalfa. Species that can tolerate seasonal wetness are the best suited. The quality of hay may be reduced in areas that are subject to overwashing.

In areas that have not been drained, this soil is moderately suited to pasture. Production can be improved by seeding a mixture of grasses and legumes that can tolerate wetness. Deferring grazing during wet seasons helps to prevent compaction of the surface layer and damage to plant roots.

This soil is well suited to timber production. No major limitations affect the planting or growth of trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Species that can tolerate wetness should be selected for planting. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is poorly suited to use as a site for buildings. Seasonal wetness is the main limitation. Surface and subsurface drains can reduce the wetness. Waterproofing basement walls, installing drains at the base of footings, and using sump pumps help to keep basements dry. Surface water from adjacent slopes should be diverted away from the building site.

This soil is poorly suited to septic tank absorption fields. The seasonal wetness and the restricted permeability are limitations. Perimeter drains can reduce the wetness by lowering the water table if drainage outlets are available. Enlarging the field or installing a double absorption field system helps to overcome the restricted permeability. Surface water should be excluded from the absorption field area.

There are few natural pond sites. The ability of excavated ponds to hold water varies considerably from one area to another. Careful onsite investigation is needed.

In areas that have not been drained, this soil is recognized as farmland of local importance. The land capability classification is IIe. The pasture and hayland suitability group is C-1. The woodland ordination symbol is 5A.

FkB—Frankstown Variant-Mertz complex, 3 to 8 percent slopes. These gently sloping, well drained soils are on the ridgetops of Flint Ridge. Most areas are about 45 percent Frankstown Variant silt loam and 35 percent Mertz very cherty silt loam. The two soils are intermingled in such an intricate pattern that it is not practical to separate them in mapping. Most areas are oblong and range from 5 to 40 acres in size.

The Frankstown Variant soil is moderately deep. Typically, the surface layer is dark brown, friable silt loam about 4 inches thick. The subsoil is about 18 inches thick. The upper part is yellowish brown, friable and firm silt loam. The lower part is yellowish brown, firm cherty silt loam. Flint bedrock is at a depth of about 22 inches.

The Mertz soil is deep. Typically, the surface layer is brown, friable very cherty silt loam about 6 inches thick. The subsoil is about 42 inches thick. The upper part is yellowish brown, friable cherty silt loam. The lower part is strong brown, firm very cherty silty clay loam. The underlying material to a depth of 60 inches or more is strong brown, firm channery silty clay loam.

Included with these soils in mapping are areas that are shallow over flint bedrock and areas that have a very stony or bouldery surface layer. Also included are areas of the moderately well drained Aaron and Keene soils in landscape positions similar to or slightly higher than those of the Frankstown Variant and Mertz soils. Included areas make up about 20 percent of most delineations.

Permeability is moderate in the Frankstown Variant soil and moderately slow in the Mertz soil. Runoff is medium on both soils. Available water capacity is low in the Frankstown Variant soil and moderate in the Mertz soil. The content of organic matter is moderately low in the surface layer of both soils. The root zone is moderately deep in the Frankstown Variant soil and deep in the Mertz soil. Both soils have a moderate capacity to store and release plant nutrients.

Most areas of these soils have been cleared of stones and are cultivated. The stones are piled at the borders of fields or are on nearby steep slopes.

These soils are only moderately suited to cultivated crops and to forage plants. Fertility, droughtiness, and erosion are management concerns. The hazard of erosion is moderate in cultivated areas. The Frankstown Variant soil is droughty. Most fields have been partially cleared of chert fragments. The remaining chert fragments and the included very stony areas hinder the use of farm equipment. The soils dry readily and warm up early in the spring. In cultivated areas, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface helps to control erosion and conserves moisture. Including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, and establishing grassed waterways also reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction.

These soils are well suited to hay and pasture. The roots of some species are restricted by bedrock in the Frankstown Variant soil. The soils warm up early in spring and produce good early season pasture. Droughtiness later in the growing season reduces the production of forage plants. If the soils are plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion. More moisture is available for seed germination in the spring than later in the growing season.

These soils are only moderately suited to timber production. The bedrock and the low available water capacity in the Frankstown Variant soil reduce the growth rate of plants during dry periods. Stones on the surface of the Mertz soil limit the use of some types of equipment. The hazard of windthrow can be reduced by using logging techniques that do not leave the

Figure 12.—Bedrock in the moderately deep Frankstown Variant soil is exposed in this basement excavation in an area of Frankstown Variant-Mertz complex, 3 to 8 percent slopes. The Frankstown Variant soil is on the left side of the measuring rod, and the Mertz soil is on the right. Note the deep, very cherty subsoil in the Mertz soil.

remaining trees widely spaced. Plant competition on the Mertz soil can be controlled by removing vines and the less desirable trees and shrubs.

The Mertz soil is well suited to use as a site for buildings. The Frankstown Variant soil is poorly suited to use as a site for buildings with basements because the hard flint bedrock severely limits excavation for utility lines and basements (fig. 12). This soil is better suited to dwellings without excavated basements. Maintaining a vegetative cover on construction sites can minimize runoff and erosion.

These soils are poorly suited to septic tank absorption fields because of the depth to bedrock in the Frankstown Variant soil and the moderately slow permeability in the Mertz soil. Effluent that enters the fractured bedrock can pollute ground water. Enlarging the absorption field or using a double field helps to overcome the restricted permeability in the Mertz soil. Areas of the shallower Frankstown Variant soil should not be used for absorption fields.

The potential for ponds is very low. Excavation is limited by the very hard bedrock and by large, loose rocks. Because of the position of the soils on ridgetops, the watershed area is limited.

These soils are recognized as farmland of local importance. The land capability classification is IIe. The pasture and hayland suitability group is F-1 for the Frankstown Variant soil and B-1 for the Mertz soil. The woodland ordination symbol is 4D for the Frankstown Variant soil and 4F for the Mertz soil.

GdB—Gilpin silt loam, 2 to 8 percent slopes. This moderately deep, gently sloping, well drained soil is mainly on shoulder slopes and nose slopes of dissected upland ridgetops. Resistant beds of sandstone or siltstone shape the local relief. Slopes are smooth and slightly convex. Most areas range from 3 to 60 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is yellowish brown, friable silt loam, clay loam, and channery clay loam about 21 inches thick. Light olive brown, fractured siltstone, soft shale, and fine grained sandstone bedrock is at a depth of about 30 inches. In some areas the subsoil is less acid. In places the subsoil is sandy loam and channery sandy loam. Small areas of deep, well drained soils are on the wider ridgetops.

Included with this soil in mapping are areas of the moderately well drained Keene soils and areas of severely eroded soils. Keene soils are on benches. The severely eroded soils are on shoulders and narrow ridges. They are shallow over bedrock and have a surface layer of channery silt loam. Also included are a few areas that are underlain by limestone bedrock. Included areas make up about 20 percent of most delineations.

Permeability is moderate in the Gilpin soil. Runoff is medium. Available water capacity is low. The root zone is restricted by the moderate depth to bedrock. The capacity to store and release plant nutrients is moderate.

Most areas are used for crops or pasture. A small acreage is wooded.

This soil is well suited to cultivated crops and forage plants. Fertility, droughtiness, and erosion are management concerns. The hazard of erosion is moderate in cultivated areas. The soil dries readily and is well suited to early spring crops. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface helps to control erosion and conserves moisture. Including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways also help to control erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction.

This soil is well suited to hay and pasture. The roots of some species are restricted by the bedrock. The soil warms up early in spring and produces good early season forage. Forage production is reduced by droughtiness later in the growing season. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

This soil is well suited to timber production. No major limitations affect the planting, growth, or harvesting of trees. Species that can tolerate drought should be selected for planting.

This soil is well suited to use as a site for buildings. The depth to bedrock is a limitation on sites for dwellings with basements. The upper part of the bedrock, to a depth of a few feet, is generally rippable with power equipment.

This soil is poorly suited to conventional septic tank absorption fields because of the limited depth to bedrock. Effluent that enters the fractured bedrock can pollute ground water. Some included areas of the deeper, well drained soils are better suited to this use. Using a mound system can increase the filtering capacity of the absorption field.

There are few natural pond sites. Excavated ponds commonly are not practical because of the limited depth to bedrock.

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

GdC2—Gilpin silt loam, 8 to 15 percent slopes, eroded. This moderately deep, strongly sloping, well drained soil is on shoulder slopes and nose slopes on narrow or dissected upland ridgetops. Erosion has removed part of the original surface layer and reduced the thickness of the subsoil. Slopes are smooth, but a few shallow drainageways are near the edge of some areas. Individual areas of this soil are long and sinuous and range from 3 to 60 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is brown, firm silt loam and channery silt loam about 16 inches thick. Hard, fine grained siltstone bedrock is at a depth of about 22 inches. Many areas are less acid. Some areas that are severely eroded have a surface layer of channery silt loam. In places the soil is deeper over bedrock.

Included with this soil in mapping are small areas of Lowell, Wellston, Rigley, and Berks soils. The deep Lowell and Wellston soils are commonly near the center of the wider ridgetops. Rigley soils are sandier than the Gilpin soil. They are in a few narrow bands on the shoulders of some ridgetops. Berks soils have a very channery subsoil. Also included are areas that have hard bedrock at a depth of less than 20 inches. Included areas make up about 20 percent of most delineations.

Permeability is moderate in the Gilpin soil. Runoff is rapid. Available water capacity is low. The content of organic matter is moderately low in the surface layer. The root zone is restricted by the moderate depth to bedrock. The capacity to store and release plant nutrients is moderate.

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

This soil is only moderately suited to cultivated crops. Erosion and droughtiness are the main management concerns. Many areas are significantly eroded. The hazard of erosion is severe in cultivated areas. The soil dries readily and is well suited to early spring crops. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface helps to control erosion and conserves moisture. Including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction.

This soil is well suited to hay and pasture. The roots of some forage plants are restricted by the bedrock. The soil warms up early in spring and is well suited to early season pasture. Forage production is reduced by droughtiness later in the growing season. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion.

This soil is well suited to timber production. No major limitations affect the planting, growth, or harvesting of trees. Species that can tolerate drought should be selected for planting.

This soil is well suited to use as a site for buildings. Natural drainage is good. The moderate depth to bedrock and the slope are management concerns. In some areas, bedrock at a depth of 20 to 40 inches interferes with excavation for basements and utility lines. Commonly, the bedrock is shattered enough to be excavated without blasting. Erosion is a hazard during construction. Maintaining as much vegetation on the site as possible helps to control erosion.

This soil is poorly suited to conventional septic tank absorption fields. The soil above the bedrock is not thick enough to adequately filter the effluent. Effluent that seeps into cracks in the underlying rock can pollute ground water. Installing the absorption field in a mound of suitable fill material improves the filtering capacity. The included areas of deep, well drained soils are better sites for septic tank absorption fields. Installing the distribution lines across the slope helps to prevent the downslope seepage of effluent.

The potential for ponds is very low in areas of this soil because of the limited depth to bedrock.

This soil is recognized as farmland of local importance. The land capability classification is IIIe. The pasture and hayland suitability group is F-1. The woodland ordination symbol is 4A.

GeD2—Gilpin-Upshur complex, 15 to 25 percent slopes, eroded. These moderately steep, well drained soils are on dissected hillsides and benches. Erosion has removed part of the original surface layer, and the present surface layer is a mixture of material from the original surface layer and the subsoil. The Gilpin soil is on the steeper parts of hillsides, and the Upshur soil is in the less sloping areas and on benches. Landslips are common on the Upshur soil. Most areas of these soils are oblong and are 5 to 50 acres in size. They are about 40 percent Gilpin soil and 35 percent Upshur soil. The two soils occur as areas so closely intermingled that it is impractical to map them separately.

The Gilpin soil is moderately deep. Typically, the surface layer is dark grayish brown and yellowish brown, friable silt loam about 4 inches thick. The subsoil is yellowish brown, friable silt loam about 26 inches thick. Olive, fractured siltstone bedrock is at a depth of about 30 inches. Many areas are severely eroded and have a surface layer of channery silt loam.

The Upshur soil is deep. Typically, the surface layer is reddish brown, firm silty clay loam about 5 inches thick. The subsoil is reddish brown and dark reddish brown, firm silty clay and shaly silty clay about 37 inches thick. The underlying material to a depth of 60 inches or more is dark reddish brown, firm shaly silty clay loam. Some areas are underlain by thinly bedded limestone. Many areas are severely eroded and have a surface layer of silty clay.

Included with these soils in mapping are areas of Berks and Lowell soils. Berks soils are on the steeper slopes. They are stonier than the Gilpin and Upshur soils. Lowell soils are on the wider benches. They are yellower than the Gilpin and Upshur soils. Also included are moderately deep, clayey soils. Included soils make up about 25 percent of most delineations.

Permeability is moderate in the Gilpin soil and slow in the Upshur soil. Runoff is rapid on the Gilpin soil and very rapid on the Upshur soil. Available water capacity is low in the Gilpin soil and moderate in the Upshur soil. The content of organic matter is moderately low in the surface layer of both soils. The root zone is restricted by the moderate depth to bedrock in the Gilpin soil. The root zone of the Upshur soil is deep. The capacity to store and release plant nutrients is high in the Upshur soil and moderate in the Gilpin soil. The shrink-swell potential is high in the subsoil of the Upshur soil.

Most areas are used as oil fields or as woodland. Some areas have been cleared prior to strip mining for coal.

These soils are poorly suited to cultivated crops. Many areas are eroded, and controlling further erosion is the main management concern. The hazard of erosion is very severe in cultivated areas. Conserving moisture is a management concern on the Gilpin soil. Maintaining a permanent plant cover is the best means of controlling erosion. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Tilth is poor in eroded areas of the Upshur soil. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways can reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction.

These soils are only moderately suited to hay and pasture. The roots of some species are restricted by bedrock in the Gilpin soil and by the clayey subsoil in the Upshur soil. The Gilpin soil warms up early in the spring and is well suited to early season pasture, but the Upshur soil remains soft and sticky until late spring. Forage production is reduced by droughtiness in summer, especially on the Gilpin soil. If the soils are plowed, the hazard of erosion is severe. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion.

These soils are only moderately suited to timber production. The aspect of the slope affects the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The Upshur soil cannot support heavy equipment because it has low strength and is slippery when wet. Spreading aggregate on haul roads or log landings helps to stabilize the surface. The slope limits the use of planting and logging equipment. Establishing roads and skid trails on the contour helps to control erosion. Establishing water bars and maintaining a vegetative cover also help to control erosion. Where roads and trails cross channels, adding stones helps to prevent gullying. Using planting techniques that spread the roots of seedlings and that increase soil-root contact reduces the seedling mortality rate on the Upshur soil. Using seedlings that have been transplanted once or adding mulch reduces the seedling mortality rate on south-facing slopes. The hazard of windthrow on the Upshur soil can be minimized by using harvesting methods that do not leave the remaining trees isolated or widely spaced.

These soils are poorly suited to use as sites for buildings because of the slope and because of the hazard of slippage and the high shrink-swell potential in areas of the Upshur soil. The Gilpin soil is better suited than the Upshur soil to building site development. In most areas the upper layers of bedrock in the Gilpin soil can be excavated. In areas of the Upshur soil, reinforcing building walls with concrete, supporting the walls with a large spread footing, and backfilling around foundations with granular material that has a low shrink-swell potential help to prevent the damage caused by shrinking and swelling. The damage caused by landslides can be prevented by building in areas of the more stable Gilpin soil. The Upshur soil is less likely to slide if saturated layers are drained. Tree roots help to stabilize the soil. Cutting and filling increase the hazard of landslides.

These soils are generally unsuited to septic tank absorption fields. The slope, the limited depth to bedrock in the Gilpin soil, and the slow permeability and the hazard of slippage in areas of the Upshur soil are severe management concerns.

Ponds can be developed in areas on benches where drainageways cross the Upshur soil. Areas of the Gilpin soil should not be selected as sites for ponds. If the Upshur soil is to be packed into fill, the soil material should be at the correct moisture content.

The land capability classification is IVe. The pasture and hayland suitability group is F-1 for the Gilpin soil and F-5 for the Upshur soil. The woodland ordination symbol is 4R on both north and south aspects for the Gilpin soil. It is 4R on north aspects and 3R on south aspects for the Upshur soil.

GeE2—Gilpin-Upshur complex, 25 to 40 percent slopes, eroded. These steep, well drained soils are on dissected hillsides and benches. The Gilpin soil is on the steeper parts of benches, and the Upshur soil is on the less sloping parts. Landslides and gullies are common. A few springs are in areas of these soils. Erosion has removed part of the original surface layer, and the present surface layer is a mixture of subsoil material and material from the original surface layer. Most areas are oblong and range from about 20 to 150 acres in size. They are about 40 percent Gilpin soil and 35 percent Upshur soil. The two soils occur as areas so intricately mixed that mapping them separately is not practical.

The Gilpin soil is moderately deep. Typically, the surface layer is dark grayish brown, friable silt loam about 4 inches thick. The subsoil is brown, friable channery silt loam about 24 inches thick. Olive shale bedrock is at a depth of about 28 inches. Many areas are severely eroded and have a surface layer of channery silt loam.

The Upshur soil is deep. Typically, the surface layer is dark reddish brown, firm silty clay loam about 5 inches thick. The subsoil is about 40 inches thick. The upper part is reddish brown and red, firm silty clay, and the lower part is reddish brown and red, firm channery silty clay. The underlying material is variegated light yellowish brown and reddish brown, firm very channery silty clay. Soft shale bedrock is at a depth of about 62 inches. Some areas are underlain by thinly bedded limestone. Many areas are severely eroded and have a surface layer of silty clay. In many places the subsoil is brown silty clay.

Included with these soils in mapping are areas of Berks soils on the steeper slopes. Also included are moderately deep soils in which the subsoil has more clay than that of the Gilpin soil and is not as red as that of the Upshur soil. Included soils make up about 25 percent of most delineations.

Permeability is moderate in the Gilpin soil and slow in the Upshur soil. Runoff is very rapid on both soils. Available water capacity is low in the Gilpin soil and moderate in the Upshur soil. The content of organic matter is moderately low in the surface layer of both soils. The root zone is moderately deep in the Gilpin soil and is deep in the Upshur soil. The shrink-swell potential is high in the subsoil of the Upshur soil.

Most areas are used as oil fields or as woodland. Some areas have been cleared prior to strip mining for coal.

These soils are unsuited to cultivated crops and hay because of the slope and a very severe hazard of erosion. Maintaining a permanent plant cover is the best means of controlling erosion.

These soils are poorly suited to pasture. The slope limits the use of equipment needed to seed and fertilize pastures. The roots of some forage plants are restricted by the bedrock in the Gilpin soil and by the clayey subsoil in the Upshur soil. The Gilpin soil warms up early in spring and is well suited to early season pasture, but the Upshur soil remains soft until late spring. Droughtiness in summer reduces forage production on the Gilpin soil. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion. Erosion can be severe in pastures unless a dense sod is maintained.

These soils are only moderately suited to timber production. The aspect of the slope affects the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The Upshur soil cannot support heavy equipment because it has low strength and is slippery when wet. Spreading aggregate on haul roads or log landings helps to stabilize the surface. The slope limits the use of planting and logging equipment. Establishing roads and skid trails on the contour helps to control erosion. Establishing water bars and maintaining a vegetative cover also help to control erosion. Where roads and trails cross channels, adding stones helps to prevent gullying. Using planting techniques that spread the roots of seedlings and increase soil-root contact reduces the seedling mortality rate on the Upshur soil. Using seedlings that have been transplanted once or adding mulch also reduces the seedling mortality rate, especially on south-facing slopes. The hazard of windthrow in areas of the Upshur soil can be minimized by using harvesting methods that do not leave the remaining trees isolated or widely spaced.

These soils are generally unsuited to use as sites for buildings or for septic tank absorption fields because of the slope, the limited depth to bedrock in the Gilpin soil, and the high shrink-swell potential, the restricted permeability, and the hazard of slippage in areas of the Upshur soil.

Careful onsite investigation is needed to determine the suitability of these soils as pond sites. Beds of porous siltstone alternate with beds of clay shale in areas of this map unit. Most draws have a steep gradient, and a high fill is needed to create a water impoundment of any size.

The land capability classification is VIe. The pasture and hayland suitability group is F-2 for the Gilpin soil and F-6 for the Upshur soil. The woodland ordination symbol is 4R on north and south aspects for the Gilpin soil. It is 4R on north aspects and 3R on south aspects for the Upshur soil.

GfA—Glenford silt loam, 0 to 2 percent slopes. This deep, nearly level, moderately well drained soil is on terraces in the valleys of former glacial lakes. Most areas of this soil are elongated strips or are irregular in shape and are 10 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 10 inches thick. The subsoil is about 40 inches thick. The upper part is yellowish brown, friable silt loam; the next part is dark yellowish brown, mottled, firm silt loam; and the lower part is yellowish brown, mottled, firm silty clay loam. The underlying material to a depth of 60 inches or more is brown, firm silty clay loam.

Included with this soil in mapping are small areas of Fitchville, McGary, Sebring, and Luray soils. The somewhat poorly drained Fitchville and McGary soils are on flats. The poorly drained or very poorly drained Sebring and Luray soils are in slight depressions. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 15 percent of most delineations.

Permeability is moderately slow in the Glenford soil. Runoff is slow. Available water capacity is high. The content of organic matter is moderately low in the surface layer. The shrink-swell potential is moderate, and the potential for frost action is high. The capacity to store and release plant nutrients is moderate. A seasonal high water table is perched in the lower part of the subsoil in winter and spring and during other extended wet periods.

Most areas are used as cropland. Some areas are used for hay or pasture in rotation with crops. Only a few areas are wooded.

This soil is well suited to cultivated crops, including specialty crops. The hazard of erosion is slight in cultivated areas. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, and planting cover crops increase the content of organic matter and improve tilth. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Subsurface drains can reduce wetness in scattered areas of the included Fitchville soils.

This soil is well suited to hay and pasture. Most of the commonly grown forage plants thrive on this soil. Acidity in the root zone is a limitation that affects some legumes. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover on the surface in the fall and seeding a grass-legume mixture can reduce the damage caused by frost heave.

This soil is well suited to timber production. No major limitations affect the planting or growth of trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is only moderately suited to use as a site for buildings or for septic tank absorption fields. The seasonal wetness and the moderate shrink-swell potential are limitations on sites for buildings. Drains are commonly installed at the base of footings to remove excess water. Landscaping and using diversions help to keep surface water away from foundations. The stability of foundations is a concern in inadequately drained areas because the soil has low strength when wet. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. The restricted permeability and the seasonal wetness are limitations on sites for septic tank absorption fields. Enlarging the absorption field or installing a double field that can be alternately dosed helps to overcome the restricted permeability. Perimeter drains can lower the seasonal high water table.

Excavated ponds are likely to have an excessive seepage rate.

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

GfB—Glenford silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is on terraces in the valleys of former glacial lakes. Most areas are on smooth and convex shoulder slopes or low knolls. They are round or long and narrow and range from 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 33 inches thick. The upper part is brown, friable silt loam; the next part is yellowish brown, mottled, friable silt loam; and the lower part is brown, mottled, firm silty clay loam. The underlying material to a depth of 60 inches or more is brown, mottled, firm silty clay loam. Some areas on the higher knolls are well drained. Areas near the margin of uplands have a loamy subsoil.

Included with this soil in mapping are small areas of Fitchville, Omulga, and Markland soils. The somewhat poorly drained Fitchville soils are in depressions. Omulga soils have a fragipan. Markland soils have a surface layer of silty clay loam. They are more clayey than the Glenford soil. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 20 percent of most delineations.

Permeability is moderately slow in the Glenford soil. Runoff is medium. Available water capacity is high. The content of organic matter is moderately low in the surface layer. Tilth is good, and the root zone is deep. The capacity to store and release plant nutrients is moderate. A seasonal high water table is perched in the lower part of the subsoil in late winter and in spring and during other extended wet periods.

Most areas are used for row crops, hay, or pasture. Some areas are wooded.

This soil is well suited to cultivated crops, including specialty crops. The hazard of erosion is moderate in cultivated areas. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, and tilling on the contour can reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Subsurface drains can reduce wetness in included areas of the wetter Fitchville soils.

This soil is well suited to hay and pasture. It is suited to most of the commonly grown forage plants. Acidity in the root zone is a limitation that affects some legumes. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover of vegetation on the surface in the fall and including grasses in the seeding mixture can reduce the damage caused by frost heave. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion.

This soil is well suited to timber production. No major limitations affect the planting or growth of trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is only moderately suited to use as a site for buildings. The seasonal wetness and the shrink-swell potential are limitations on sites for dwellings. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. Reinforcing walls with concrete, supporting the walls with a large spread footing, and backfilling around foundations with granular material that has a low shrink-swell potential help to prevent the damage caused by shrinking and swelling. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion on construction sites.

This soil is only moderately suited to use as a site for septic tank absorption fields. The seasonal wetness and the restricted permeability are limitations. Perimeter drains can reduce the wetness. Enlarging the absorption area or installing a double absorption field system helps to overcome the restricted permeability.

Excavated ponds are likely to have an excessive seepage rate. The soil does not pack well and is a poor source of material for earthen dams.

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

GfC2—Glenford silt loam, 6 to 15 percent slopes, eroded. This deep, strongly sloping, moderately well drained soil is on dissected terraces in the valleys of former glacial lakes. Most areas are on shoulder slopes at the margin of the dissected terraces, but some areas are on the foot slopes of upland hillsides. Sheet and rill erosion has removed part of the original surface layer, and cultivation has mixed subsoil material into the present surface layer. Most areas are long strips that range from 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown and yellowish brown, friable silt loam about 6 inches thick. The subsoil is about 34 inches thick. The upper part is brown, friable silt loam, and the lower part is yellowish brown, mottled, firm silty clay loam. The underlying material to a depth of 60 inches or more is yellowish brown, mottled, firm silty clay loam. In severely eroded areas the surface layer is silty clay loam. In areas where the underlying material is sandy loam, the soil is well drained.

Included with this soil in mapping are small areas of Coshocton and Clarksburg soils. Coshocton soils are at the edge of upland hillsides. They have a higher content of sand and coarse fragments in the subsoil and underlying material than the Glenford soil. Clarksburg soils are on the lower part of foot slopes. They have a fragipan. Also, they have a higher content of coarse fragments in the surface layer and subsoil than the Glenford soil. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 20 percent of most delineations.

Permeability is moderately slow in the Glenford soil. Runoff is medium or rapid. Available water capacity is high. The content of organic matter is moderately low in the surface layer. The root zone is deep. The capacity to store and release plant nutrients is moderate. The potential for frost action is high. The shrink-swell potential is moderate in the upper part of the subsoil. A seasonal high water table is perched in the lower part of the subsoil during extended wet periods.

Most areas are used for cultivated crops or pasture. Some areas are wooded.

This soil is only moderately suited to cultivated crops. The hazard of erosion is severe in cultivated areas. Improving soil fertility and conserving moisture are management concerns. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways can reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Subsurface drains are needed in scattered seepy areas.

This soil is well suited to hay and pasture. It is suited to most of the commonly grown forage plants. Acidity in the root zone is a limitation that affects some legumes. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover on the surface in the fall and seeding a mixture of grasses and legumes can minimize the damage caused by frost heave. If the soil is plowed or finely worked, the hazard of erosion is severe. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion.

This soil is well suited to timber production. No major limitations affect the planting or growth of trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is only moderately suited to use as a site for buildings. The seasonal wetness and the shrink-swell potential are limitations on sites for dwellings. Removing as little vegetation as possible, adding mulch, and establishing a temporary plant cover help to prevent erosion on construction sites. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. Reinforcing walls with concrete, supporting the walls with a large spread footing, and backfilling around foundations with granular material that has a low shrink-swell potential help to prevent the damage caused by shrinking and swelling.

This soil is only moderately suited to use as a site for septic tank absorption fields. The seasonal wetness, the restricted permeability, and the slope are management concerns. Installing the leach lines on the contour helps to prevent the surfacing of effluent. Perimeter drains can reduce the wetness by lowering the water table. Enlarging the field or installing a double absorption field helps to overcome the restricted permeability.

This soil does not pack well and is poor material for earthen dams. There is some potential for ponds in draws that cross areas of this soil, but careful onsite investigation is needed.

This soil is recognized as farmland of local importance. The land capability classification is IIIe. The pasture and hayland suitability group is A-6. The woodland ordination symbol is 5A.

GtC2—Guernsey-Upshur silty clay loams, 6 to 15 percent slopes, eroded. These deep, strongly sloping soils are on benches below the steeper hillsides and on isolated knolls on the broader ridgetops. They formed in material weathered from alternating thin beds of brown, gray, and red clay shale. Most areas are dissected by drainageways. Erosion has removed part of the surface layer, and tillage has incorporated part of the subsoil into the remaining surface layer. Many areas have an irregular or hummocky surface because of scars, gullies, and landslides. Most areas are long and narrow or are circular and are 5 to 75 acres in size. They are about 50 percent Guernsey soil and 30 percent Upshur soil. The two soils occur as areas so narrow and intermingled that it is impractical to map them separately.

The Guernsey soil is moderately well drained. Typically, the surface layer is brown, friable silty clay loam about 7 inches thick. The subsoil is about 32 inches thick. The upper part is light olive brown and brown, mottled, firm silty clay. The lower part is brown, firm channery silty clay and mixed weak red and olive gray, firm channery clay. The underlying material to a depth of about 62 inches is mixed light olive brown and light olive gray, very firm channery silty clay. Below this is soft clay shale bedrock. In severely eroded areas the surface layer is silty clay. In places the soil is well drained.

The Upshur soil is well drained. Typically, the surface layer is dark brown, firm silty clay loam about 4 inches thick. The subsoil is about 36 inches thick. The upper part is yellowish red, firm silty clay, and the lower part is dark reddish brown, firm silty clay and dark red, firm silty clay loam. The underlying material to a depth of 74 inches or more is yellowish brown and dark reddish brown, calcareous, firm silty clay loam and silty clay. In some areas the soil is reddish brown and is moderately well drained or has a surface layer of silt loam and a red, clayey subsoil.

Included with these soils in mapping are small areas of Claysville, Westgate, and Zanesville soils. The somewhat poorly drained Claysville soils are near seepy areas. Westgate and Zanesville soils are in the less sloping areas. They contain less clay in the upper part of the subsoil than the Guernsey and Upshur soils. Zanesville soils have a fragipan. Included soils make up about 20 percent of most delineations.

Permeability is moderately slow or slow in the Guernsey soil and slow in the Upshur soil. Runoff is rapid on both soils. Available water capacity is moderate. The content of organic matter in the surface layer is moderately low. The root zone is deep, but the clayey subsoil restricts the root development of some species. Tilth is only fair because of the high content of clay and the moderately low content of organic matter. The shrink-swell potential is high in the subsoil. The potential for frost action is moderate. A seasonal high water table is in the lower part of the subsoil of the

Guernsey soil during extended wet periods. The water table generally is below a depth of 60 inches in areas of the Upshur soil.

Most areas are used for pasture or hay. Some areas are used as oil fields or as woodland.

These soils are poorly suited to cultivated crops. Erosion is the major management concern. The hazard of erosion is severe in cultivated areas. Using a system of conservation tillage that leaves crop residue on the surface, establishing grassed waterways, stripcropping on the contour, and planting cover crops improve tilth, reduce the runoff rate, and help to prevent excessive erosion. Natural drainage generally is adequate, but subsurface drains are needed in scattered seepy areas. Tilling when the soils are wet causes compaction of the surface layer and cloddiness. The hummocky surface interferes with the use of equipment in some areas.

These soils are well suited to hay and pasture but are poorly suited to alfalfa. A wide variety of forage plants can grow on the Guernsey soil, but the clayey subsoil of the Upshur soil restricts the roots of some species. Frost heave in areas of the Guernsey soil can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover on the surface in the fall or including grasses in the seeding mixture can minimize the damage caused by frost heave. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion.

These soils are only moderately suited to timber production. The clayey subsoil affects the planting and growth of trees in areas of the Upshur soil. Both soils cannot support heavy equipment because they have low strength and are slippery when wet. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Using planting techniques that spread the roots of seedlings and that increase soil-root contact can reduce the seedling mortality rate. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. The hazard of windthrow on the Upshur soil can be reduced by using harvesting methods that do not leave the remaining trees isolated or widely spaced.

These soils are poorly suited to use as sites for buildings because of the high shrink-swell potential and the hazard of slippage. Also, seasonal wetness is a limitation in areas of the Guernsey soil. Coating basement walls and installing drains at the base of footings help to keep basements dry. Reinforcing walls with concrete, supporting the walls with a large spread footing, and sloping trench walls before backfilling around foundations with granular material that has a low shrink-swell potential help to prevent the damage caused by shrinking and swelling. Cutting and filling increase the hazard of hillside slippage, but installing a drainage system in seepy areas reduces this hazard. Removing as little vegetation as possible, adding mulch, and establishing a temporary plant cover reduce the hazard of erosion on construction sites.

These soils are poorly suited to conventional septic tank absorption fields. The seasonal wetness and the restricted permeability are limitations. Installing the leach lines on the contour helps to prevent the surfacing of effluent. Perimeter drains can reduce the seasonal wetness. Installing the leach lines in permeable fill material can improve the filtering capacity of the soils. An aerator or an alternative system should be considered.

These soils have good potential as pond sites. The soil material packs well only if used at the proper moisture content. Onsite investigation is needed to detect layers of porous or shattered rock that would permit excessive seepage.

The land capability classification is IVe. The pasture and hayland suitability group is A-6 for the Guernsey soil and F-5 for the Upshur soil. The woodland ordination symbol is 4A for the Guernsey soil and 3C for the Upshur soil.

GtD2—Guernsey-Upshur silty clay loams, 15 to 25 percent slopes, eroded. These deep, moderately steep soils are in coves or on dissected benches on hillsides. Erosion has removed part of the surface layer, and tillage has incorporated part of the subsoil into the remaining surface layer. Most areas of these soils are long and narrow or are circular and range from 5 to 75 acres in size. They are crossed by many drainageways. They are about 45 percent Guernsey soil and 30 percent Upshur soil. The two soils occur as areas so closely intermingled that it is impractical to map them separately.

The Guernsey soil is moderately well drained. Typically, the surface layer is brown, friable silty clay loam about 7 inches thick. The subsoil is about 32 inches thick. The upper part is light olive brown and brown, mottled, firm silty clay and clay. The lower part is weak red and olive gray, firm clay. The underlying material is light olive brown and light olive gray, very firm silty clay about 23 inches thick. In places the surface layer is silty clay and is composed mostly of subsoil material. Some areas are somewhat poorly drained, and other areas are well drained.

The Upshur soil is well drained. Typically, the surface layer is dark brown silty clay loam about 4 inches thick. The subsoil is firm clay about 36 inches thick. The upper part is yellowish red, and the lower part is dark reddish brown and dark red. The underlying material is yellowish brown and dark reddish brown, very firm, calcareous clay and silty clay loam about 34 inches thick.

Included with these soils in mapping are small areas of Claysville, Westgate, and Berks soils. The somewhat poorly drained Claysville soils are in seepy areas. Westgate soils are on the less sloping benches. They have a thicker silty surface layer than that of the Guernsey and Upshur soils. The moderately deep Berks soils are on the steeper slopes. Also included are moderately well drained areas of reddish brown soils. Included areas make up about 25 percent of most delineations.

Permeability is slow or moderately slow in the Guernsey soil and slow in the Upshur soil. Runoff is rapid on both soils. Available water capacity is moderate. The content of organic matter is moderately low in the surface layer, and tilth is fair. The root zone is deep, but the clayey subsoil restricts the root development of some species. A seasonal high water table is perched in the lower part of the subsoil of the Guernsey soil in late winter and in spring and during other extended wet periods. The water table is generally below a depth of 60 inches in the Upshur soil. The shrink-swell potential is high in the lower parts of the subsoil of both soils. The potential for frost action is moderate.

Most areas are used as pasture or as wooded pasture. Some areas are used as oil fields or woodland.

These soils are generally unsuited to cultivation because of the slope, landslides, gullies, and a very severe hazard of erosion. Maintaining a permanent plant cover is the best means of controlling erosion.

These soils are only moderately suited to hay and pasture. They are poorly suited to deep-rooted legumes, such as alfalfa, because of frost heave and seasonal wetness in areas of the Guernsey soil and the restricted root zone in areas of the Upshur soil. If the soils are plowed, the hazard of erosion is severe. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion. In some areas the gullied or hummocky surface interferes with seeding and the improvement of forage stands.

These soils are only moderately suited to timber production. The aspect of the slope affects the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The soils cannot support heavy equipment because they have low strength and are slippery when wet. Spreading aggregate on haul roads or log landings helps to stabilize the surface. The slope limits the use of planting and logging equipment. Establishing roads and skid trails on the contour helps to control erosion. Establishing water bars and maintaining a vegetative cover also help to control erosion. Where roads and trails cross channels, adding stones helps to prevent gullying. Using planting techniques that spread the roots of seedlings and increase soil-root contact reduces the seedling mortality rate. Using seedlings that have been transplanted once or adding mulch also reduces the seedling mortality rate. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. The hazard of windthrow on the Upshur soil can be reduced by using harvesting techniques that do not leave the remaining trees isolated or widely spaced.

These soils are generally unsuited to use as sites for buildings or for septic tank absorption fields. The slope, the seasonal wetness, the high shrink-swell potential, the restricted permeability, and the hazard of slippage are severe limitations. These limitations are difficult and costly to overcome.

There are some pond sites in areas of these soils. The soil material packs well if used at the right moisture content. Onsite investigation is needed to detect porous or shattered rock layers that would permit excessive seepage.

The land capability classification is VIe. The pasture and hayland suitability group is A-6 for the Guernsey soil and F-5 for the Upshur soil. The woodland ordination symbol is 4R on both north and south aspects for the Guernsey soil. It is 4R on north aspects and 3R on south aspects for the Upshur soil.

HaC2—Homewood silt loam, 8 to 15 percent slopes, eroded. This deep, strongly sloping, moderately well drained soil is on shoulder slopes and dissected glaciated ridgetops. Erosion has removed part of the original surface layer, and tillage has incorporated clay, coarse fragments, and other subsoil material into the remaining surface layer. Most areas range from 5 to 40 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 7 inches thick. The subsoil is about 73 inches thick. The upper part is yellowish brown, firm silty clay loam and clay loam. The next part is a fragipan of yellowish brown and brown, very firm and brittle clay loam. The lower part of the subsoil is yellowish brown, firm clay loam. Some areas are severely eroded and have a surface layer of gravelly clay loam. In some small areas the soil is less sloping and has a mantle of silt as much as 30 inches thick.

Included with this soil in mapping are areas of Coshocton soils. These soils are on foot slopes and benches at the margin of glaciated areas. They make up about 20 percent of most delineations.

Permeability is moderate in the upper part of the

Homewood soil and slow in the fragipan. Runoff is rapid in cultivated areas. The root zone is moderately deep. Available water capacity is low above the fragipan. The content of organic matter in the surface layer is moderately low because of the loss of the original surface soil. A high water table is perched above the fragipan in late winter and in spring and during other extended wet periods. The capacity to store and release plant nutrients and the potential for frost action are moderate.

Many areas are used as cropland. Some areas are used as pasture or woodland.

This soil is only moderately suited to cultivated crops. Many areas are significantly eroded, and controlling further erosion is the main management concern. The hazard of erosion is severe in cultivated areas. Improving soil fertility and conserving moisture also are management concerns. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, and establishing grassed waterways can reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Using subsurface drains in seepy areas increases crop production in most years.

This soil is well suited to hay and pasture. The roots of some species are restricted by the fragipan. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover on the surface in the fall or seeding a grass-legume mixture can minimize the damage caused by frost heave. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion.

This soil is well suited to timber production. No major limitations affect the planting or growth of trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface.

This soil is well suited to use as a site for buildings. The slope, the shrink-swell potential, and the seasonal wetness are the main management concerns. Increased runoff and erosion are management concerns on construction sites in sloping areas. Designing buildings so that they conform to the natural slope of the land and maintaining a vegetative cover help to control runoff and erosion. Drains around footings can lower the water table. Backfilling the drains with granular material helps to intercept water seeping along the top of the fragipan. Installing reinforced foundation footings and walls and backfilling with granular material that has a low shrink-swell potential help to prevent the damage caused by shrinking and swelling.

This soil is poorly suited to use as a site for septic tank absorption fields. The restricted permeability in the lower part of the subsoil and the seasonal high water table are limitations. Using perimeter drains around absorption fields can lower the water table and intercept lateral seepage from the higher areas. Enlarging the absorption field increases the capacity of the soil to filter the effluent. Installing distribution lines on the contour helps to prevent the surfacing of effluent.

There is good potential for ponds along drainageways in areas of this soil. The soil material packs well and makes good fill. Excavating into rock layers should be avoided. Onsite investigation is needed to determine the depth to bedrock.

This soil is recognized as farmland of local importance. The land capability classification is IIIe. The pasture and hayland suitability group is F-3. The woodland ordination symbol is 5D.

HaD2—Homewood silt loam, 15 to 20 percent slopes, eroded. This moderately deep, steep, moderately well drained soil is on glaciated hillsides that are dissected. Erosion has removed much of the original surface layer. Most areas are irregular in shape and range from 5 to 30 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 58 inches thick. The upper part is strong brown and yellowish brown, firm silty clay loam and yellowish brown, firm clay loam. The next part is a fragipan of yellowish brown, mottled, very firm and firm gravelly clay loam about 18 inches thick. The lower part of the subsoil is yellowish brown, mottled, firm clay loam. The underlying material to a depth of 80 inches or more is brown, firm clay loam. In a few severely eroded areas, the surface layer is gravelly clay loam. In some places the subsoil does not have a layer of very firm gravelly clay loam.

Included with this soil in mapping are small areas of Gilpin, Berks, Coshocton, and Westmoreland soils. The moderately deep Gilpin and Berks soils are in the steeper areas. They have bedrock within a depth of 40 inches. Coshocton and Westmoreland soils formed in colluvium or residuum on foot slopes and benches. Also included are somewhat poorly drained soils in drainageways and seep zones. Included soils make up about 20 percent of most delineations.

Permeability is moderate in the upper part of the Homewood soil and slow in the fragipan. Runoff is very rapid. The root zone is restricted by the dense fragipan. Available water capacity is low above the fragipan. Because of past erosion, the content of organic matter in the surface layer is low. The capacity to store and release plant nutrients is moderate. A high water table is perched above the fragipan during wet periods.

Most areas are used for pasture or hay. Some areas are used as wooded pasture.

This soil is poorly suited to cultivated crops. Erosion is the main management concern, and the hazard of erosion is very severe in cultivated areas. Fertility and droughtiness also are management concerns. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, and establishing grassed waterways can reduce the hazard of erosion. Maintaining a permanent plant cover is the best means of controlling erosion. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and hinders the emergence of seedlings. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Using subsurface drains in seepy areas increases crop production in most years.

This soil is only moderately suited to hay and pasture. The roots of some forage plants are restricted by the fragipan. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover on the surface in the fall or seeding a grass-legume mixture can minimize the damage caused by frost heave. If the soil is plowed, the hazard of erosion is severe. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion. After a good forage stand is established, it should be maintained for as long as possible. Erosion can be severe in pastures that are overgrazed.

This soil is only moderately suited to timber production. The aspect of the slope affects the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. The slope limits the use of planting and logging equipment. Establishing roads and skid trails on the contour, establishing water bars, and maintaining a vegetative cover help to control erosion. Where roads and trails cross channels, adding stones helps to prevent gullying. Using seedlings that have been transplanted once or adding mulch can reduce the seedling mortality rate on south-facing slopes. The hazard of windthrow can be reduced by using harvesting methods that do not leave the remaining trees isolated or widely spaced.

This soil is only moderately suited to use as a site for buildings. The slope is the main management concern. Removing as little vegetation as possible, adding mulch, and establishing a temporary plant cover can reduce the hazard of erosion on construction sites. Drains around footings can lower the water table. Backfilling the drains with gravel helps to intercept water seeping along the top of the fragipan. The damage caused by shrinking and swelling can be minimized by installing reinforced foundation footings and walls and by backfilling with granular material that has a low shrink-swell potential.

This soil is generally unsuited to conventional septic tank absorption fields because of the slope, the seasonal high water table, and the restricted permeability in the fragipan.

This soil typically packs well and is good fill material for dams. Ponds that are developed in draws have a good chance of holding water. Onsite investigation is needed to determine the thickness of suitable material over bedrock.

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

JtA—Jimtown loam, 0 to 3 percent slopes. This deep, nearly level, somewhat poorly drained soil is on glacial outwash terraces and margins of former glacial lake valleys. Many areas receive runoff or seepage from higher landscape positions. Most areas are 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is about 40 inches thick. It is mottled. The upper part is grayish brown, friable loam, and the lower part is yellowish brown, friable gravelly loam. The underlying material to a depth of 80 inches or more is yellowish brown, friable very gravelly loam and dark gray, loose very gravelly sandy loam. In many areas the underlying material is fine sandy loam and silt loam. Some areas are poorly drained.

Included with this soil in mapping are small areas of Fitchville and Chili soils. Fitchville soils are on the margin of some areas that have a thick mantle of silt. The well drained Chili soils are on convex slopes. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 20 percent of most delineations.

Permeability is moderate in the Jimtown soil. Runoff is slow. Available water capacity and the content of organic matter in the surface layer are moderate. The capacity to store and release plant nutrients also is moderate. The seasonal high water table is at a depth of 12 to 30 inches in winter and in spring and during other extended wet periods. The root zone is restricted by the water table.

Most areas are used for cultivated crops or for hay and pasture.

If drained, this soil is well suited to cultivated crops. Subsurface drains can lower the seasonal high water table. Grassed waterways and open ditches can carry the runoff from adjacent upland soils to natural drainageways or to other ditches. The hazard of erosion is slight in cultivated areas. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and hinders the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, and planting cover crops increase the content of organic matter in the soil and improve tilth. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction.

Drained areas of this soil are well suited to hay and pasture. Plant species that can tolerate seasonal wetness are the best suited. The number of suitable species is more limited in areas that have not been drained. Areas that have not been drained are moderately suited to bluegrass pasture. Deferring grazing during wet periods helps to prevent compaction of the surface layer and damage to plant roots.

This soil is well suited to timber production. No major limitations affect the planting or growth of trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Species that can tolerate wetness should be selected for planting.

This soil is only moderately suited to use as a site for buildings. The seasonal wetness is the main limitation. Surface and subsurface drains can be used to lower the water table. Waterproofing basement walls, installing drains at the base of footings, and using sump pumps help to keep water away from basements. Safety precautions are needed to prevent the caving of cutbanks in excavated areas.

This soil is poorly suited to use as a site for septic tank absorption fields. The seasonal high water table in the upper part of the subsoil is a severe limitation. Perimeter drains can lower the water table if suitable outlets are available.

There are no natural pond sites in areas of this soil, and excavated ponds are unlikely to hold water.

In areas that have not been drained, this soil is recognized as farmland of local importance. The land capability classification is IIw. The pasture and hayland suitability group is C-1. The woodland ordination symbol is 5A.

KeB—Keene silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is on knolls on ridgetops and benches. Most areas are long or crescent shaped and range from 5 to 60 acres in size.

Typically, the surface layer is brown, friable silt loam about 10 inches thick. The upper part of the subsoil is dark yellowish brown, friable silt loam about 11 inches thick. The lower part is light gray and yellowish brown, mottled, firm channery silty clay loam about 34 inches thick. The underlying material is gray silty clay about 7 inches thick. It is mottled. Soft, weathered shale bedrock is at a depth of about 62 inches. In places the lower part of the subsoil has brown or reddish brown colors. In areas where the silt mantle is thin, the subsoil contains more clay. Some areas have a layer of very dark gray silty clay in the subsoil. This layer is associated with coal blossom. In a few areas the subsoil contains more rock fragments. The margins of a few areas are more sloping. Areas on Flint Ridge have common flint fragments.

Included with this soil in mapping are small areas of Zanesville, Alford, and Wellston soils. Zanesville soils have a fragipan. The well drained Alford and Wellston soils are in convex landscape positions. Also included, near seep zones and drainageways, are soils that are wetter than the Keene soil. Included soils make up about 20 percent of most delineations.

Permeability is moderate or moderately slow in the upper part of the subsoil of the Keene soil and is moderately slow or slow in the lower part. Runoff is medium. Available water capacity is high. The content of organic matter is moderate in the surface layer. The root zone is deep. The capacity to store and release plant nutrients is moderate. A seasonal high water table is perched in the lower part of the subsoil during extended wet periods.

Most areas are used as cropland. Some areas are used as pasture.

This soil is well suited to cultivated crops, including specialty crops. Erosion is the main management concern. The hazard of erosion is moderate in cultivated areas. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and hinders the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, and tilling on the contour reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Subsurface drains can reduce the wetness in scattered areas.

This soil is well suited to hay and pasture. It is suited to a wide variety of forage plants. Acidity in the root zone and wetness are limitations that affect some legumes. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover on the surface in the fall or seeding a grass-legume mixture can minimize the damage caused by frost heave. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion.

This soil is well suited to timber production. It has low strength when wet, however, and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is only moderately suited to use as a site for buildings. The seasonal wetness is a limitation, especially on sites for buildings with basements. Coating basement walls and installing perimeter drains can minimize seepage and reduce wetness. The moderate shrink-swell potential also is a limitation. Reinforcing walls, supporting the walls with a large spread footing, and backfilling around foundations with granular material that has a low shrink-swell potential can minimize the damage caused by shrinking and swelling.

This soil is only moderately suited to use as a site for septic tank absorption fields. The seasonal wetness and the restricted permeability in the lower part of the subsoil are limitations. Perimeter drains can reduce the wetness by lowering the water table. Enlarging the absorption field helps to overcome the restricted permeability.

There are few natural pond sites. Commonly, the watershed area for excavated ponds is limited. Onsite investigation is needed to identify any layers that would permit excessive seepage. The upper layers of the soil do not pack well and are poor fill.

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

KeC2—Keene silt loam, 6 to 15 percent slopes, eroded. This deep, strongly sloping, moderately well drained soil is on knolls and shoulder slopes on ridgetops and benches. Erosion has removed part of the original surface layer. Most areas are oblong or irregular in shape and range from 10 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The upper part of the subsoil is yellowish brown, firm silt loam and yellowish brown, mottled, firm silty clay loam about 22 inches thick. The lower part of the subsoil, to a depth of about 58 inches, is light gray and light olive brown, mottled, very firm silty clay loam and channery silty clay loam. The underlying material is dark grayish brown, mottled, very firm clay about 16 inches thick. Soft, weathered, gray clay shale bedrock is at a depth of about 74 inches. In many places the subsoil contains more rock fragments and sand. A few areas on Flint Ridge have common flint fragments. In areas where the mantle of silt is thin, the subsoil contains more clay. A few places have a thin layer of coal blossom. In some areas the subsoil is silt loam. The margins of a few areas are moderately steep. The ridgetops in a few areas are gently sloping and are less eroded. A few areas are on foot slopes.

Included with this soil in mapping are small areas of the well drained Gilpin, Wellston, and Westmoreland soils. Gilpin soils have sandstone or siltstone bedrock within a depth of 40 inches. Wellston and Westmoreland soils are in areas where the subsoil is underlain by siltstone. Also included, near seep zones and along drainageways, are soils that are wetter than the Keene soil. Included soils make up about 20 percent of most delineations.

Permeability is moderate or moderately slow in the upper part of the subsoil of the Keene soil and is moderately slow or slow in the lower part. Runoff is rapid. Available water capacity is high. The content of organic matter is moderately low in the surface layer. The root zone is deep. The capacity to store and release plant nutrients is moderate. A seasonal high water table is perched in the lower part of the subsoil during extended wet periods. The potential for frost action is high.

Most areas are used as cropland or pasture. Some areas are wooded.

This soil is only moderately suited to cultivated crops. Many areas are significantly eroded, and controlling further erosion is the main management concern. The hazard of erosion is severe in cultivated areas. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, and establishing grassed waterways can reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Using subsurface drains in seepy areas increases crop production in most years.

This soil is well suited to hay and pasture. It is suited to a wide variety of forage plants. Acidity in the root zone and wetness are limitations that affect some legumes. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover on the surface in the fall or seeding a grass-legume mixture can minimize the damage caused by frost heave. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

This soil is well suited to timber production. It has low strength when wet, however, and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Plant competition can be minimized by removing vines and the less desirable trees and shrubs.

This soil is only moderately suited to use as a site for buildings. The seasonal wetness, the moderate shrink-swell potential of the subsoil, and the slope are management concerns. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. Reinforcing walls with pilasters and concrete, supporting the walls with a large spread footing, and backfilling around foundations with material that has a low shrink-swell potential can minimize the damage caused by shrinking and swelling. The hazard of erosion on construction sites can be reduced by removing as little vegetation as possible, by mulching, or by establishing a temporary plant cover.

This soil is only moderately suited to use as a site for septic tank absorption fields. The seasonal wetness, the restricted permeability, and the slope are management concerns. Perimeter drains can reduce the wetness by lowering the water table. Enlarging the absorption field helps to overcome the restricted permeability. Installing the distribution lines on the contour helps to prevent the surfacing of effluent.

The potential for pond sites varies in individual areas of this soil. The upper part of the soil does not pack well and is poor fill. The lower part of the subsoil and the underlying material commonly can hold water, but excavation may expose porous or shattered rock that permits excessive seepage. Careful onsite investigation is needed.

This soil is recognized as farmland of local importance. The land capability classification is IIIe. The pasture and hayland suitability group is A-6. The woodland ordination symbol is 4A.

Km—Killbuck silt loam, occasionally flooded. This deep, nearly level, poorly drained soil is on flood plains in areas where tributary streams enter former glacial lake valleys and form alluvial fans. Flooding is brief and most commonly occurs following intense local thunderstorms during the growing season. Slopes range from 0 to 2 percent. Most areas are fan shaped and range from 5 to 20 acres in size.

Typically, the upper 28 inches of this soil consists of recent deposits of alluvium. The surface layer is dark grayish brown silt loam about 10 inches thick. The subsoil is about 18 inches thick. It is mottled. The upper part is gray and grayish brown, friable silt loam; the next part is gray, friable silt loam; and the lower part is dark gray, firm silty clay loam. Below this is a very poorly drained buried soil that extends to a depth of 80 inches or more. The upper part is black, mottled, firm silty clay about 7 inches thick. The lower part is gray and brownish gray, mottled, firm silty clay loam. Some areas have less than 15 inches or more than 36 inches of recent alluvium overlying the dark buried soil.

Included with this soil in mapping are areas of Luray, Lorain, and Newark soils. The very poorly drained Luray and Lorain soils are in depressions on lake plains. They do not have a surface deposit of recent alluvium. The somewhat poorly drained Newark soils are on flood plains. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 15 percent of most delineations.

Permeability is moderately slow in the Killbuck soil. Runoff is very slow. Available water capacity is high. The content of organic matter is moderate in the surface layer. The capacity to store and release plant nutrients is high. A seasonal high water table is near the surface from winter through early summer and during other extended wet periods. The root zone is limited by the water table but is deep in areas that have been adequately drained. The shrink-swell potential is moderate. The potential for frost action is high.

Most areas are used as pasture or are wooded. Areas that have not been drained have potential for use as wetland. Some drained areas are used for crops.

If drained, this soil is moderately suited to cultivated crops. Flooding and poor drainage are the main management concerns. The flooding can delay planting and cause damage to crops. Flood damage can be minimized by improving stream channels and keeping them free of debris. Small tributary streams can be channeled into grassed waterways. Surface and subsurface drains commonly are used to lower the water table in areas that have suitable outlets.

This soil is only moderately suited to hay. Areas that have not been drained are suited only to species that can tolerate considerable wetness. Drained areas are suited to a wider variety of species. Seeding a companion crop of small grain or reseeding after wheat has been harvested in midsummer can minimize the damage caused by flooding.

Areas of this soil that have not been drained are suited to bluegrass pasture but are too wet for many legumes. Even in drained areas, species that can tolerate wetness should be selected. Deferring grazing during wet periods helps to prevent excessive compaction of the surface layer and damage to plant roots.

This soil is only moderately suited to timber production. The flooding and the wetness affect the planting, growth, and harvesting of trees. Native bottomland hardwoods that can tolerate flooding and wetness grow well. Selecting water-tolerant species for planting can reduce the seedling mortality rate. Planting and logging should take place during dry periods or when the soil is frozen. The hazard of windthrow can be reduced by using harvesting methods that do not leave the remaining trees isolated or widely spaced. Removing vines and the less desirable trees and shrubs helps to control plant competition.

This soil is generally unsuited to use as a site for buildings or for septic tank absorption fields because of the flooding, the wetness, and the restricted permeability. The flooding is usually brief, but the water table is high during much of the year. Drainage systems that are used to lower the water table are limited by inadequate outlets in many areas. Roads can be elevated above the level of flooding. Culverts should have an adequate capacity to carry the stream flow during periods of flash flooding.

Some sites are suitable for excavated ponds, but onsite investigation is needed to determine the nature of the underlying material. Ponds that have intermittent streams as a water source should have emergency spillways large enough to carry the flow during flash floods. Larger streams should be diverted around the ponds.

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

LaC—Lakin loamy fine sand, 8 to 15 percent slopes. This deep, strongly sloping, excessively drained soil is on the eastern margin of glacial outwash or lacustrine terraces. It is on well defined knolls or dunes that were formed by wind-deposited fine sand during the postglacial period. Slopes are convex and are dissected in some areas. Individual areas are commonly oblong and range from 3 to 30 acres in size.

Typically, the surface layer is brown, friable loamy fine sand about 9 inches thick. The subsurface layer is yellowish brown loamy fine sand about 15 inches thick. The subsoil is brown and yellowish brown, loose loamy fine sand and friable fine sandy loam about 31 inches thick. The underlying material to a depth of 87 inches or more is pale brown, loose fine sand and yellowish brown, loose loamy fine sand. In many areas, the surface layer is fine sandy loam and the subsoil has a slightly higher content of clay.

Included with this soil in mapping are narrow areas of soils in drainageways that have a surface layer of sandy loam or silt loam and that have a fragipan. These soils have a seasonal high water table in the subsoil. They make up about 20 percent of most delineations.

Permeability is rapid in the Lakin soil. Runoff is slow. Available water capacity is low. The content of organic matter is moderately low in the surface layer. The root zone is deep. The capacity to store and release plant nutrients is low.

This soil is used mainly as cropland. The main crops are corn and grass-legume hay. A few areas are used as pasture or woodland or as sites for buildings.

This soil is only moderately suited to cultivated crops. Droughtiness and erosion are the major management concerns. The soil warms up and dries early in the spring, but it is droughty in summer. Crops that mature early in the growing season are better suited than full-season crops. The hazard of erosion is moderate in cultivated areas. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface conserves moisture and helps to control erosion. Including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways also reduce the hazard of erosion. Banded or split applications of fertilizer minimize the loss of nutrients, especially nitrogen, and help to prevent the pollution of ground water.

This soil is only moderately suited to hay and pasture. Deep-rooted species that can tolerate droughtiness are the best suited. The early warming of the soil results in good spring growth, but droughtiness limits production later in the growing season. Because of the droughtiness, plants that are seeded early in spring become better established than plants that are seeded later in the growing season. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion.

This soil is moderately suited to timber production. No major limitations affect the planting, growth, or harvesting of trees. Growth is slowed by insufficient moisture. Species that can tolerate droughtiness should be selected for planting. Using seedlings that have been transplanted once can reduce the seedling mortality rate.

This soil is well suited to use as a site for buildings. Buildings should be designed to conform to the natural slope of the land. Erosion on construction sites can be minimized by reseeding exposed areas as soon as possible. Caving of trenches is a safety hazard in excavations. Droughtiness limits the establishment of lawns. Newly seeded lawns should be mulched and watered.

This soil is only moderately suited to use as a site for septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent from septic tank absorption fields. The effluent can pollute ground water. Establishing the absorption field in suitable fill material can improve the filtering capacity of the soil. Laying the lines across the slope can minimize the downslope seepage of effluent.

Ponds constructed in areas of this soil are very unlikely to hold water.

This soil is recognized as farmland of local importance. The land capability classification is IVs. The pasture and hayland suitability group is B-1. The woodland ordination symbol is 3S.

LcD—Lakin-Alford complex, 15 to 25 percent slopes. These deep, moderately steep, well drained soils are on dunes or hillsides on the eastern margin of former glacial lakes or glacial outwash terraces. The Lakin soil formed in windblown fine sand, and the Alford soil formed in windblown silt. The two soils occur as areas so intricately intermingled that they cannot be mapped separately. Most areas are oblong and are 3 to 20 acres in size. They are about 45 percent Lakin soil and 35 percent Alford soil.

Typically, the surface layer of the Lakin soil is dark brown, friable loamy fine sand about 10 inches thick. The subsoil is about 37 inches thick. It consists of alternating bands of brown, friable fine sandy loam and yellowish brown, very friable loamy fine sand. The underlying material to a depth of 77 inches or more is pale brown, loose loamy sand and sand. In some areas the subsoil is not banded and is sandy loam throughout.

Typically, the surface layer of the Alford soil is brown, friable silt loam about 4 inches thick. The subsoil is yellowish brown, firm silt loam about 41 inches thick. The underlying material to a depth of 60 inches or more is yellowish brown, friable silt loam. In some areas the surface layer is loam or very fine sandy loam.

Included with these soils in mapping are small areas of the moderately well drained Glenford, Markland, and Omulga soils. These included soils are in concave landscape positions. Also included are a few narrow flood plains and small areas of sandy soils that have a fragipan. Included areas make up about 20 percent of most delineations.

Permeability is rapid in the Lakin soil and moderate in the Alford soil. Runoff is medium or rapid on both soils. Available water capacity is low in the Lakin soil and high in the Alford soil. Both soils have a deep root zone. The content of organic matter in the surface layer is moderately low in the Lakin soil. It is low in the Alford soil because the plow layer is a mixture of material from the surface layer and the subsoil. The capacity to store and release plant nutrients is low in the Lakin soil and moderate in the Alford soil.

Most areas are used for pasture or hay. Some areas support second-growth stands of native hardwoods.

These soils are poorly suited to cultivated crops. Droughtiness, erosion, tilth, and the content of organic matter are the major management concerns. The hazard of erosion is very severe in cultivated areas. The Lakin soil is droughty. Using no-till farming methods or a system of conservation tillage that leaves crop residue on the surface conserves moisture, helps to control erosion, improves tilth, and increases the content of organic matter. Including grasses and legumes in the cropping system, stripcropping on the contour, and planting cover crops also help to control erosion. Maintaining a permanent plant cover is the best means of controlling erosion. The leaching of plant nutrients, especially nitrogen, is rapid in the Lakin soil. Banded or split applications of fertilizer minimize the loss of nutrients and help to prevent the pollution of ground water.

These soils are only moderately suited to hay and pasture. The early warming of the soils results in good spring growth, but droughtiness during the summer limits production, especially on the Lakin soil. Deep-rooted species that can tolerate droughtiness are the best suited in areas of the Lakin soil. The Alford soil is suited to a wider variety of forage plants. Because of the droughtiness in summer, plants seeded in early spring can become better established than those seeded later in the growing season. Seeding cover crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

These soils are only moderately suited to timber production. The aspect of the slope affects the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The Alford soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. The slope limits the use of planting and logging equipment. Establishing roads and skid trails on the contour helps to control erosion. Establishing water bars and maintaining a vegetative cover also help to control erosion. Where roads and trails cross channels, adding stones helps to prevent gullying. Species that can tolerate droughtiness should be selected for planting in areas of the Lakin soil. Using seedlings that have been transplanted once or adding mulch can reduce the seedling mortality rate in areas of the Lakin soil and on south-facing slopes in areas of the Alford soil. Plant competition can be controlled on the

Alford soil by removing vines and the less desirable trees and shrubs.

These soils are only moderately suited to use as sites for most buildings because of the slope. Controlling erosion and runoff is a management concern on construction sites. Diverting surface water away from buildings and reseeding as soon as possible after construction help to prevent erosion and water damage. Caving of trench walls is a hazard in excavations. Maintaining as much vegetative cover as possible on the site during construction helps to control erosion. Stockpiling the surface soil and using it to blanket the surface during final grading help to reestablish the plant cover.

These soils are moderately suited to septic tank absorption fields. The thickness of the subsoil is a limitation in areas of the Lakin soil. The sandy underlying material is a poor filter, and untreated effluent that reaches this material can pollute ground water. The Alford soil is a better site for septic tank absorption fields than the Lakin soil. Leach lines should be established across the slope to prevent the surfacing of effluent.

These soils contain poor material for use in earthen dams. Ponds constructed by damming small draws in areas of these soils are likely to have excessive seepage unless they are lined with clay.

The land capability classification is IVe. The pasture and hayland suitability group is B-1 for the Lakin soil and A-2 for the Alford soil. The woodland ordination symbol is 3S for the Lakin soil and 5R for the Alford soil.

Lk—Lindside silt loam, occasionally flooded. This deep, nearly level, moderately well drained soil is on flood plains along the major streams. It is on flats in broad stream valleys and is the dominant soil in some tributary valleys. The flooding is brief and commonly occurs during the dormant season. Slopes range from 0 to 3 percent. Most areas are narrow and winding and range from 10 to 200 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is yellowish brown and pale brown, friable silt loam about 31 inches thick. It is mottled. The underlying material to a depth of 60 inches or more is dark brown, friable silt loam. Some areas along tributary streams that have a steeper grade have layers of gravelly loam and sandy loam. In a few areas, gravelly sand or loamy sand is at a depth of more than 4 feet. Natural levees that consist of well drained soils are in some areas. Flooding is frequent along some tributaries.

Included with this soil in mapping are small areas of Newark, Melvin, Chagrin, and Tioga soils. The somewhat poorly drained Newark and poorly drained Melvin soils are in depressions and former meander channels. Chagrin and Tioga soils are on alluvial terraces. They are subject to rare flooding. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up 20 percent of most delineations.

Permeability is moderate or moderately slow in the Lindside soil. Runoff is slow. Available water capacity is high. The content of organic matter is moderate in the surface layer. The root zone is deep. The capacity to store and release plant nutrients is moderate. A seasonal high water table is in the lower part of the subsoil during wet periods. The shrink-swell potential is low. The potential for frost action is high.

Most of the broader areas are used as cropland. Areas in the narrower valleys are used as pasture or woodland. The woodland consists of mixed bottom-land hardwoods.

This soil is well suited to corn and soybeans but is less suited to winter grain crops because of the flooding. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and hinders the emergence of seedlings. Shallow cultivation of intertilled crops, however, breaks up the crust. Using no-till farming methods or a system of conservation tillage that leaves crop residue on the surface conserves moisture and increases the rate of water infiltration. Banded or split applications of fertilizer minimize the loss of nutrients, especially nitrogen, and help to prevent the pollution of ground water. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. In a few areas, land grading helps surface water to drain faster. Subsurface drains are beneficial in areas of the wetter included soils. Keeping stream channels free of obstructions, such as logjams, helps to prevent flooding. Small levees have been constructed in some areas to reduce the hazard of flooding. Streambank erosion is a major source of sediments that cause water pollution. Streambanks can be stabilized by shaping, planting shrubs, and placing stone riprap in some places. Controlling weeds is difficult because weed seeds are carried in by floodwater. Winter cover crops can protect the soil from scouring. In some areas, grass-lined floodwater channels are needed to handle peak flow and reduce flood damage to cropland. Diversions at the base of slope breaks to the uplands or terraces minimize the damage caused by flash flooding.

This soil is well suited to hay. A wide range of forage species can be planted. Newly seeded plants are subject to occasional flood damage. Damage is more likely in areas where a finely tilled seedbed has been

Figure 13.—Flooding in an area of Lindside silt loam, occasionally flooded.

prepared. Plants seeded in summer are less likely to be damaged than those seeded in early spring. Including legumes in the seeding mixture provides nitrogen for subsequent row crops.

This soil is well suited to pasture. A wide variety of forage plants can thrive on this soil. The brief flooding during the growing season reduces the quality of forage plants.

This soil is well suited to timber production. Flooding affects the planting, growth, and harvesting of trees. Native bottom-land hardwoods grow well on this soil. Because flooding is usually brief, most management activities can be performed during periods when the soil is not flooded. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is generally unsuited to use as a site for buildings or for septic tank absorption fields because of the flooding and the seasonal wetness (fig. 13). Local roads can be elevated above flood levels, but the fill can partially block the natural floodway and increase the level of flooding upstream. Excavated ponds are unlikely to hold water and are subject to flood damage.

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

Lm—Lobdell loam, channery substratum, occasionally flooded. This deep, nearly level, moderately well drained soil is on flood plains and alluvial fans in narrow valleys along the headwaters of tributary streams. It is subject to very brief periods of flooding, usually in the form of flash floods after intense local thunderstorms during the growing season. The long, narrow areas are commonly split into small fields by tributary channels. Slopes range from 0 to 3 percent. Most areas are 5 to 20 acres in size.

Typically, the surface layer is brown, very friable loam about 6 inches thick. The subsoil is dark yellowish brown, friable silt loam and brown, mottled channery silt loam about 22 inches thick. The underlying material to a depth of 60 inches or more is grayish brown and dark brown, friable and firm channery loam. In many areas the surface layer is gravelly loam. In places siltstone bedrock is at a depth of about 36 to 60 inches. In some areas the subsoil has very gravelly layers.

Included with this soil in mapping are small areas of Newark and Melvin soils. These soils are commonly in slight depressions and abandoned stream channels. They are less well drained than the Lobdell soil. Also included are gently sloping soils on rarely flooded alluvial fans at the base of hillside drainageways, areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding, and small areas of soils that have bedrock within a depth of 36 inches and that have a low available water capacity. Included areas make up about 20 percent of most delineations.

Permeability is moderate in the Lobdell soil. Runoff is slow. Available water capacity is moderate. The content of organic matter is moderately low or moderate in the surface layer. The root zone is deep in most areas. A seasonal high water table is in the lower part of the subsoil during extended wet periods. The potential for frost action is high. The shrink-swell potential is low.

Most areas are used as pasture or woodland because they are too narrow, small, or irregularly shaped for cultivation. Many local roads follow strips of this soil to avoid steep grades and deep cuts. The roads are subject to washouts during flash floods. A few of the wider areas are used for crops.

The larger areas of this soil are well suited to crop production. Corn and forage plants are commonly grown. Winter grain crops are more susceptible to flood damage than corn or hay. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Shallow cultivation of intertilled crops, however, breaks up the crust. Using no-till farming methods or a system of conservation tillage that leaves crop residue on the surface conserves moisture and increases the rate of water infiltration. Banded or split applications of fertilizer minimize the loss of nutrients, especially nitrogen, and help to prevent the pollution of ground water. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Land grading in a few areas allows surface water to drain faster. Subsurface drains are needed in areas of the wetter included soils. Keeping stream channels free of obstructions, such as logjams, helps to prevent flooding. Streambank erosion is a major source of sediments that pollute the water. Streambanks can be stabilized by shaping, by planting shrubs, and by placing stone riprap in some places. Controlling weeds is difficult because weed seeds are carried in by floodwater. Winter cover crops protect the soil from scouring. In some areas, grass-lined floodwater channels are needed to handle peak flow and minimize damage to cropland. Diversions at the base of slope breaks to the uplands or terraces minimize the damage caused by flash flooding.

This soil is well suited to hay. A wide variety of species can be planted. Flash floods can damage newly seeded plants. The damage can be especially severe in areas of new plantings where a finely tilled seedbed has been prepared. A no-till seeding method should be used.

This soil is well suited to pasture. A wide variety of forage plants can thrive on this soil. The brief flooding during the growing season can reduce the quality of forage. Seeding deep-rooted legumes can increase production. Scouring of the surface layer, deposition of sediments and flood debris, and crusting of the surface layer are management concerns.

This soil is well suited to timber production. Flooding affects the planting, growth, and harvesting of trees. Native bottom-land hardwoods grow well. Because flooding is commonly brief, most management activities can be performed during periods when the soil is not flooded. Some evergreen species can sustain frost damage in the narrow valleys. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is generally unsuited to use as a site for buildings or for septic tank absorption fields because of the flooding and the risk of surface-water pollution. The damage to local roads and streets caused by flooding can be minimized by installing culverts that have a capacity to carry the peak flow during periods of flash flooding. Excavated ponds are unlikely to hold water and are subject to flood damage.

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

Lo—Lorain silty clay. This deep, nearly level, very poorly drained soil is in level or depressed areas in former glacial lake valleys. It receives runoff from adjoining soils and is often ponded. Some areas are ponded for most of the year. Most areas range from 20 to 100 acres in size.

Typically, the surface layer is very dark gray, friable silty clay about 7 inches thick. The subsoil is about 53 inches thick. The upper part is dark gray and gray, mottled, firm silty clay. The lower part is dark grayish brown, mottled, very firm clay. In some areas the surface layer is thicker and darker and has a high content of organic matter. These areas are commonly in the deeper depressions. Some places are poorly drained and have less clay in the surface layer and the subsoil. Other places have underlying layers of fine sandy loam or silt loam. In some areas the surface layer is gray.

Included with this soil in mapping are areas of the somewhat poorly drained Fitchville and McGary soils on small knolls. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 15 percent of most delineations.

Permeability is slow in the Lorain soil. Runoff is very slow or ponded. Available water capacity is moderate. The content of organic matter is high in the surface layer. The seasonal high water table is near or above the surface in winter and spring and during other extended wet periods. The root zone is deep except during periods when the water table is high. The capacity to store and release plant nutrients is high. The potential for frost action also is high, and the shrink-swell potential is high in the subsoil.

Undrained areas of this soil are used mainly as woodland or for shrubs. Most of the woodland is second-growth swamp forest. Areas of this soil can be used as wetland. Some areas have been drained and are used for crops. Many areas that are partially drained are used for pasture.

If drained, this soil is moderately suited to crops. Wetness and surface compaction are the major management concerns. Surface and subsurface drainage systems can remove surface water and lower the water table. Establishing and maintaining drainage outlets is expensive in most areas. Ditches are used as outlets in some areas, but the ditches tend to fill with sediment because the gradient is low. A pump drainage system is needed in some areas. Tilling in the fall can minimize compaction of the surface layer because the subsoil is usually drier in the fall than in the spring. Using tillage methods that leave the surface layer rough or ridged and partially covered by crop residue helps to control runoff, increases the rate of water infiltration, and hastens drying. Ridge tillage improves yields.

Drained areas of this soil are moderately suited to hay and pasture. Even in drained areas, grasses and legumes that can tolerate wetness are the best suited. Areas that have not been drained are poorly suited to hay and pasture. Rushes and other kinds of swamp vegetation crowd out the seeded forage plants. Deferred grazing during wet seasons can prevent compaction of the surface layer and damage to plant roots.

This soil is only moderately suited to timber production. Ponding and wetness affect the planting, growth, and harvesting of trees. Native bottom-land hardwoods that can tolerate ponding and wetness grow well. Selecting water-tolerant species for planting reduces the seedling mortality rate. Planting and logging should take place during dry periods or when the soil is frozen. The windthrow hazard can be reduced by using harvesting methods that do not leave the remaining trees isolated or widely spaced.

This soil is well suited to use as habitat for wetland wildlife. Removing vines and the less desirable trees and shrubs can control plant competition.

Because of the ponding, the high shrink-swell potential, and the restricted permeability, this soil is generally unsuited to use as a site for buildings or for septic tank absorption fields. Corrective measures commonly are not practical. There are few natural pond sites, but excavated ponds are likely to hold water.

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

LpC2—Lowell silt loam, 8 to 15 percent slopes, eroded. This deep, strongly sloping, well drained soil is on dissected uplands. Most areas are on rounded ridgetops or shoulder slopes, but some areas are on benches. Slopes are long and smooth and typically are convex. Erosion has removed part of the original surface layer. Most areas range from 3 to 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 41 inches thick. The upper part is yellowish brown, friable silty clay loam and silty clay. The lower part is light olive brown, grayish brown, and yellowish brown, firm silty clay and silty clay loam. The underlying material to a depth of 60 inches or more is olive, very firm, weathered clay shale and siltstone. In some areas, mottles are at a depth of more than 30 inches. In severely eroded areas the surface layer is silty clay loam. In some places the soil is moderately well drained. Some areas that occur as thin bands around low knolls on ridgetops have a redder subsoil. In areas on benches and foot slopes, the depth to bedrock is more than 5 feet. In many places the subsoil is calcareous and contains fragments of limestone.

Included with this soil in mapping are small areas of Claysville, Gilpin, and Westgate soils. The somewhat poorly drained Claysville soils are in seep spots. Gilpin soils are in the steeper areas. They are moderately deep over siltstone and have less clay in the subsoil than the Lowell soil. Westgate soils are mostly in saddles and near the center of ridgetops. They have less clay in the upper part of the subsoil than the Lowell soil. Included soils make up about 20 percent of most delineations.

Permeability is moderately slow in the Lowell soil. Runoff is rapid in cultivated areas. Available water capacity is moderate. The content of organic matter is moderately low in the surface layer. The root zone is deep. A seasonal high water table is perched in the lower part of the subsoil during extended wet periods. The shrink-swell potential is high in the subsoil. The potential for frost action is moderate.

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

This soil is only moderately suited to cultivated crops. Many areas are eroded, and controlling further erosion is the main management concern. The hazard of erosion is severe in cultivated areas. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, and establishing grassed waterways can reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using subsurface drains in seepy areas increases crop production in most years.

This soil is well suited to hay and pasture. It is suited to a wide variety of forage plants. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion.

This soil is well suited to timber production. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface.

This soil is only moderately suited to use as a site for buildings and is poorly suited to septic tank absorption fields. The slope, the seasonal wetness, the high shrink-swell potential, and the restricted permeability are limitations. The hazard of erosion on construction sites can be reduced by removing as little vegetation as possible and by reseeding areas as soon as possible. Reinforcing foundation walls and footings and backfilling trenches with granular material that has a low shrink-swell potential help to prevent the damage caused by shrinking and swelling. Drains around footings can reduce the wetness. Installing leach lines across the slope helps to prevent the surfacing of effluent. Elevating the field increases the depth to the water table, and installing the lines in more permeable fill improves the filtering capacity of the soil. Perimeter drains help to lower the water table. Enlarging the absorption field helps to overcome the restricted permeability.

The watershed area for ponds is limited on the ridgetops. If ponds are excavated only in the clayey layers of this soil, they are likely to hold water. Onsite investigation is needed to determine the thickness of the clayey layers.

This soil is recognized as farmland of local importance. The land capability classification is IIIe. The pasture and hayland suitability group is A-1. The woodland ordination symbol is 4C.

LpD2—Lowell silt loam, 15 to 25 percent slopes, eroded. This deep, moderately steep, well drained soil is on the knolls and ridges of dissected hillsides. Areas on ridges are mainly long and narrow, and areas on knolls are rounded. Slopes are long, smooth, and convex. Most areas range from 10 to 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 49 inches thick. In sequence downward, it is dark brown, friable silty clay loam; strong brown, very firm silty clay; strong brown, very firm clay; and yellowish brown, mottled, very firm clay. The underlying material is brown, firm channery silty clay loam about 13 inches thick. Brown, soft, clay shale bedrock is at a depth of about 70 inches. In some areas the soil is moderately well drained. In many places, the soil is redder and the subsoil contains more clay. In severely eroded areas the surface layer is silty clay loam. In many areas the subsoil is moderately alkaline and is limy.

Included with this soil in mapping are small areas of Westgate, Berks, Gilpin, and Westmoreland soils. Westgate soils are in the less sloping areas. They have less clay in the upper part of the subsoil than the Lowell soil. Westmoreland soils and the moderately deep Berks and Gilpin soils are on the steeper slopes. Westmoreland soils are less clayey than the Lowell soil. Included soils make up about 20 percent of most delineations.

Permeability is moderately slow in the Lowell soil. Runoff is very rapid. Available water capacity is moderate. The content of organic matter is moderately low in the surface layer. The root zone is deep. The capacity to store and release plant nutrients is high. A seasonal high water table is perched in the lower part of the subsoil in the spring or during other wet periods. The shrink-swell potential is high. The potential for frost action is moderate.

Most areas are used as pasture. Some wooded areas are used for grazing. Many areas that are no longer farmed are held as coal or oil reserves. These areas have a cover of native grasses, briers, shrubs, and young hardwoods.

This soil is poorly suited to cultivated crops. Many areas are eroded, and controlling further erosion is the main management concern. The hazard of erosion is very severe in cultivated areas. Maintaining a permanent plant cover is the best means of controlling erosion. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, and establishing grassed waterways can reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using subsurface drains in seepy areas increases crop production in most years.

This soil is moderately suited to hay and pasture, but it is poorly suited to winter grazing. It is suited to a wide variety of forage plants. If the soil is plowed, the hazard of erosion is severe. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion. Restricting grazing during wet periods helps to prevent compaction of the surface layer and damage to plant roots.

This soil is only moderately suited to timber production. The aspect of the slope affects the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. The slope limits the use of planting and logging equipment. Establishing roads and skid trails on the contour helps to control erosion. Establishing water bars and maintaining a vegetative cover also help to control erosion. Where roads and trails cross channels, adding stones helps to prevent gullying. Using planting techniques that spread the roots of seedlings and increase soil-root contact can reduce the seedling mortality rate. Using seedlings that have been transplanted once or adding mulch can reduce the seedling mortality rate on south-facing slopes. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is poorly suited to use as a site for buildings. The slope and the high shrink-swell potential are management concerns. On construction sites, the hazard of erosion can be reduced by removing as little vegetation as possible, by mulching, and by establishing a temporary plant cover on the surface. On sites for local roads and streets, the hazard of erosion can be reduced by building on the contour and by seeding road cuts. Installing reinforced concrete foundation walls and footings and backfilling trenches with granular material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling.

This soil is generally unsuited to use as a site for septic tank absorption fields because of the seasonal wetness, the restricted permeability, and the slope. The surfacing of effluent is very likely and can cause pollution of streams.

The watershed area for ponds is very limited on the ridgetops. Excavated ponds are likely to hold water unless layers of porous or shattered rock below the clay shale are exposed. Onsite investigation is needed to determine the thickness of the clayey layers.

The land capability classification is IVe. The pasture and hayland suitability group is A-2. The woodland ordination symbol is 4C on north aspects and 3C on south aspects.

LrE2—Lowell-Gilpin complex, 25 to 40 percent slopes, eroded. These steep, well drained soils are on dissected hillsides. The Lowell soil is on the less sloping parts of hillsides and benches. The Gilpin soil is on the steeper bluffs. Erosion has removed part of the original surface soil, and scars and gullies are common. The two soils occur as alternating strips across the hillside that are too small to map separately. Most areas range from 20 to 250 acres in size. They are about 45 percent Lowell soil and 35 percent Gilpin soil.

The Lowell soil is deep. Typically, the surface layer is dark yellowish brown, friable silt loam about 7 inches thick. The subsoil is about 41 inches thick. The upper part is dark brown, friable silty clay loam. The lower part is dark brown, firm channery silty clay and light olive brown, firm silty clay. The underlying material to a depth of 60 inches or more is light olive brown, very firm channery silty clay loam. In some severely eroded areas, the surface layer is silty clay loam. Some areas on benches are moderately well drained. In places the subsoil is calcareous and has common fragments of limestone. In some areas the soil has reddish brown colors.

The Gilpin soil is moderately deep. Typically, the surface layer is brown, friable channery silt loam about 2 inches thick. The subsoil is about 20 inches thick. It is light olive brown and pale brown, friable channery and very channery silt loam. Weathered siltstone bedrock is at a depth of about 22 inches. In places the bedrock is at a depth of more than 5 feet. In some areas on the steeper slopes, the soil is shallow or moderately deep and is very channery throughout. Outcrops of siltstone bedrock are on the side slopes of ravines.

Included with these soils in mapping are small areas of Claysville and Westgate soils. The somewhat poorly drained Claysville soils are around seep spots, especially in bands of the Lowell soil. The moderately well drained Westgate soils are on the less sloping benches. Included soils make up about 20 percent of most delineations.

Permeability is moderately slow in the Lowell soil and is moderate in the Gilpin soil. Runoff is very rapid on both soils. Available water capacity is high in the Lowell soil and is very low in the Gilpin soil. The potential for frost action is moderate in both soils. The content of organic matter is moderately low in the surface layer. The root zone is deep in the Lowell soil and moderately deep in the Gilpin soil. The shrink-swell potential is high in the Lowell soil and low in the Gilpin soil.

Most areas are used as pasture or woodland or as habitat for woodland wildlife.

These soils are generally unsuited to cultivation because of the slope and a very severe hazard of erosion. Maintaining a permanent plant cover is the best means of controlling erosion.

These soils are poorly suited to hay and pasture. They are suited to a wide variety of forage plants, but seeding and applying fertilizer are difficult. The slope limits the use of farm equipment. Forage production is low on the Gilpin soil during dry periods. If the soils are plowed, the hazard of erosion is very severe. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion. After a pasture is established, it should be maintained for as long as possible. Erosion can be severe unless a thick sod is maintained.

These soils are only moderately suited to timber production. The aspect of the slope affects the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The soils have low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Establishing roads and skid trails on the contour helps to control erosion. Establishing water bars and maintaining a vegetative cover also help to control erosion. Using planting techniques that spread the roots of seedlings and that increase soil-root contact can reduce the seedling mortality rate. Plant competition can be minimized by removing vines and the less desirable trees and shrubs.

These soils are generally unsuited to use as sites for buildings or for septic tank absorption fields. The slope limits the use of equipment and is a severe limitation on sites for buildings. If septic tank absorption fields are installed, excessive downslope seepage of effluent is likely because of the slope. Hillside slippage is a hazard in areas of the Lowell soil.

Areas of these soils have poor potential for pond sites. Layers of shattered rock that permit excessive seepage are on the side slopes of most draws.

The land capability classification is VIe. The pasture and hayland suitability group is A-3. The woodland ordination symbol is 5R for the Lowell soil and 4R for the Gilpin soil.

LrF—Lowell-Gilpin complex, 40 to 70 percent slopes. These very steep, well drained soils are on dissected hillsides. The Lowell soil is commonly on narrow benches and the less sloping parts of hillsides. The Gilpin soil is on the steeper bluffs. Landslides are common in some areas. The two soils occur as areas so intricately mixed that mapping them separately is not practical. Most areas are 30 to 300 acres in size. They are about 45 percent Lowell soil and 30 percent Gilpin soil.

The Lowell soil is deep. Typically, the surface layer is brown, friable silt loam about 4 inches thick. The subsoil is about 50 inches thick. The upper part is dark brown, firm silty clay loam. The next part is yellowish brown and light yellowish brown, firm silty clay. The lower part is variegated strong brown, olive brown, and brown, firm silty clay. The underlying material is brown, firm channery silty clay. In some areas the subsoil is reddish brown. In other areas, the subsoil is limy and limestone fragments are throughout the soil. In many severely eroded areas, the surface layer is silty clay. Areas on some of the less sloping benches are moderately well drained.

The Gilpin soil is moderately deep. Typically, the surface layer is brown, friable channery silt loam about 4 inches thick. The subsoil is about 26 inches thick. The upper part is yellowish brown, friable channery silt loam and channery silty clay loam, and the lower part is dark yellowish brown, friable very channery silt loam. Olive shale bedrock is at a depth of about 30 inches. In some areas the bedrock is at a depth of more than 40 inches.

Included with these soils in mapping are small areas of Westgate, Berks, and Claysville soils. The moderately well drained Westgate soils are on some of the wider benches. Berks soils are on the steepest slopes. They are more channery than the Lowell and Gilpin soils. The somewhat poorly drained Claysville soils are in seepy areas. Also included are a few areas of massive sandstone rock outcrops. Included areas make up about 25 percent of most delineations.

Permeability is moderately slow in the Lowell soil and moderate in the Gilpin soil. Runoff is very rapid on both soils. Available water capacity is high in the Lowell soil and very low in the Gilpin soil. The root zone is deep in the Lowell soil and moderately deep in the Gilpin soil.

Most areas are wooded. Past logging practices and grazing have left the stands dominated by the less desirable trees. Some areas are dominated by thorny brush and thickets.

Because of the slope, areas of these soils are not suited to crops or pasture. Maintaining a permanent vegetative cover is the best means of controlling erosion.

These soils are only moderately suited to timber production. The slope limits the use of planting and logging equipment. The aspect of the slope affects the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The soils have low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Establishing roads and skid trails on the contour helps to control erosion. Establishing water bars and maintaining a vegetative cover also help to control erosion. Using planting techniques that spread the roots of seedlings and that increase soil-root contact can reduce the seedling mortality rate. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

These soils are unsuited to use as sites for buildings or for septic tank absorption fields because of the slope. The slope limits the use of equipment. The Lowell soil is subject to slippage. Also, the restricted permeability in the Lowell soil and the moderate depth to bedrock in the Gilpin soil are limitations.

The potential for ponds is poor. Layers of shattered or porous rock that permit excessive seepage are on the sides of many draws in areas of these soils.

The land capability classification is VIIe. The pasture and hayland suitability group is H-1. The woodland ordination symbol is 5R for the Lowell soil and 4R for the Gilpin soil.

Lu—Luray silty clay loam. This deep, nearly level, very poorly drained soil is on the terraces of former glacial lakes. It is in level or depressional areas that receive runoff from surrounding soils. Slopes range from 0 to 2 percent. Most areas are irregular in shape and range from 5 to 80 acres in size.

Typically, the surface layer and the subsurface layer are very dark gray and black, firm silty clay loam. They have a combined thickness of about 16 inches. The subsoil is firm silty clay loam about 39 inches thick. It is mottled. The upper part is dark gray and gray, and the lower part is light olive gray. The underlying material to a depth of 60 inches or more is light olive gray, mottled, firm silt loam. In some areas the surface layer is silty clay or silt loam. In a few places the dark surface layer is thinner.

Included with this soil in mapping are small areas of Fitchville, Sebring, and Lorain soils. The somewhat poorly drained Fitchville soils are on slightly elevated knolls. The poorly drained Sebring soils have a surface layer that is lighter colored than that of the Luray soil. The very poorly drained Lorain soils are in small depressions. They are more clayey than the Luray soil. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 20 percent of most delineations.

Permeability is moderately slow in the Luray soil. Runoff is very slow or ponded. Available water capacity is high or very high. The content of organic matter is high. A seasonal high water table is at or above the surface during extended wet periods and is within the root zone well into the growing season. Rooting depth is limited by the seasonal high water table. The capacity to store and release plant nutrients is high. The shrink-swell potential is moderate.

Most areas are drained and are used as cropland. Areas that have not been drained are used mainly as woodland. Most of the woodland is second-growth swamp forest. A few partially drained areas are used as pasture. This soil is well suited to use as habitat for wetland wildlife.

If drained, this soil is well suited to crops. Wetness is the main management concern. A complete system of subsurface drains is needed to provide adequate drainage. Surface drains can be used in ponded areas. Ditches are needed to provide outlets in many areas, but the ditches are expensive to establish and maintain. Fall tillage is less likely to result in surface compaction than spring tillage because the subsoil is usually drier in the fall. Using tillage methods that leave a rough or ridged surface that is partially covered by crop residue helps to control runoff, increases the rate of water infiltration, and hastens drying. Ridge tilling improves yields.

Drained areas are only moderately suited to hay and pasture. Species that can tolerate wetness are the best suited. Few areas are drained sufficiently for alfalfa. Areas that have not been drained are poorly suited to hay and pasture. Rushes and swamp grass crowd out the forage species. Extended periods of ponding can damage or kill the sod. Deferred grazing during wet seasons prevents compaction of the surface layer and damage to plant roots.

This soil is only moderately suited to timber production. The ponding and the wetness affect the planting, growth, and harvesting of trees. Native bottom-land hardwoods that can tolerate ponding and wetness grow well. Selecting water-tolerant species for planting reduces the seedling mortality rate. Planting and logging should be carried out during dry periods or when the soil is frozen. The hazard of windthrow can be reduced by using harvesting methods that do not leave the remaining trees isolated or widely spaced. Removing vines and the less desirable trees and shrubs helps to control plant competition.

This soil is poorly suited to use as a site for buildings and is generally unsuited to use as a site for septic tank absorption fields. The wetness, the ponding, and the restricted permeability are severe limitations. Ditches, subsurface drains, and storm sewers can improve the drainage system. Agricultural drains generally should be deepened and enlarged to carry storm-water runoff from residential areas. Installing drains at the base of footings and coating exterior basement walls help to keep basements dry. Establishing a drainage system that is adequate for septic tank absorption fields is very difficult and expensive.

There are few natural pond sites. Excavated ponds vary considerably in their ability to hold water. Onsite investigation is needed to determine the nature of the underlying material.

The land capability classification is IIw. The pasture and hayland suitability group is C-1. The woodland ordination symbol is 5W.

MaB—Markland silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is on lacustrine terraces in valleys that once held glacial lakes. Most areas are irregular in shape and are 5 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is yellowish brown, firm silty clay loam and silty clay about 29 inches thick. It has common gray mottles and coatings at a depth of more than 18 inches. The underlying material to a depth of 80 inches or more is yellowish brown, firm, laminated silty clay loam. In some areas the surface layer is loam. Some of the more sloping areas are eroded and have a surface layer of silty clay loam. In some of the less sloping areas, the subsoil has less clay. In some places the underlying material is silt loam and fine sandy loam.

Included with this soil in mapping are small areas of Watertown, Lorain, and Sebring soils. The well drained Watertown soils are on ridges. They are sandier than the Markland soil. The poorly drained Lorain and Sebring soils are in depressions where surface water accumulates. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up less than 20 percent of most delineations.

Permeability is slow in the Markland soil. Runoff is medium. Available water capacity is moderate. The content of organic matter is moderate in the surface layer. The root zone is deep, but the clayey subsoil restricts the root development of some species. A seasonal high water table is in the lower part of the subsoil in late winter and in spring and during other extended wet periods. The capacity to store and release plant nutrients is high. The shrink-swell potential is high in the subsoil and underlying material. The potential for frost action is moderate.

Most areas are used as cropland. A few areas are used as pasture or woodland.

This soil is only moderately suited to cultivated crops. The hazard of erosion is severe in cultivated areas. Erosion exposes the clayey subsoil. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, and establishing grassed waterways can reduce the hazard of erosion. The soil dries and warms up slowly in the spring because of the clayey subsoil. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Subsurface drains are moderately effective in reducing wetness in scattered low areas.

This soil is moderately suited to hay and pasture. It is also suited to a variety of forage plants. The clayey subsoil restricts the root development of some species. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover of vegetation on the surface in the fall or including grasses in the seeding mixture can minimize the damage caused by frost. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion.

This soil is only moderately suited to timber production. The clayey subsoil affects the planting and growth of trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Using planting techniques that spread the roots of seedlings and increase soil-root contact can reduce the seedling mortality rate. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. The hazard of windthrow can be reduced by using logging methods that do not leave the remaining trees widely spaced.

This soil is only moderately suited to use as a site for buildings. Reinforcing foundations and footing walls helps to prevent the damage caused by shrinking and swelling of the subsoil. Installing foundation drains and using sealers on basement walls help to minimize seepage.

This soil is poorly suited to use as a site for septic tank absorption fields. Specially designed absorption fields are needed because of the seasonal wetness and the restricted permeability. Perimeter drains can reduce the wetness by lowering the water table. Elevating the field with more permeable fill material helps to overcome the restricted permeability. Aeration systems should be considered as an alternative to a standard septic tank absorption field.

Excavated ponds are likely to hold water. The clayey soil material is hard to pack when wet.

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

MbC2—Markland silty clay loam, 6 to 15 percent slopes, eroded. This deep, strongly sloping, moderately well drained soil is on the dissected terraces of former glacial lakes. The surface is crossed by many small drainage channels. Slopes are short and irregular. The upper slopes are convex, and the lower slopes are concave. Erosion has removed part of the original surface layer, and the present surface layer is mixed with subsoil material. Most areas are fan-shaped or U-shaped bands. They range from 5 to 30 acres in size.

Typically, the surface layer is brown, firm silty clay loam about 6 inches thick. The subsoil is 24 inches thick. The upper part is yellowish brown, firm silty clay. The lower part is yellowish brown, mottled silty clay and silty clay loam. The underlying material to a depth of 60 inches or more is yellowish brown, mottled, firm silty clay loam. In some areas that are not eroded, the surface layer is silt loam. In many places the subsoil has less clay and is more permeable. Some areas on knolls are well drained.

Included with this soil in mapping are small areas of Watertown, McGary, and Fitchville soils. Watertown soils are in areas where layers of sand are interbedded with clay sediments. The somewhat poorly drained McGary and Fitchville soils are along drainageways. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 20 percent of most delineations.

Permeability is slow in the Markland soil. Runoff is rapid. Available water capacity is moderate. The content of organic matter is moderately low in the surface layer because of erosion. Tilth is only fair. The root zone is potentially deep, but the clayey subsoil restricts the roots of some species. A seasonal high water table is in the lower part of the subsoil in late winter and in spring and during other extended wet periods. The capacity to store and release plant nutrients is moderate. The shrink-swell potential is high in the subsoil and the underlying material because of the high content of clay.

Most areas are used as cropland. A few areas are used as pasture or woodland.

This soil is poorly suited to cultivated crops. The hazard of erosion is very severe in cultivated areas. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, and establishing grassed waterways can reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Using subsurface drains in seepy areas increases crop production in most years.

This soil is moderately suited to hay and is well suited to pasture. It is suited to most of the commonly grown forage plants, but the clayey subsoil restricts the root development of some species. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover of vegetation on the surface in the fall and including grasses in the seeding mixture can minimize the damage caused by frost. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

This soil is only moderately suited to timber production. The clayey subsoil affects the planting and growth of trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Using planting techniques that spread the roots of seedlings and increase soil-root contact can reduce the seedling mortality rate. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Using logging methods that do not leave the remaining trees widely spaced can reduce the hazard of windthrow.

This soil is only moderately suited to use as a site for buildings and is generally unsuited to use as a site for septic tank absorption fields. The seasonal wetness and shrinking and swelling of the subsoil are limitations on sites for buildings. Reinforcing foundation walls and footings helps to prevent the structural damage caused by shrinking and swelling. Installing foundation drains and using sealers on basement walls minimizes seepage. Removing as little vegetation as possible and reseeding exposed areas help to prevent further erosion on construction sites. The seasonal wetness, the restricted permeability, and the slope are management concerns on sites for septic tank absorption fields.

Ponds can be established by damming small drainageways in areas of this soil. If used at the proper moisture content, the soil material packs well and can be used as fill.

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

McD2—Markland-Glenford complex, 15 to 35 percent slopes, eroded. These deep, moderately steep and steep, moderately well drained soils are on the highly dissected remnants of terraces in the valleys of former glacial lakes. They formed in alternating beds of clay, silt, and fine sand. The Markland soil is typically on the upper parts of hillsides and at the head of small ravines. The Glenford soil is typically on the less sloping lower parts of hillsides, where slopes range from 15 to 25 percent. Most areas of these soils are narrow and have slopes that face a major stream valley. They range from 5 to 25 acres in size. They are about 40 percent Markland soil and 30 percent Glenford soil.

The two soils occur as areas so narrow and intermingled that it is impractical to map them separately.

Typically, the surface layer of the Markland soil is dark brown, friable silty clay loam about 7 inches thick. The subsoil is yellowish brown, firm silty clay and silty clay loam about 24 inches thick. It is mottled in the lower part. The underlying material extends to a depth of 80 inches or more. It consists of thin alternating layers of silt loam and silty clay loam. Gullies are common in some severely eroded areas along drainageways.

Typically, the surface layer of the Glenford soil is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is yellowish brown, firm silt loam about 22 inches thick. The underlying material extends to a depth of 60 inches or more. It consists of thin alternating layers of fine sandy loam and silt loam. The slope is more than 35 percent in many areas along ravines or in places where streams have undercut hillsides. Some areas are well drained. In a few areas a fragipan is in the lower part of the subsoil.

Included with these soils in mapping are small areas of Watertown, Newark, and Melvin soils and small areas of Rodman soils. The well drained Watertown soils formed in sandy sediments. Newark and Melvin soils are on narrow flood plains in the larger ravines. Rodman soils are more gravelly than the Markland and Glenford soils. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding and areas of small rock ledges and outcrops. Included areas make up about 30 percent of most delineations.

Permeability is slow in the Markland soil and moderately slow or moderate in the Glenford soil. Runoff is rapid on both soils. Available water capacity is moderate in the Markland soil and high in the Glenford soil. The content of organic matter is moderately low in the surface layer of both soils. The root zone is potentially deep, but the clayey subsoil in the Markland soil restricts the roots of some species. A seasonal high water table is in the lower part of the subsoil in both soils during extended wet periods. The shrink-swell potential is high in the Markland soil and moderate in the Glenford soil. The potential for frost action is moderate in the Markland soil and high in the Glenford soil.

Most areas are used for pasture or support second-growth woodland. Many areas were cultivated in the past, but tillage is no longer practical because of erosion and the formation of gullies.

These soils are generally unsuited to cultivation because of the slope and a very severe hazard of erosion. Maintaining a permanent plant cover is the best means of controlling erosion.

These soils are poorly suited to hay and are only moderately suited to pasture. They are suited to most of the commonly grown forage plants in areas where the slope does not interfere with intensive management. In many areas the slope limits the use of equipment that is needed for seeding and harvesting hay crops and for improving pastures. In such areas, pastures of native grasses can be moderately productive unless they are overgrazed. Frost heave can damage deep-rooted legumes. Leaving a plant cover on the surface in the fall or seeding a grass-legume mixture can minimize the damage caused by frost heave. If the soils are plowed, the hazard of erosion is severe. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion.

These soils are moderately suited to timber production. The aspect of the slope affects the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The soils have low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. The slope limits the use of planting and logging equipment. Establishing roads and skid trails on the contour, establishing water bars, and maintaining a vegetative cover help to control erosion. Where roads and trails cross channels, adding stones helps to prevent gullying. Using planting techniques that spread the roots of seedlings and that increase soil-root contact can reduce the seedling mortality rate in areas of the Markland soil. Using seedlings that have been transplanted once or adding mulch can reduce the seedling mortality rate on south-facing slopes. Plant competition can be minimized by removing vines and the less desirable trees and shrubs. The hazard of windthrow on the Markland soil can be reduced by using harvesting methods that do not leave the remaining trees isolated or widely spaced.

These soils are poorly suited to use as sites for buildings because of the slope, the high shrink-swell potential, and the seasonal wetness. Erosion and runoff are problems on construction sites. Diverting surface water away from buildings and reseeding exposed areas as soon as possible help to prevent erosion and water damage. Shrinking and swelling of the subsoil can affect foundations. Reinforcing foundation walls and footings and backfilling with granular material can reduce the structural damage caused by shrinking and swelling. Saturated zones have low strength and may slide if slopes are too steep or if heavy loads are added. Installing drains around footings can reduce the wetness around foundations and in basements.

These soils are generally unsuited to use as sites for septic tank absorption fields because of the slope, the restricted permeability, and the seasonal wetness.

The suitability for ponds varies considerably in areas of this map unit. Careful onsite investigation is needed.

The land capability classification is VIe. The pasture and hayland suitability group is F-5 for the Markland soil and A-2 for the Glenford soil. The woodland ordination symbol is 4R for the Markland soil and 5R for the Glenford soil.

MdA—McGary silt loam, 0 to 3 percent slopes. This deep, nearly level, somewhat poorly drained soil is on terraces in the valleys of former glacial lakes. Most areas are round or irregular in shape and range from 5 to 320 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is yellowish brown and brown, mottled, firm silty clay loam and silty clay about 34 inches thick. The underlying material to a depth of 60 inches or more is brown, mottled, very firm silty clay loam. In many areas the surface layer is silty clay loam and is darker. In some places the subsoil is less clayey. A few areas along drainageways and near slope breaks have slopes of 3 to 8 percent.

Included with this soil in mapping are narrow strips of the very poorly drained Lorain soils in drainageways and depressions. Also included are areas of the moderately well drained Markland soils on dissected slopes. Included soils make up about 20 percent of most delineations.

Permeability is slow or very slow in the McGary soil. Runoff is slow. Available water capacity is moderate. The content of organic matter is moderate in the surface layer. A seasonal high water table is in the upper part of the subsoil in winter and spring and during other extended wet periods. Rooting depth is limited by the water table. The capacity to store and release plant nutrients is moderate. The shrink-swell potential is high. The potential for frost action is moderate.

Most areas are used for crops, but some areas that have not been drained are used for pasture. A few wooded areas support second-growth stands of water-tolerant hardwoods, such as pin oak, ash, and elm.

If drained, McGary soils are moderately suited to cultivated crops. Wetness is the main management concern. It commonly delays planting and harvesting and restricts the growth of roots. Surface drains are used in some areas to remove excess surface water. A complete system of closely spaced subsurface drains is effective in most areas, but water moves slowly into the drains. The roots of perennial crops form channels that increase the movement of water into subsurface drains. Surface crusting after heavy rains reduces the rate of water infiltration and retards the emergence of seedlings. Tilling or harvesting when the soil is too wet results in compaction of the surface layer. Using tillage methods that leave a rough or ridged surface that is partially covered by crop residue helps to control runoff, increases the rate of water infiltration, and hastens drying.

If drained, this soil is moderately suited to hay and pasture. Grasses and legumes that can tolerate wetness are the best suited. Areas that have not been drained are suited to bluegrass pasture but are too wet for most legumes. Deferred grazing during wet periods helps to prevent compaction of the surface layer and damage to plant roots.

This soil is only moderately suited to timber production. Seasonal wetness and the clayey subsoil affect the planting, growth, and harvesting of trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Using planting techniques that spread the roots of seedlings and that increase soil-root contact can reduce the seedling mortality rate. Removing vines and the less desirable trees and shrubs helps to control plant competition. Using logging techniques that do not leave the remaining trees widely spaced can reduce the hazard of windthrow.

This soil is poorly suited to buildings and septic tank absorption fields. The high shrink-swell potential and the seasonal wetness are limitations on sites for buildings. The soil is best suited to use as a site for houses without basements. Ditches and subsurface drains can improve drainage, but adequate outlets are not available in some areas. Grading the building sites helps to divert surface water away from foundations. Excavations for foundations and basements should be backfilled with granular material that has a low shrink-swell potential. Reinforcing foundation walls and footings helps to prevent the damage caused by shrinking and swelling. Installing drains at the base of footings and coating exterior basement walls help to prevent wet basements. Drains also can be installed under foundation slabs.

The seasonal wetness and the restricted permeability are limitations on sites for septic tank absorption fields. Perimeter drains are moderately effective in lowering the seasonal high water table. Enlarging the absorption field or installing the lines in more permeable fill helps to overcome the restricted permeability. Aeration systems require a smaller leach field, but perimeter drains can reduce the wetness.

There are few natural pond sites. Excavated ponds are likely to hold water.

This soil is recognized as farmland of local importance. The land capability classification is IIIw. The pasture and hayland suitability group is C-2. The woodland ordination symbol is 4W.

Me—Melvin silt loam, frequently flooded. This deep, nearly level, poorly drained soil is on flood plains. It is on bottom land along small streams and depressions or swales of old channels in the larger stream valleys. Slopes are 0 to 2 percent. Some areas are saturated most of the year because of ponding caused by beavers or by seepage. Flooding is brief and usually occurs during the dormant season, but flash floods may occur during the growing season following intense local thunderstorms. Most areas are narrow and winding and range from 3 to 40 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 3 inches thick. The underlying material to a depth of 60 inches or more is gray, very dark gray, and light brownish gray, friable silt loam and loam. In some areas the underlying material is shale or siltstone bedrock. In places the subsoil is loam and sandy loam. In a few areas a buried soil is below recent silty alluvium. Some areas are ponded.

Included with this soil in mapping are many areas of the somewhat poorly drained Newark soils and a few areas of Lindside and Nolin soils. Lindside and Nolin soils are on slightly elevated knobs and ridges. They are better drained than the Melvin soil. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 25 percent of most delineations.

Permeability is moderate in the Melvin soil. Runoff is very slow. Available water capacity is very high. A seasonal high water table is at or near the surface during winter and spring. The water table is within the root zone well into the growing season and limits the rooting depth. The content of organic matter is moderate in the surface layer. The capacity to store and release plant nutrients is moderate. The shrink-swell potential is low. The potential for frost action is high.

Most areas are used as pasture or as habitat for wetland wildlife. A few drained areas are used as cropland.

If drained, this soil is moderately suited to row crops. The wetness and the hazard of flooding are management concerns. They delay planting and limit the choice of crops. The flooding often damages winter grain crops. Keeping existing channels free of logs and debris reduces the hazard of flooding. If outlets are available, surface and subsurface drains are effective in removing ponded water and lowering the water table. In some areas, diversions are needed to intercept runoff from the uplands and terraces. Tilling only at the optimum moisture content helps to prevent cloddiness and compaction. Minimizing tillage, incorporating crop residue into the surface layer, and planting cover crops help to maintain tilth and protect the surface in areas that are subject to scouring by floodwater. Controlling weeds is difficult because weed seeds are carried in by floodwater.

This soil is only moderately suited to hay. Species that can tolerate wetness should be selected for planting. Such species commonly grow well, even during dry periods. Floodwater may damage hay plantings, especially in early spring.

This soil is suited to pasture grasses, such as bluegrass and reed canarygrass, but it is too wet for most legumes. Grasses grow well throughout the dry part of the summer. Grazing when the soil is wet and soft damages plant roots. This damage is difficult to prevent because the soil is wet much of the time. Rushes and cattails are common in ponded areas of pastures.

This soil is only moderately suited to timber production. The flooding and the wetness affect the planting, growth, and harvesting of trees. Native bottom-land hardwoods that can tolerate flooding and wetness grow well. Selecting water-tolerant species for planting reduces the seedling mortality rate. Planting and logging should take place during dry periods or when the soil is frozen. The hazard of windthrow can be reduced by using harvesting methods that do not leave the remaining trees isolated or widely spaced. Removing vines and the less desirable trees and shrubs helps to control plant competition.

This soil is unsuited to use as a site for buildings or for septic tank absorption fields because of the flooding and the seasonal wetness. Local roads can be elevated above the flood level, but the fill should not block the flow of water. Excavated ponds are likely to hold water during wet periods, but only those that are fed by strong springs maintain their water level during dry periods. Floodwater may damage fills.

The land capability classification is IIIw. The pasture and hayland suitability group is C-3. The woodland ordination symbol is 4W.

MkD—Mertz very cherty silt loam, 15 to 35 percent slopes. This deep, moderately steep and steep, well drained soil is on hillsides and bluffs along Flint Ridge. Slopes are convex and uniform. They commonly range from 100 to 200 feet in length. Stones are common on the surface. Most areas of this soil are sinuous and range from 10 to 50 acres in size.

Typically, the surface layer is black, friable very cherty silt loam about 3 inches thick. The subsurface layer is dark grayish brown, friable very cherty silt loam about 4 inches thick. The subsoil is about 53 inches thick. The upper part is yellowish brown and strong brown, friable very cherty silt loam and cherty and very cherty silty clay loam. The lower part is strong brown, firm channery silty clay loam. In some areas the surface layer and the upper part of the subsoil are channery rather than cherty. In many areas on the lower parts of slopes, the subsoil has fewer fragments of flint.

Included with this soil in mapping are small areas of Frankstown Variant, Westmoreland, Rigley, and Coshocton soils. Frankstown Variant soils are moderately deep over bedrock and have a stony surface layer. Westmoreland and Rigley soils are in areas that have sandstone bedrock. The moderately well drained Coshocton soils are along the lower edge of slopes. Included soils make up about 30 percent of most delineations.

Permeability is moderately slow in the Mertz soil. Runoff is very rapid. Available water capacity is moderate. In cultivated areas the content of organic matter is moderately low in the surface layer. The root zone is deep. The potential for frost action is moderate. The capacity to store and release plant nutrients is low.

Most areas are wooded. A few areas are used as pasture.

This soil is generally unsuited to cultivated crops and hay because of the slope, a very severe hazard of erosion, and stones on the surface that interfere with the use of equipment.

This soil is poorly suited to pasture because of the slope and the stones on the surface. A wide variety of forage plants can grow well, but seeding them is difficult. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion. Erosion can be severe in overgrazed pastures.

This soil is only moderately suited to timber production. The aspect of the slope and the coarse fragments affect the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The slope limits the use of planting and logging equipment. Establishing roads and skid trails on the contour, establishing water bars, and maintaining a vegetative cover help to control erosion. Where roads and trails cross channels, adding stones helps to prevent gullying. Using seedlings that have been transplanted once or adding mulch can reduce the seedling mortality rate on south-facing slopes.

This soil is poorly suited to use as a site for buildings because of the slope. Controlling runoff and erosion is a management concern on construction sites. Maintaining a vegetative cover on the surface helps to control runoff and reduces the hazard of erosion. Establishing access roads or trails on the contour also helps to control runoff and erosion. Designing buildings so that they conform to the natural contour of the land reduces the need for excavation and land shaping.

This soil is poorly suited to use as a site for septic tank absorption fields because of the slope and the restricted permeability. Installing leach lines on the contour helps to prevent the surfacing of effluent. Enlarging the field helps to overcome the restricted permeability.

The potential for developing ponds in areas of this soil is very limited.

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

MrB—Morristown shaly silty clay loam, 1 to 15 percent slopes. This deep, nearly level to strongly sloping, well drained soil is on ridgetops and benches of mine spoil in areas that have been surface-mined for coal. Most areas have been graded, but soil material has not been added. The underlying material is a mixture of rock fragments and partially weathered fine earth material that was in or below the profile of the original soil before mining. The rock fragments are mostly limestone and shale but include small amounts of siltstone, sandstone, and black, carbonaceous shale. Slopes are smooth. Small, shallow gullies are in some areas. Many stones are on the surface in some areas. Most areas are long and narrow or are circular. They range from 5 to 100 acres in size.

Typically, the surface layer is brown shaly silty clay loam about 5 inches thick. The underlying material to a depth of 60 inches or more is light olive brown, firm very channery silty clay loam that contains many stones and boulders. Ungraded highwalls of shale and limestone bedrock are on the margin of some areas.

Included with this soil in mapping are Bethesda soils. These soils are in small areas where black shale is mixed with the mine spoil. They are more acid than the Morristown soil. Also included are small ponded areas in depressions and hollows. Included areas make up about 20 percent of most delineations.

Permeability is moderately slow in the Morristown soil. Runoff is medium. Available water capacity is low. The content of organic matter is very low in the surface layer. The depth of the root zone varies because of differences in the density of the underlying material. The capacity to store and release plant nutrients is low.

The shrink-swell potential and the potential for frost action are moderate.

Areas of this soil are used as habitat for wildlife, especially white-tailed deer, beaver, and Canada geese. Most areas support trees or shrubs, mainly black locust, silver maple, black oak, yellow-poplar, and European alder. Some areas support grasses and legumes.

This soil is generally unsuited to cultivated crops and hay because of droughtiness and a restricted rooting depth.

This soil is poorly suited to pasture. Forage production is low during periods of low rainfall because of the limited available water capacity. The soil remains soft until late spring. Grazing when the soil is soft can cause root damage and excessive compaction. If the soil is cultivated, the hazard of erosion is moderate. Seeding cover crops or companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion. Companion crops, however, compete with forage plants for the limited supply of moisture. The content of nitrogen and phosphorus is generally low, and the content of potassium is medium. Water for livestock is not available in many areas.

This soil is only moderately suited to timber production. Coarse fragments affect the planting and growth of trees. Species that can tolerate droughty, alkaline conditions should be selected for planting. Maintaining a cover of grasses and legumes helps to control erosion until the trees become established, but these plants compete with seedlings for moisture. Using inoculated seedlings that have been transplanted once and adding mulch around the seedlings reduce the seedling mortality rate. The stones on the surface limit the use of planting and logging equipment.

This soil is poorly suited to use as a site for buildings or for septic tank absorption fields. Uneven settlement, the content of coarse fragments, and the restricted permeability are the main limitations. Buildings should not be constructed until the process of settling is complete. The length of time required for settling varies. Areas that are deeper over bedrock generally require longer periods of time to settle. Buried trees and woody debris are in a few areas that were formerly wooded. These areas should not be used as construction sites or for septic tank absorption fields because of the hazard of future subsidence as the wood decays. Using a very large or double field helps to overcome the restricted permeability on sites for septic tank absorption fields. The larger stones should be removed before backfilling the leach lines.

There is some potential for excavated ponds, but careful onsite investigation is needed to determine the nature of the underlying material.

The land capability classification is VIs. The pasture and hayland suitability group is E-3. No woodland ordination symbol is assigned.

MrD—Morristown shaly silty clay loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is in areas of mine spoil on hillsides that have been surface-mined for coal. The mine spoil has been graded and is 10 to 100 feet thick. Soil material has not been added. The underlying material is a mixture of rock fragments and partially weathered fine earth material that was in or below the profile of the original soil prior to mining. The rock fragments are mostly limestone and shale, but a few are siltstone, sandstone, and black, carbonaceous shale. Many stones are on the surface and in the surface layer. The microrelief is irregular, and deep gullies dissect some areas. Most areas are oblong and range from 5 to 80 acres in size.

Typically, the surface layer is brown shaly silty clay loam about 5 inches thick. The underlying material to a depth of more than 72 inches is light olive brown, firm very channery silty clay loam. The content of stones and boulders increases with increasing depth.

Included with this soil in mapping are Bethesda soils. These soils are in areas where black shale is mixed with mine spoil. They are more acid than the Morristown soil. Also included are ponded areas in depressions and hollows and areas of ungraded highwalls of shale and limestone bedrock. Included areas make up about 25 percent of most delineations.

Permeability is moderately slow in the Morristown soil. Runoff is very rapid. Available water capacity is low. The content of organic matter is very low in the surface layer. The depth of the root zone varies because of differences in the density of the underlying material. The capacity to store and release plant nutrients is low. The potential for frost action and the shrink-swell potential are moderate.

Areas of this soil are used as habitat for wildlife, including white-tailed deer, beaver, and Canada geese. Most areas support trees and shrubs, mainly black locust, silver maple, black oak, yellow-poplar, and European alder. Some areas support grasses and legumes.

This soil is generally unsuited to cultivated crops and hay because of droughtiness, the hazard of erosion, and the irregular slopes.

This soil is poorly suited to pasture. It is droughty and does not produce much forage during periods of low rainfall. The soil remains soft until late spring. Grazing when the soil is soft can damage plant roots and cause excessive compaction. If the soil is cultivated, the hazard of erosion is severe. Seeding cover crops or companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion. Companion crops, however, compete with forage plants for the limited moisture supply. The content of nitrogen and phosphorus is generally low, and the content of potassium is medium. Water for livestock is not available in many areas.

This soil is moderately suited to timber production. The aspect of the slope and the coarse fragments affect the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. Species that can tolerate the droughty, alkaline conditions should be selected for planting. Maintaining a cover of grasses and legumes helps to control erosion until the trees become established, but these plants compete with the seedlings for moisture. Using inoculated seedlings that have been transplanted once and mulching around the seedlings can reduce the seedling mortality rate on south-facing slopes. The slope and the stones on the surface limit the use of planting and logging equipment. Establishing roads and skid trails on the contour helps to control erosion. Establishing water bars and maintaining a vegetative cover also help to control erosion.

This soil is poorly suited to use as a site for buildings and is generally unsuited to use as a site for septic tank absorption fields because of the slope, the restricted permeability, the susceptibility to hillside slippage, and uneven settlement. Buildings should not be constructed until the process of settling is complete. The length of time required for settling varies. Areas that are deeper over bedrock usually require longer periods of time for settlement. Buried trees and woody debris are in a few areas that were formerly wooded. These areas should not be used as construction sites or for septic tank absorption fields because of the hazard of future subsidence as the wood decays. Making cuts on building sites may result in slippage.

The potential for pond sites in areas of this soil is extremely variable. Careful onsite investigation is needed to determine the nature of the underlying material.

The land capability classification is VIs. The pasture and hayland suitability group is E-3. No woodland ordination symbol is assigned.

MrF—Morristown shaly silty clay loam, 25 to 70 percent slopes. This deep, steep and very steep, well drained soil is on ungraded mine spoil ridges and trenches in areas that have been surface-mined for coal or limestone. The underlying material is a mixture of rock fragments and partially weathered fine earth material that was in or below the profile of the original soil. Rock fragments are mostly limestone and shale, but some are siltstone, sandstone, and black, carbonaceous shale. A highwall of exposed bedrock and a deep, water-filled trench are along the upper edge of many areas. Large gullies are in some areas. There are many stones on the surface. Most areas of this soil are long and narrow and range from 10 to 100 acres in size.

Typically, the surface layer is yellowish brown, friable shaly silty clay loam about 5 inches thick. The underlying material to a depth of 60 inches or more is dark gray and gray, firm channery and very channery silty clay loam and clay loam. Some areas between trenches are less sloping.

Included with this soil in mapping are small areas of Bethesda soils. These soils are acid throughout. Also included are small, shallow ponds. Included areas make up about 15 percent of most delineations.

Permeability is moderately slow in the Morristown soil. Runoff is very rapid. Available water capacity is low because of the high content of coarse fragments. The content of organic matter is very low in the surface layer. The root zone is shallow or moderately deep, depending on the density of the underlying material. The capacity to store and release plant nutrients is low. The shrink-swell potential and the potential for frost action are moderate.

Most areas support trees that were planted after mining activities ended.

This soil is generally unsuited to cultivated crops, hay, and pasture because of the slope, a very severe hazard of erosion, and droughtiness. Maintaining a permanent plant cover is the best means of controlling erosion.

This soil is moderately suited to timber production. The aspect of the slope and the coarse fragments affect the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. Species that can tolerate droughty, alkaline conditions should be selected for planting. Maintaining a cover of grasses and legumes helps to control erosion until the trees become established. Using inoculated seedlings that have been transplanted once and mulching around the seedlings reduce the seedling mortality rate on south-facing slopes. The slope and the stones on the surface limit the use of planting and logging equipment. Establishing roads and skid trails on the contour helps to control erosion. Establishing water bars and maintaining a vegetative cover also help to control erosion.

This soil is unsuited to use as a site for buildings or for septic tank absorption fields because of uneven settlement, the slope, the restricted permeability, and the susceptibility to hillside slippage. Cutting and filling on building sites increase the hazard of hillside slippage. Nearby areas of unmined soils are better sites for buildings. If the soil is used as a site for septic tank absorption fields, excessive downslope seepage of effluent is likely.

The slope limits the use of equipment needed to build ponds. Some ponds were created by mining activities in areas of this soil.

The land capability classification is VIIe. The pasture and hayland suitability group is H-1. No woodland ordination symbol is assigned.

MsB—Morristown silty clay loam, 1 to 8 percent slopes. This deep, nearly level and gently sloping, well drained soil is on ridgetops and benches of graded mine spoil in reclaimed areas that were surface-mined for coal or limestone. The surface in these areas has been graded to the original contour and blanketed with a layer of material derived from natural soils. The underlying material is a mixture of rock fragments and partially weathered fine earth material that was in or below the underlying material of the original soil. Rock fragments are mostly subrounded limestone and shale, but some are siltstone, sandstone, and coal. The wider areas of this soil are nearly level. Slopes are long and smooth. Most areas are oblong and range from 3 to 50 acres in size.

Typically, the surface layer is dark brown, firm silty clay loam about 8 inches thick. The underlying material to a depth of 60 inches or more is light gray, very firm channery or very channery silty clay loam and very channery silt loam. The content of coarse fragments of limestone, shale, siltstone, sandstone, and coal in the underlying material ranges from 15 to 70 percent. In some areas reaction is acid. Eroded areas where numerous rills and small gullies have formed are common. In places the surface layer is friable silt loam and is easier to till.

Included with this soil in mapping are poorly drained areas that support wetland vegetation and a few areas that have not been reclaimed after mining and that have a surface layer of channery clay loam or shaly silty clay loam. Also included are areas where the surface has been covered with 12 to 24 inches of loamy soil material. These areas have a higher available water capacity than the Morristown soil and are more productive. Included areas make up about 20 percent of most delineations.

Permeability is moderately slow in the Morristown soil. Runoff is medium or rapid. Available water capacity is low because the content of coarse fragments is high and the underlying material is compact. The content of organic matter is low in the surface layer. The root zone is moderately deep. It is limited by stones and dense layers in the underlying material. The capacity to store and release plant nutrients is moderate or low. The potential for frost action and the shrink-swell potential are moderate.

Most areas support grasses and legumes, but only a small acreage is grazed or harvested for hay.

This soil is moderately suited to cultivated crops. Droughtiness, erosion, tilth, and the content of organic matter are management concerns. The hazard of erosion is moderate in cultivated areas. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, stripcropping on the contour, and planting cover crops reduce the hazard of erosion. Using a conservation tillage system also improves tilth, increases the content of organic matter in the surface layer, and conserves moisture. The soil dries and warms up slowly in the spring because water moves slowly through the dense underlying material. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Reclamation activities that were conducted under wet conditions have compacted the surface layer in many areas. Surface and subsurface drains are moderately effective in reducing wetness in scattered low or seepy areas.

This soil is only moderately suited to hay and pasture. Species that can tolerate droughtiness are the best suited. The soil is droughty because of the thin surface layer and the compact, channery underlying material. The soil remains soft until late spring. Grazing when the soil is soft can damage plant roots and cause compaction. Forage production is low during dry periods. If the soil is cultivated, the hazard of erosion is moderate. Seeding cover crops or companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion. Companion crops, however, compete with forage plants for the limited supply of moisture.

This soil is only moderately suited to timber production. The coarse fragments affect the planting and growth of trees. Species that can tolerate droughty, alkaline conditions should be selected for planting. Maintaining a cover of grasses and legumes helps to control erosion until the trees become established. Using inoculated seedlings that have been transplanted once and mulching around the seedlings reduce the seedling mortality rate.

This soil is only moderately suited to use as a site for buildings and is generally unsuited to use as a site for septic tank absorption fields. Uneven settlement is likely for several years after reclamation. Construction should be delayed until the settling process is complete. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion on construction sites. The shrink-swell potential is a limitation on sites for dwellings. Backfilling around foundations with granular material that has a low shrink-swell potential and supporting the walls with a large spread footing help to overcome this limitation. The restricted permeability and uneven settlement are severe limitations on sites for septic tank absorption fields.

There are few natural pond sites, and the watershed area is limited for excavated ponds. The ability of the underlying mine spoil to hold water varies considerably from place to place. Onsite investigation is needed.

The land capability classification is IIIs. The pasture and hayland suitability group is B-4. No woodland ordination symbol is assigned.

MsC—Morristown silty clay loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on graded mine spoil on ridgetops and benches in reclaimed areas that were surface-mined for coal. The surface in these areas has been graded to the original contour and blanketed with a layer of material derived from natural soils. The underlying material is a mixture of rock fragments and partially weathered fine earth material that was in or below the profile of the original soil. The rock fragments are mostly limestone and shale, but some are siltstone, sandstone, and coal. A few stones are on the surface. Most drainageways have been lined with limestone rocks, but small gullies and rills are in some areas. Most areas are elongated and range from 20 to 150 acres in size.

Typically, the surface layer is yellowish brown, friable silty clay loam about 8 inches thick. The underlying material to a depth of 60 inches or more is dark grayish brown and very dark gray, firm very channery clay loam and extremely channery silty clay loam. Reaction is acid in places. Some areas are eroded and have rills and gullies.

Included with this soil in mapping are small areas of Bethesda soils. These soils are extremely acid. Also included are small areas that have not been reclaimed after mining and that have a channery or shaly surface layer. Included areas make up about 15 percent of most delineations.

Permeability is moderately slow in the Morristown soil. Runoff is rapid. Available water capacity is low because of the high content of coarse fragments in the underlying material. The content of organic matter is low in the surface layer, and tilth is fair. The depth of the root zone varies. It is limited by dense layers in the underlying material. The potential for frost action and the shrink-swell potential are moderate.

Most areas are used for grasses and legumes for hay and pasture. Some areas are used for small grain.

This soil is poorly suited to cultivated crops. Droughtiness, erosion, tilth, and the content of organic matter are management concerns. The hazard of erosion is severe in cultivated areas. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface helps to control erosion and conserves moisture. Including grasses and legumes in the cropping system, stripcropping on the contour, and planting cover crops also help to control erosion. The slow movement of water through the dense underlying material slows the drying and warming of the soil in spring. Limiting field operations when the soil is too wet can minimize compaction of the surface. Compaction is a problem in many areas where reclamation operations were performed under wet conditions.

This soil is only moderately suited to hay and pasture. Forage plants that can tolerate droughtiness are the best suited. Forage production is low during periods of low rainfall because of the limited available water capacity. The soil remains soft until late spring. Grazing when the surface is soft can damage plant roots and cause excessive compaction. If the soil is cultivated, the hazard of erosion is moderate. Seeding cover crops or companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion. Companion crops, however, compete with forage plants for the limited moisture supply.

This soil is only moderately suited to timber production. The coarse fragments affect the planting and growth of trees. Species that can tolerate droughty, alkaline conditions should be selected for planting. Maintaining a cover of grasses and legumes helps to control erosion until the trees become established. Using inoculated seedlings that have been transplanted once and mulching around the seedlings reduce the seedling mortality rate.

Uneven settlement is likely for several years after reclamation. After it has settled, the soil is moderately suited to use as a site for buildings. The thickness of the soil over bedrock and the hazard of erosion are important considerations. Removing as little vegetation as possible, adding mulch, and establishing a temporary plant cover help to minimize erosion on construction sites. Land shaping is needed in some areas. The shrink-swell potential is a limitation on sites for dwellings. Backfilling around foundations with material that has a low shrink-swell potential and supporting the walls with a large spread footing help to prevent the damage caused by shrinking and swelling.

This soil is generally unsuited to use as a site for septic tank absorption fields. Restricted permeability and unstable fill are severe limitations.

The potential for pond sites is extremely variable because of the mixed nature of the underlying material. Careful onsite investigation is needed. Fills constructed prior to the completion of the settling process are likely to crack.

The land capability classification is IVs. The pasture and hayland suitability group is B-4. No woodland ordination symbol is assigned.

MsD—Morristown silty clay loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is on hillsides of graded mine spoil in reclaimed areas that were surface-mined for coal or limestone. The surface in these areas has been graded to the original contour and blanketed with a layer of material derived from natural soils. The underlying material is a mixture of rock fragments and partially weathered fine earth material that was in or below the profile of the original soil. The rock fragments are mainly subrounded limestone and shale, but some are siltstone, sandstone, and coal. Slopes are dominantly long, smooth, and convex. A few gullies and rills have formed in areas where water flow is concentrated on the lower slopes. Most areas are oblong and range from 10 to 50 acres in size.

Typically, the surface layer is dark brown and dark yellowish brown, firm silty clay loam about 3 inches thick. The underlying material to a depth of 60 inches or more is mixed light yellowish brown and gray, firm channery or very channery loam and silty clay loam. The content of limestone, shale, siltstone, sandstone, and coal ranges from 15 to 70 percent in the underlying material.

Included with this soil in mapping are areas of the extremely acid Bethesda soils, areas that have a surface layer of channery silty clay loam, eroded areas where numerous gullies have formed or land slips have occurred, and areas that have a surface layer of silt loam. Also included are some areas where the surface has been covered with 12 to 24 inches of natural soil material. These areas have a higher available water capacity than the Morristown soil and are more productive. Included areas make up about 20 percent of most delineations.

Permeability is moderately slow in the Morristown soil. Runoff is very rapid. Available water capacity is low because the content of coarse fragments is high and the underlying material is compact. The root zone is generally moderately deep, but the depth is variable. Roots are restricted by compact layers in the underlying material. The potential for frost action and the shrink-swell potential are moderate.

Most areas support grasses and legumes, but only a small acreage is grazed or harvested for hay.

This soil is poorly suited to cultivated crops. Droughtiness, a very severe hazard of erosion, tilth, and the content of organic matter are management concerns. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface conserves moisture and helps to control erosion. Including grasses and legumes in the cropping system, stripcropping on the contour, and planting cover crops also reduce the hazard of erosion. The soil dries and warms up slowly in the spring because of the slow movement of water through the dense underlying material. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Reclamation activities conducted under wet conditions have compacted the surface layer in many areas.

This soil is only moderately suited to hay and pasture. Forage plants that can tolerate droughtiness are the best suited. Commonly, forage production is low during periods of low rainfall because of the limited available water capacity. The soil remains soft until late spring. Grazing when the soil is soft can damage plant roots and cause excessive compaction. If the soil is cultivated, the hazard of erosion is moderate. Seeding cover crops or companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion. Erosion can be severe in pastures if bare spots develop as a result of overgrazing.

This soil is only moderately suited to timber production. The aspect of the slope and the coarse fragments affect the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. Species that can tolerate droughty, alkaline conditions should be selected for planting. Maintaining a cover of grasses and legumes helps to control erosion until the trees become established. Using inoculated seedlings that have been transplanted once and mulching around the seedlings reduce the seedling mortality rate on south-facing slopes. The slope limits the use of planting and logging equipment. Establishing roads and skid trails on the contour helps to control erosion. Establishing water bars and maintaining a vegetative cover also help to control erosion.

This soil is poorly suited to use as a site for buildings. The slope and uneven settlement are management concerns. Construction should be delayed until the settling process is complete. Making cuts to develop a building site on the moderately steep slopes can result in slippage. Some building designs require less cutting and filling. The soil is unsuited to use as a site for septic tank absorption fields because of the restricted permeability. Unstable fill and the slope are also severe limitations.

The suitability of this soil for ponds varies considerably because of the mixed nature of the underlying material. Careful onsite investigation is needed.

The land capability classification is IVs. The pasture and hayland suitability group is B-4. No woodland ordination symbol is assigned.

MsE—Morristown silty clay loam, 25 to 50 percent slopes. This deep, steep and very steep, well drained soil is on hillsides of graded mine spoil in reclaimed areas that were surface-mined for coal. The surface in these areas has been graded and blanketed with a layer of material derived from natural soils. Reclamation has covered the highwall. The underlying material is a mixture of rock fragments and partially weathered fine earth material that was in the profile of the original soil. The rock fragments are mostly subrounded siltstone, limestone, and shale, but some are sandstone and coal. Slopes are long and smooth. Most areas are fan shaped and range from 3 to 50 acres in size.

Typically, the surface layer is mixed brown, dark brown, yellowish brown, and dark yellowish brown, firm silty clay loam about 6 inches thick. The underlying material to a depth of 60 inches or more is mixed yellowish brown and dark gray, firm channery and very channery silty clay loam. The content of limestone, shale, siltstone, sandstone, and carbonaceous shale fragments in the underlying material ranges from 25 to 70 percent.

Included with this soil in mapping are small areas of the acid Bethesda soils. Also included are small areas that have a surface layer of channery or shaly silty clay loam and eroded areas that have numerous rills, small gullies, or landslides. Included areas make up about 20 percent of most delineations.

Permeability is moderately slow in the Morristown soil. Runoff is very rapid. Available water capacity is low because the content of coarse fragments is high and the underlying material is very compact in places. The surface layer is sticky when wet and has a low content of organic matter. The root zone is generally moderately deep, but the depth is variable. It is limited by dense zones in the underlying material. The shrink-swell potential and the potential for frost action are moderate.

Most areas support grasses and legumes, but only a small acreage is grazed.

This soil is unsuited to cultivated crops because of the slope and a very severe hazard of erosion. The slope restricts the use of most farm equipment. Maintaining a permanent plant cover is the best means of controlling erosion.

This soil is poorly suited to hay and pasture. Forage plants that can tolerate droughtiness are the best suited. Forage production is low during dry periods. The slope limits the use of equipment. The soil remains soft until late spring. Grazing when the soil is soft can damage plant roots and cause excessive compaction. If the soil is cultivated, the hazard of erosion is very severe. Seeding cover crops or companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

This soil is only moderately suited to timber production. The aspect of the slope and the coarse fragments affect the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. Species that can tolerate droughty, alkaline conditions should be selected for planting. Maintaining a cover of grasses and legumes helps to control erosion until the trees become established. Using inoculated seedlings that have been transplanted once and mulching around the seedlings reduce the seedling mortality rate, especially on south-facing slopes. The slope limits the use of planting and logging equipment. Establishing roads and skid trails on the contour helps to control erosion. Establishing water bars and maintaining a vegetative cover also help to control erosion.

This soil is generally unsuited to use as a site for buildings because of uneven settlement, the slope, and the hazard of landslides. It is generally unsuited to use as a site for septic tank absorption fields because of the slope, unstable fill, and the restricted permeability.

There is little potential for developing ponds in areas of this soil. Any excavation can result in slippage and damage to the fill.

The land capability classification is VIe. The pasture and hayland suitability group is E-2. No woodland ordination symbol is assigned.

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 along the smaller streams or is in long, narrow areas adjacent to sloping uplands or terraces on the wider flood plains. Some areas are dissected by old stream channels and small drainage ditches. Flooding is brief and usually occurs during the dormant season, but flash floods may occur during the growing season following intense local thunderstorms. Most areas range from 5 to 50 acres in size. Slopes range from 0 to 3 percent.

Typically, the surface layer is dark grayish brown, very friable silt loam about 11 inches thick. The subsoil is brown and grayish brown, mottled, very friable silt loam about 21 inches thick. The underlying material to a depth of 60 inches or more is dark yellowish brown and light brownish gray, friable silt loam. In some areas the surface layer is loam or silty clay loam. In many places the content of clay is lower. Some areas on low terraces are subject to rare flooding.

Included with this soil in mapping are small areas of Nolin, Chagrin, Lindside, Lobdell, and Melvin soils. The well drained Nolin and Chagrin soils and the moderately well drained Lindside and Lobdell soils are on natural levees near stream channels and on other slightly elevated parts of flood plains. The poorly drained Melvin soils are in the lower areas that are frequently flooded. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 20 percent of most delineations.

Permeability is moderate in the Newark soil. Runoff is slow. Available water capacity is high. The content of organic matter is moderate. The root zone is deep, but it is limited by a seasonal high water table in the upper part of the subsoil in winter and spring and during other extended wet periods. The capacity to store and release plant nutrients is moderate. The potential for frost action is high.

Some areas in the wider valleys are used as cropland. Most areas in the narrower valleys are used as pasture or woodland. The suitability of this soil for a particular use depends on the extent of drainage and the frequency of flooding during the growing season. Areas that are not drained are suited to use as habitat for wetland wildlife.

If drained and protected from flooding, this soil is well suited to cultivated crops. Wetness and the hazard of flooding are management concerns. Planting is delayed in some years. Winter grains are most likely to be damaged by flooding. Surface and subsurface drains can remove surface water after flooding and can lower the seasonal high water table, but some areas on narrow flood plains do not have suitable outlets. In some places, diversions can be used to intercept runoff from the adjacent higher areas. The hazard of flooding can be reduced by keeping channels free of logs and debris. Using tillage methods that leave the surface rough or ridged and partially covered by crop residue helps to control runoff, increases the rate of water infiltration, and hastens drying. In adequately drained areas, the soil is suited to no-till planting. Controlling weeds is difficult because weed seeds are carried in by floodwater.

If drained, this soil is well suited to hay. Drained areas are suited to most of the commonly grown species. Only species that can tolerate wetness should be seeded in undrained areas. Areas that have been recently seeded to hay can be damaged by floodwater, especially where a finely tilled seedbed has been prepared. In such areas, plants seeded in midsummer are less likely to be damaged than those seeded in early spring.

This soil is only moderately suited to pasture. Areas that have not been drained are suited to bluegrass pasture. Forage production can be improved by seeding grass-legume mixtures that can tolerate wetness. Deferred grazing during wet seasons can prevent compaction of the surface layer and damage to plant roots. The brief periods of flooding during the growing season reduce the quality of forage.

This soil is well suited to timber production. The flooding and the wetness affect the planting, growth, and harvesting of trees. Native bottom-land hardwoods that tolerate flooding and wetness grow well. Selecting water-tolerant species for planting reduces the seedling mortality rate. Because the flooding is usually brief, most management activities can be performed during periods when the soil is not flooded. Planting and logging should take place during dry periods or when the soil is frozen. The hazard of windthrow can be reduced by using harvesting methods that do not leave the remaining trees isolated or widely spaced. Removing vines and the less desirable trees and shrubs helps to control plant competition.

This soil is generally unsuited to building site development or septic tank absorption fields because of the flooding. The seasonal wetness also is a limitation. Roads can be constructed on fill above the level of flooding, but the fill should not block the flow of floodwater. Culverts under local roads and streets should have the capacity to carry the peak flow during flash floods.

Areas in narrow valleys can be used as sites for dams to create artificial lakes or ponds. The soil is not stable enough to support large earthen fills. Deep core trenches commonly are needed. Dams and spillways should be designed to handle the flow from the entire upstream watershed. Generally, a simple earthen dam cannot handle the flow. Ponds excavated away from the stream channel are unlikely to hold water and are subject to flood damage.

Areas of this soil that have not been drained are recognized as farmland of local importance. The land capability classification is IIw. The pasture and hayland suitability group is C-3. The woodland ordination symbol is 5W.

No—Nolin silt loam, occasionally flooded. This deep, nearly level, well drained soil is on flood plains along the major streams. Most areas are cut by meandering channels. The soil receives stream overflow mainly during the dormant season or after periods of prolonged heavy rainfall. Slopes range from 0 to 2 percent. Most areas are crescent shaped and range from 10 to 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The underlying material to a depth of 60 inches or more is brown and dark yellowish brown, friable silt loam. Some areas that have an increased rate of runoff because of strip mining or other changes are frequently flooded. In elevated areas the soil has layers of loam and fine sandy loam and is subject to rare flooding.

Included with this soil in mapping are areas of Newark, Melvin, and Lobdell soils. The somewhat poorly drained Newark soils are in slight depressions or in areas where tributary streams enter the flood plain. The poorly drained Melvin soils are in old channel meanders. Lobdell soils are on small alluvial fans that are subject to rare flooding. Also included are areas in the flood pool of the Dillon Lake dam that are subject to controlled flooding. Included areas make up about 20 percent of most delineations.

Permeability is moderate in the Nolin soil. Runoff is slow. Available water capacity is very high. The content of organic matter in the surface layer is moderate. The root zone is deep. The capacity to store and release plant nutrients is moderate. A seasonal high water table is at a depth of 3 to 6 feet during extended wet periods. The potential for frost action is high.

Most of the broader areas are used as cropland. The narrower valleys are used as pasture or woodland.

This soil is well suited to corn and soybeans. Winter grain crops are more likely to be damaged by flooding than other crops. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Shallow cultivation of intertilled crops, however, breaks up the crust. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface conserves moisture and increases the rate of water infiltration. Banded or split applications of fertilizer minimize the loss of nutrients, especially nitrogen, and help to prevent the pollution of ground water. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. In a few areas, land grading allows surface water to drain faster. Keeping stream channels free of obstructions, such as logjams, reduces the hazard of flooding. Small levees have been constructed in some areas to help prevent flooding. Streambank erosion is a major source of sediments that pollute the water. Streambanks can be stabilized by shaping, by planting shrubs, and by placing stone riprap in some places. Controlling weeds is a concern because weed seeds are carried in by floodwater. Winter cover crops protect the soil from scouring. In some areas, grass-lined floodwater channels are needed to handle peak flow and minimize scouring. Diversions at the base of slope breaks to the uplands or terraces minimize the damage caused by flash flooding.

This soil is well suited to hay. A wide variety of species can be planted. In finely tilled seedbeds, surface crusting may delay the emergence of seedlings. Plants seeded in midsummer are less likely to be damaged by flooding than those seeded in early spring. Planting a companion crop of small grain minimizes the damage to young seedlings caused by flooding. Including legumes in the seeding mixture provides nitrogen for subsequent row crops.

This soil is well suited to pasture. A wide variety of forage plants can thrive on this soil. The brief periods of flooding during the growing season reduce the quality of forage.

This soil is well suited to timber production. The flooding affects the planting, growth, and harvesting of trees. Native bottom-land hardwoods that can tolerate flooding grow well. Because the flooding is usually brief, most management activities can be performed during periods when the soil is not flooded. Removing vines and the less desirable trees and shrubs helps to control plant competition.

This soil is generally not suited to use as a site for buildings because of the flooding. Some structures and local roads can be elevated above flood levels, but extensive filling can partially block the natural floodway and increase the level of flooding upstream.

This soil is generally unsuited to septic tank absorption fields because of the flooding. The surfacing of effluent during periods of flooding is likely to cause pollution of streams. Excavated ponds are unlikely to hold water and are subject to flood damage.

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

OmB—Omulga silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is on terraces of valley fill. Slopes are typically smooth and convex. Most areas range from 3 to 25 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 50 inches thick. The upper part is yellowish brown, firm silt loam. It is mottled at a depth of more than 21 inches. The next part is a fragipan of yellowish brown, very firm and brittle silt loam. The lower part of the subsoil is yellowish brown, firm silty clay loam. The underlying material to a depth of 66 inches or more is brown, mottled, firm silty clay. In some areas the content of coarse fragments in the subsoil is higher.

Included with this soil in mapping are areas of Fitchville and Glenford soils. These soils receive runoff and seepage water from adjacent higher soils. The somewhat poorly drained Fitchville soils commonly occur as narrow bands adjacent to the uplands. Glenford soils do not have a fragipan. Included soils make up about 20 percent of most delineations.

Permeability is moderate in the upper part of the subsoil in the Omulga soil. It is slow in the fragipan and moderately slow below the fragipan. Runoff is medium in cultivated areas. The root zone is only moderately deep because of the fragipan. Available water capacity in the root zone is low. A high water table is perched above the fragipan during wet periods. The content of organic matter is moderately low in the surface layer. The shrink-swell potential is moderate. The potential for frost action is high.

Most areas were farmed in the past. Some areas are still farmed, but many areas are now dominated by native trees, brush, and grasses. A few areas are used as building sites. Only a small acreage is wooded.

This soil is well suited to cultivated crops. The hazard of erosion is moderate in cultivated areas. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, and establishing grassed waterways can reduce the hazard of erosion. The soil dries and warms up slowly in the spring because the fragipan in the subsoil holds water in the upper part of the profile. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Subsurface drains can reduce the wetness in scattered low areas.

This soil is well suited to hay and pasture. The roots of some species are restricted by the fragipan. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover of vegetation on the surface in the fall or seeding a grass-legume mixture can minimize the damage caused by frost heave. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion.

This soil is well suited to timber production. The fragipan restricts the roots of some trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Using logging techniques that do not leave the remaining trees widely spaced can reduce the hazard of windthrow. Removing vines and the less desirable trees and shrubs helps to control plant competition.

This soil is only moderately suited to use as a site for buildings. The seasonal wetness and the shrink-swell potential are limitations. Installing drains around footings and coating exterior walls help to keep basements dry. Reinforcing foundation walls and footings helps to prevent the damage caused by shrinking and swelling.

This soil is poorly suited to septic tank absorption fields. The restricted permeability in the fragipan and the seasonal wetness are limitations. Perimeter drains can reduce the wetness by lowering the seasonal high water table. Enlarging the absorption area or installing a double absorption field system helps to prevent the surfacing of effluent.

The material in the upper part of the soil does not pack well and is poorly suited to use as fill for earthen dams. Areas of this soil have potential for use as sites for excavated ponds, but careful onsite investigation is needed to determine the nature of the underlying material.

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

OmC—Omulga silt loam, 6 to 15 percent slopes. This deep, strongly sloping, moderately well drained soil is on dissected terraces of valley fill at the base of the steeper hillsides. Slopes commonly range from 150 to 300 feet in length. Most areas are long and narrow and range from 5 to 10 acres in size.

Typically, the surface layer is dark gray and brown, friable silt loam about 7 inches thick. The subsoil is about 59 inches thick. The upper part, to a depth of about 30 inches, is yellowish brown, friable silt loam or silty clay loam. The lower part, to a depth of about 66 inches, is a fragipan of yellowish brown, mottled, very firm, brittle silty clay loam. The underlying material to a depth of 80 inches or more is yellowish brown, firm silty clay loam and silty clay. In some areas the subsoil has a higher content of coarse fragments. In places the underlying material is sandy loam. In some areas, the subsoil does not have a fragipan and permeability is less restricted.

Included with this soil in mapping are areas of the well drained Alford and Wellston soils. These soils do not have a fragipan. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 20 percent of most delineations.

Permeability is moderate in the upper part of the subsoil in the Omulga soil. It is slow in the fragipan and moderately slow in the underlying material. Runoff is rapid. The rooting depth is generally restricted to the zone above the fragipan. Available water capacity is low in the root zone. The content of organic matter is low in the surface layer. The potential for frost action is high. The shrink-swell potential is moderate in the subsoil. The capacity to store and release plant nutrients is moderate. A seasonal high water table is perched above the fragipan in the winter and spring and during other extended wet periods. Hillside seepage is common in areas of this soil, especially on the lower parts of slopes.

Most areas are used for pasture or hay. A few areas are used for corn.

This soil is only moderately suited to cultivated crops. Erosion is the main management concern. The hazard of erosion is severe in cultivated areas. Improving soil fertility and conserving moisture also are management concerns. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, and establishing grassed waterways can reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Using subsurface drains in seepy areas increases crop production in most years.

This soil is well suited to hay and pasture. The roots of some species are restricted by the fragipan. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover of vegetation on the surface in the fall and including grasses in the seeding mixture can minimize the damage caused by frost heave. If the soil is plowed, the hazard of erosion is severe. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion.

This soil is well suited to timber production. The fragipan restricts the roots of some trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Using logging techniques that do not leave the remaining trees widely spaced can reduce the hazard of windthrow. Removing vines and the less desirable trees and shrubs helps to control plant competition.

This soil is only moderately suited to use as a site for buildings because of the slope, the wetness, and the shrink-swell potential. Increased runoff and erosion are management concerns on construction sites. Maintaining a vegetative cover and reseeding areas where vegetation has been removed help to control runoff and reduce the hazard of erosion. Reinforcing foundation walls and footings helps to prevent the damage caused by shrinking and swelling. Installing drains around footings and coating subgrade walls help to prevent wet basements. Backfilling the drains with gravel helps to intercept water seeping along the top of the fragipan. Surface water from adjacent slopes should be diverted away from the building site.

This soil is poorly suited to use as a site for septic tank absorption fields because of the restricted permeability in the fragipan and the seasonal wetness. Perimeter drains can reduce the seasonal wetness by lowering the water table. Enlarging the absorption area or installing a double absorption field system helps to prevent the surfacing of effluent. Installing the leach lines on the contour reduces the need for deep excavations and results in a more uniform distribution of effluent.

The material in the upper part of the soil does not pack well and is poor fill for dams. There is some potential for developing ponds in draws that cross areas of this soil, but careful onsite investigation is needed. In most cases, fill should be brought in from another area.

This soil is recognized as farmland of local importance. The land capability classification is IIIe. The pasture and hayland suitability group is F-3. The woodland ordination symbol is 4D.

RaB—Rawson silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is on terraces in the valleys of former glacial lakes. It is on the margin of terraces in areas where runoff from the adjoining uplands forms small alluvial fans. Individual areas are round or long and narrow and range from 5 to 30 acres in size.

Typically, the surface layer is brown, friable silt loam about 10 inches thick. The subsoil is about 33 inches thick. The upper 7 inches is yellowish brown, firm silt loam. The next part is brown, mottled, very firm loam and friable sandy loam. The lower part is brown, mottled, firm silty clay. The underlying material to a depth of 65 inches or more is brown, mottled, very firm silty clay. In many areas the surface layer is loam or gravelly loam. In some places the depth to the underlying material is greater. In some small areas, slopes are 8 to 12 percent and the soil is more gravelly and is better drained. In areas where intermittent streams from adjacent uplands emerge onto the terrace and overflow, the soil is subject to rare flooding.

Included with this soil in mapping are areas of Jimtown, Fitchville, Markland, Omulga, and Chili soils. The somewhat poorly drained Jimtown and Fitchville soils are in depressions. The well drained Chili soils are on the edges of the terraces. Markland and Omulga soils have less sand in the upper part of the subsoil than the Rawson soil. They are intermingled with the Rawson soil in some areas. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 25 percent of most delineations.

Permeability is moderate in the upper part of the subsoil of the Rawson soil. It is slow or very slow in the lower part of the subsoil and in the underlying material. Runoff is medium. Available water capacity is moderate. The content of organic matter is moderate in the surface layer. The capacity to store and release plant nutrients also is moderate. A seasonal high water table is perched in the lower part of the subsoil during extended wet periods. The shrink-swell potential is moderate in the lower part of the subsoil and in the underlying material.

Most areas are used as cropland. Corn, wheat, and hay are commonly grown. Some areas are used as pasture.

This soil is well suited to cultivated crops, including specialty crops. Erosion, fertility, and the content of organic matter are the main management concerns. The hazard of erosion is moderate in cultivated areas. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, and tilling on the contour can reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Subsurface drains can reduce the wetness in scattered areas. Grassed waterways can be used to remove surface water in some areas.

This soil is well suited to hay and pasture. It is suited to a wide variety of forage plants. Some areas are too wet for alfalfa unless they are drained. Restricting grazing when the soil is wet helps to prevent compaction of the surface layer and damage to roots.

This soil is well suited to timber production. No major limitations affect the planting or growth of trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface.

This soil is only moderately suited to use as a site for buildings. Because of the seasonal wetness, it is better suited to use as a site for houses without basements than to those with basements. Installing drains at the base of footings and coating exterior walls help to prevent wet basements. Reinforcing foundation walls and footings helps to prevent the damage caused by shrinking and swelling of the clayey underlying material.

This soil is only moderately suited to septic tank absorption fields. The wetness and the restricted permeability in the underlying material restrict the movement of effluent from the leach lines. Perimeter drains can reduce the wetness by lowering the water table. Enlarging the absorption area or installing a double absorption field system helps to overcome the restricted permeability.

This soil has some potential for use as a site for excavated ponds. The underlying material can hold water. The suitability of the material in the upper part of the soil varies. Onsite investigation is needed.

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

RfC—Rigley loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on knolls or shoulder slopes on ridgetops. Individual areas generally are long and narrow and range mainly from 3 to 80 acres in size.

Typically, the surface layer is dark brown, friable loam about 10 inches thick. The subsoil is about 30 inches thick. The upper part is dark brown, friable loam, and the lower part is dark yellowish brown, friable sandy loam. The underlying material to a depth of 80 inches or more is very pale brown, friable sandy loam and loamy sand. In some areas the surface layer and the subsoil have a higher content of sandstone fragments. In places the surface layer is sandy loam. In some areas the soil is moderately deep. In places, the underlying material is more clayey and the soil is moderately well drained. Some areas are gently sloping.

Included with this soil in mapping are small areas of Berks, Gilpin, and Wellston soils. Berks soils are more channery than the Rigley soil, Gilpin soils are more clayey, and Wellston soils are more silty. Berks and Gilpin soils are moderately deep. Included soils make up about 20 percent of most delineations.

Permeability is moderately rapid in the Rigley soil. Runoff is medium or rapid. Available water capacity is moderate. The content of organic matter is moderately low in the surface layer. The root zone is deep. The capacity to store and release plant nutrients is low.

Many areas are used as cropland. Some areas are used as pasture.

This soil is only moderately suited to cultivated crops. Erosion and droughtiness are the main management concerns. The hazard of erosion is severe in cultivated areas. The soil dries rapidly and warms up early in the spring. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface helps to control erosion and conserves moisture. Including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways also reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Banded or split applications of fertilizer minimize the loss of nutrients, especially nitrogen, and help to prevent the pollution of ground water.

This soil is well suited to hay and pasture. It is suited to a wide variety of forage plants. The early warming of the soil results in good spring pasture, but droughtiness limits production later in the growing season. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

This soil is well suited to timber production. No major limitations affect the planting, growth, or harvesting of trees. Species that can tolerate drought should be selected for planting.

This soil is well suited to use as a site for buildings. The slope is the main management concern. Designing buildings so that they conform to the natural contour of the land reduces the need for grading. Removing as little vegetation as possible, adding mulch, and establishing a temporary plant cover help to control erosion on construction sites. Constructing local roads and streets on the contour and seeding road cuts also help to control erosion. Stockpiling the surface soil and using it to blanket the surface during the final grading help to reestablish the plant cover.

This soil is only moderately suited to use as a site for septic tank absorption fields. The thickness of material that can provide an adequate filter is a management concern. The underlying material is a poor filter, and unfiltered effluent that reaches this sandy material could pollute ground water. Leach lines should be installed across the slope as close to the surface as possible. Caving is a hazard in excavations.

Ponds developed in areas of this soil are likely to have an excessive seepage rate.

This soil is recognized as farmland of local importance. The land capability classification is IIIe. The pasture and hayland suitability group is A-1. The woodland ordination symbol is 4A.

RgD—Rigley channery loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is on upland hillsides and nose slopes. Some areas have common stones on the surface. Outcrops of bedrock are at the upper edge of some areas. Most areas are long and narrow and range from 5 to 50 acres in size.

Typically, the surface layer is dark grayish brown, friable channery loam about 6 inches thick. The subsoil is yellowish brown, very friable channery loam and channery sandy loam about 26 inches thick. The underlying material to a depth of 60 inches or more is yellowish brown and pale brown, very friable channery loamy sand. In some areas the subsoil has a higher content of sandstone fragments. In other areas the soil is moderately deep over sandstone bedrock. In some places the surface layer is sandy loam. Areas where the underlying material is clayey are moderately well drained.

Included with this soil in mapping are small areas of Berks, Gilpin, and Wellston soils. Berks soils are more channery than the Rigley soil, Gilpin soils are more clayey, and Wellston soils are more silty. Berks and Gilpin soils are moderately deep. Included soils make up about 20 percent of most delineations.

Permeability is moderately rapid in the Rigley soil. Runoff is rapid. Available water capacity is moderate. The content of organic matter is low in the surface layer. The root zone is deep. The capacity to store and release plant nutrients is low.

Most areas are used as pasture. Many areas are wooded. A few areas are used as cropland.

This soil is poorly suited to cultivated crops and hay. Fertility is low. Droughtiness, erosion, tilth, and the content of organic matter are management concerns. The hazard of erosion is very severe in cultivated areas. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface helps to control erosion and conserves moisture. Including grasses and legumes in the cropping system, stripcropping on the contour, and planting cover crops also help to control erosion. Maintaining a permanent plant cover is the best means of controlling erosion. Channers in the surface layer restrict the use of some tilling and harvesting machinery. Leaching of plant nutrients, especially nitrogen, is rapid. Banded or split applications of fertilizer minimize the loss of nutrients and help to prevent the pollution of ground water.

This soil is moderately suited to pasture. A wide variety of adapted forage plants can grow on this soil, but those that can tolerate droughtiness are the best suited. The early warming of the soil results in good spring pasture, but droughtiness limits production later in the growing season. If the soil is plowed, the hazard of erosion is severe. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion. In some areas, surface stones interfere with pasture improvement.

This soil is moderately suited to timber production.

The aspect of the slope affects the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The slope limits the use of planting and logging equipment. Establishing roads and skid trails on the contour helps to control erosion. Establishing water bars and maintaining a vegetative cover also help to control erosion. Using seedlings that have been transplanted once or mulching can reduce the seedling mortality rate, especially on south-facing slopes.

This soil is only moderately suited to use as a site for buildings. The slope is the major management concern. Removing as little vegetation as possible, mulching, establishing a temporary plant cover on construction sites, constructing local roads and streets on the contour, and seeding road cuts help to control erosion. Stockpiling the surface soil and using it to blanket the surface during final grading help to reestablish the plant cover.

This soil is only moderately suited to septic tank absorption fields. The slope and the limited thickness of material that can provide an adequate filter are management concerns. The underlying material is a poor filter, and unfiltered effluent that reaches this sandy material could pollute ground water. Leach lines should be installed across the slope as close to the surface as possible. Caving is a hazard in excavations.

Ponds developed in areas of this soil are likely to have an excessive seepage rate.

The land capability classification is IVe. The pasture and hayland suitability group is A-2. The woodland ordination symbol is 4R on north aspects and 3R on south aspects.

RhE—Rigley-Coshocton complex, 25 to 40 percent slopes. These deep, steep soils are on dissected hillsides. The well drained Rigley soil is on bluffs, and the moderately well drained Coshocton soil is on concave benches in areas that have seeps and a perched water table. Areas of the Coshocton soil commonly are less sloping than areas of the Rigley soil. The two soils occur as belts that are associated with different types of bedrock. These belts are around hillsides or are in ravines at the head of small streams. Each belt is at a consistent elevation. Most areas of these soils range from 10 to 250 acres in size. They are about 40 percent Rigley soil and 35 percent Coshocton soil.

Typically, the surface layer of the Rigley soil is dark grayish brown, friable channery loam about 6 inches thick. The subsurface layer is yellowish brown, very friable channery loam about 6 inches thick. The subsoil is yellowish brown, very friable channery loam, channery sandy loam, and channery loamy sand about 36 inches thick. The underlying material to a depth of 60 inches or more is pale brown, very friable channery loamy sand. In some areas the subsoil has a higher content of sandstone fragments. In other areas the soil is moderately deep over sandstone bedrock. In places the surface layer is sandy loam. In some areas, the soil is moderately well drained and the underlying material is clayey. Some areas have a stony surface layer, and a few areas have a bouldery surface layer. In some places the subsoil has more clay. Slopes are more than 40 percent in areas along ravines.

Typically, the surface layer of the Coshocton soil is dark brown, friable silt loam about 3 inches thick. The subsurface layer is brown, friable silt loam about 3 inches thick. The subsoil is about 37 inches thick. The upper part is yellowish brown, friable channery silt loam. The lower part is light yellowish brown, mottled, firm very channery and extremely channery clay loam. The underlying material is yellowish brown, mottled shaly silty clay about 5 inches thick. Soft, thinly bedded shale bedrock is at a depth of about 48 inches. In some areas the upper part of the subsoil is loam or channery loam. A few areas are stony or bouldery.

Included with these soils in mapping are areas of Berks, Gilpin, Guernsey, Alford, and Glenford soils. The moderately deep Berks and Gilpin soils are on the upper parts of slopes. The moderately well drained Guernsey soils are on the lower slopes. They have more clay in the subsoil than the Rigley and Coshocton soils. Alford and Glenford soils are on the less sloping foot slopes in areas that have deep deposits of silt. Springs are common near the areas of contact between Rigley and Coshocton soils. Small seepy areas of poorly drained soils are common around the springs. Included areas make up 25 percent of most delineations.

Permeability is moderately rapid in the Rigley soil and is moderately slow or slow in the Coshocton soil. Runoff is rapid on both soils. Available water capacity is moderate. The content of organic matter is moderately low in the surface layer. The root zone is deep. The capacity to store and release plant nutrients is low in the Rigley soil and moderate in the Coshocton soil. The water table is in the lower part of the subsoil in the Coshocton soil during extended wet periods. The shrink-swell potential is moderate in the lower part of the Coshocton soil.

Most areas are wooded. Some areas are used as pasture. Some areas were formerly cultivated.

These soils are generally unsuited to cultivated crops or hay. Cultivation is impractical. The use of equipment is severely restricted by the slope, and the hazard of erosion is very severe. Maintaining a permanent plant cover is the best means of controlling erosion.

These soils are poorly suited to pasture. The slope and the channers on the surface interfere with pasture management practices. A wide variety of forage plants can grow on these soils. Frost heave in areas of the Coshocton soil can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover of vegetation on the surface in the fall and seeding a grass-legume mixture can minimize the damage caused by frost heave. If the surface is tilled, the hazard of erosion is very severe. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

These soils are only moderately suited to timber production. The aspect of the slope affects the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The Coshocton soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. The slope limits the use of planting and logging equipment. Establishing roads and skid trails on the contour helps to control erosion. Establishing water bars and maintaining a vegetative cover also help to control erosion. Using seedlings that have been transplanted once or adding mulch can reduce the seedling mortality rate on south-facing slopes. Removing vines and the less desirable trees and shrubs helps to control plant competition.

These soils are generally unsuited to building site development and septic tank absorption fields. The slope is the main concern. Erosion on construction sites is a major problem. Excessive downslope seepage of septic tank effluent is likely.

The Rigley soil is unsuited to use as a site for ponds. Ponds can be developed in areas of the Coshocton soil, especially in areas where springs are available. Onsite investigation is needed to determine the thickness of the layers of clay shale.

The land capability classification is VIe. The pasture and hayland suitability group is A-3. The woodland ordination symbol is 4R on north aspects and 3R on south aspects.

RoF—Rodman gravelly sandy loam, 25 to 70 percent slopes. This deep, steep and very steep, excessively drained soil is on dissected hillsides and escarpments on glacial outwash terraces. Most areas are long, very narrow, and winding. They range from 2 to 10 acres in size.

Typically, the surface layer is black, very friable gravelly sandy loam about 9 inches thick. The subsurface layer is very dark grayish brown and dark yellowish brown, very friable gravelly sandy loam about 3 inches thick. The subsoil is dark brown, very friable gravelly sandy loam about 8 inches thick. The underlying material to a depth of 60 inches or more is dark brown and dark yellowish brown, loose very gravelly sand and very gravelly loamy sand. In some areas the surface layer is loam or loamy sand. In some places the surface layer and the upper part of the subsoil are very strongly acid. In a few cultivated areas, the soil is severely eroded.

Included with this soil in mapping are small areas of Lakin, Chili, and Watertown soils. Lakin soils have alternating layers of fine sandy loam and loamy fine sand in the subsoil. Chili and Watertown soils are in moderately steep areas. They have a thicker subsoil than the Rodman soil. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 20 percent of most delineations.

Permeability is moderately rapid in the subsoil of the Rodman soil and very rapid in the underlying material. Runoff is rapid. Available water capacity is low. The content of organic matter is moderate. The rooting depth is limited by sand and gravel layers at a depth of 20 to 30 inches. The capacity to store and release plant nutrients is low.

Most areas are used as woodland or pasture.

This soil is generally unsuited to crops and pasture. The slope restricts the use of equipment, and the hazard of erosion is very severe. Also, productivity is limited because the soil is very droughty. Maintaining a permanent cover of plants that can tolerate drought is the best means of controlling erosion.

This soil is only moderately suited to timber production. The aspect of the slope affects the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. The slope limits the use of planting and logging equipment. Establishing roads and skid trails on the contour helps to control erosion. Establishing water bars and maintaining a vegetative cover also help to control erosion. Using seedlings that have been transplanted once or adding mulch can reduce the seedling mortality rate on south-facing slopes.

This soil is generally unsuited to building site development and septic tank absorption fields. The slope is a serious limitation on building sites. Caving and slippage occur in areas where streams undercut the hillside. Maintaining as much vegetative cover as possible during construction reduces the hazard of erosion. Excessive downslope seepage of septic tank effluent is likely. Ponds are very unlikely to hold water.

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

Se—Sebring silt loam. This deep, nearly level, poorly drained soil is in low areas on terraces in the valleys of former glacial lakes. It receives runoff from adjacent soils and is subject to ponding, especially in areas on flats that do not have an outlet for surface water. Some areas are drained by ditches. Slopes range from 0 to 2 percent. Most areas range from 30 to 100 acres in size.

Typically, the surface layer is dark gray, firm silt loam about 10 inches thick. The subsoil is grayish brown, dark grayish brown, and yellowish brown, firm silty clay loam about 45 inches thick. It is mottled. The underlying material to a depth of 60 inches or more is grayish brown, mottled, firm silt loam. In some areas the surface layer is silty clay loam. In other areas the subsoil contains more sand and gravel.

Included with this soil in mapping are areas of Luray, Lorain, Fitchville, Melvin, and Newark soils. The very poorly drained Luray and Lorain soils are in depressions. They are generally in areas less than 2 acres in size. They have a darker surface layer that contains more organic matter than that of the Sebring soil. Lorain soils have more clay in the subsoil than the Sebring soil. The somewhat poorly drained Fitchville soils are on slight rises. Areas of Melvin and Newark soils are on flood plains and are less than 100 feet wide. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 20 percent of most delineations.

Permeability is moderately slow in the Sebring soil. Runoff is very slow or ponded. Available water capacity is high. The content of organic matter is moderate in the surface layer. The seasonal high water table is at or above the surface during extended wet periods. It restricts the rooting depth well into the growing season. The root zone is deep in drained areas. The potential for frost action is high. The shrink-swell potential is moderate. The capacity to store and release plant nutrients also is moderate.

Most areas are unimproved pasture and support weeds, brush, and trees that are adapted to wetness. Areas that have not been drained have potential as wetland. Drained areas are used for crops, mainly corn and soybeans.

If drained, this soil is only moderately suited to row crops, small grain, and hay. Most areas require both surface and subsurface drainage. Surface drains help to remove excess water in ponded areas. Subsurface drains can lower the water table in areas where drainage outlets are available. Pumps are needed in areas where outlets are not available. Diversions and open ditches can remove runoff from adjacent slopes, but they are expensive to maintain. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Ridge tillage can improve yields.

If drained, this soil is only moderately suited to hay and pasture. Species that can tolerate wetness should be selected for seeding. Few areas are drained well enough for alfalfa. Areas that have not been drained are poorly suited to hay and pasture. Rushes and other swamp plants crowd out the seeded forage plants. Extended periods of ponding can destroy the vegetation. Deferred grazing during wet periods helps to prevent compaction of the surface layer and damage to plant roots. In areas that have not been drained, however, wet periods are common during much of the year.

This soil is only moderately suited to timber production. The ponding and the wetness affect the planting, growth, and harvesting of trees. Native bottom-land hardwoods that can tolerate wetness grow well. Selecting water-tolerant species for planting reduces the seedling mortality rate. Planting and logging should take place during dry periods or when the soil is frozen. The hazard of windthrow can be reduced by using harvesting methods that do not leave the remaining trees isolated or widely spaced. Removing vines and the less desirable trees and shrubs helps to control plant competition. The soil is well suited to habitat for wetland wildlife.

This soil is generally unsuited to use as a site for buildings or for septic tank absorption fields. The seasonal high water table is the main concern. Commonly, corrective measures are not practical.

There are no natural pond sites. Excavated ponds are likely to hold water, but they may dry up during extended dry periods. Onsite investigation is needed to determine the nature of the underlying material. In some areas a low fill can be built to create a shallow wetland pond.

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

St—Stonelick loam, occasionally flooded. This deep, nearly level, well drained soil is on flood plains. Areas of this soil are in the flood pool of the Dillon Lake dam, which is subject to controlled flooding. The flooding can last for several days. The rate of sedimentation is high along the river channel above the reservoir. Slopes range from 0 to 2 percent. Most areas of this soil are along and parallel to the meanders of the river. They are more than 100 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 6 inches thick. The underlying material, to a depth of about 60 inches, is brown and dark grayish brown, friable loam and silt loam and brown, very friable fine sandy loam. Below this to a depth of 75 inches or more is dark grayish brown loam and light yellowish brown loamy fine sand. In some areas the underlying material contains more silt and less sand. In other areas the underlying material is very gravelly sand or very gravelly loamy sand. In a few places the soil is not calcareous throughout.

Included with this soil in mapping are narrow areas of the somewhat poorly drained Newark soils. These soils are in slight depressions and channels. They make up about 20 percent of most delineations.

Permeability is moderately rapid in the Stonelick soil. Runoff is slow. Available water capacity, the content of organic matter, and the potential for frost action are moderate. The root zone is deep. The capacity to store and release nutrients is moderate, but nutrient deficiencies may occur because of the mild alkalinity of the soil.

Most areas are used as wildlife habitat or as cropland. Corn and soybeans are the main crops. Some of the crops are left as food for wildlife each year.

This soil is only moderately suited to corn and soybeans. It is generally unsuited to small grain because of the hazard of flooding. Controlled flooding occurs in most years during the early part of the growing season, and planting is delayed. Conserving soil moisture is a management concern. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface conserves moisture and increases the rate of water infiltration. Applications of lime should not be needed. Applications of an acid-forming fertilizer can lower the pH of the soil. Banded or split applications of fertilizer can minimize the loss of water. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Streambank erosion is a major source of sediments that pollute the water. Streambanks can be stabilized by shaping, by planting shrubs, and by placing stone riprap in some places. Controlling weeds is a concern because weed seeds are carried in by floodwater. Winter cover crops protect the soil from scouring.

This soil is well suited to hay. Species that can tolerate droughtiness are the best suited. The prolonged controlled flooding can damage or kill hay plantings. Including legumes in the seeding mixture provides nitrogen for subsequent corn crops.

This soil is well suited to pasture. A wide variety of adapted forage plants can thrive on this soil. The early warming of the soil results in good spring pasture, but droughtiness limits production later in the growing season. The controlled flooding during the growing season reduces the quality of forage.

This soil is well suited to timber production. The flooding affects the planting, growth, and harvesting of trees. Native bottom-land hardwoods that can tolerate flooding grow well. Because the flooding is usually brief, most management activities can be performed during periods when the soil is not flooded.

This soil is generally unsuited to use as a site for buildings or for septic tank absorption fields because of the flooding.

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

Ta—Tioga fine sandy loam, rarely flooded. This deep, nearly level, well drained soil is on flood plains along the major streams. Most areas are on flood plains that are elevated only a few feet above the more frequently flooded bottom land. A few areas are natural levees along the river channel. Flooding is partially controlled by upstream dams of the Muskingum Conservancy District and by the Dillon Lake dam. The flooding is limited to rare periods of very high runoff. Slopes range from 0 to 3 percent. Most areas are crescent-shaped meander scars and range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 8 inches thick. The subsoil is dark yellowish brown and dark brown, friable fine sandy loam and dark brown, very friable sandy loam about 26 inches thick. The underlying material to a depth of 60 inches or more is brown, loose, stratified loamy fine sand. In some areas the soil has a dark surface layer that has a higher content of organic matter. In other areas the surface layer and the upper part of the subsoil are silt loam or loam.

Included with this soil in mapping are narrow strips of soils that have loamy sand below the surface layer. These soils are more droughty than the Tioga soil. Also included are a few areas of Watertown and Chavies soils and areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Watertown and Chavies soils are on the highest swells and are not flooded. Included areas make up about 20 percent of most delineations.

Permeability is moderate or moderately rapid in the Tioga soil. Runoff is slow. Available water capacity is moderate. The content of organic matter is moderate in the surface layer. The root zone is deep, but few roots penetrate the sandier layers in the underlying material during dry periods. The capacity to store and release plant nutrients is low. The potential for frost action is moderate.

Most areas are used for crops. Some areas are irrigated. The irrigation improves yields during dry periods. Very few areas are wooded.

This soil is well suited to corn, soybeans, and wheat and to specialty crops, such as melons, tomatoes, cucumbers, and potatoes. The soil dries early in the spring and is well suited to irrigation. Conserving soil moisture is the main management concern. The soil is better suited to crops that mature early in the growing season than to late-season crops. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface conserves moisture and increases the rate of water infiltration. Banded or split applications of fertilizer minimize the loss of nutrients, especially nitrogen, and help to prevent the pollution of ground water Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Streambank erosion is a major source of sediments that pollute the water. Streambanks can be stabilized by shaping, by planting shrubs, and by placing stone riprap in some places. Controlling weeds is a concern because weed seeds are carried in by floodwater. Winter cover crops protect the soil from scouring. In some areas, grass-lined floodwater channels are needed to handle peak flow and minimize scouring. Diversions at the base of slope breaks to the uplands or terraces minimize the damage caused by flash flooding.

This soil is well suited to hay and pasture. Species that can tolerate droughtiness are the best suited. The flooding can damage plantings of hay. The moisture needed for good seed germination is most likely to be available in early spring. Seeding a companion crop of small grain reduces the hazard of flood damage, but the grain crop competes for the limited supply of moisture. Including legumes in the seeding mixture provides nitrogen for subsequent crops. The early warming of the soil produces good spring pasture, but droughtiness limits production during the summer.

This soil is well suited to timber production, but only a small acreage is used as woodland. No major limitations affect the planting, growth, or harvesting of trees. Native bottom-land hardwoods grow well.

This soil is poorly suited to use as a site for buildings because of the flooding. Elevating structures and roads above known flood levels can protect them from flood damage. The fill may restrict the natural floodway and result in more flooding upstream.

This soil is only moderately suited to septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. Elevating the absorption field with suitable fill material can improve the filtering capacity of the soil. Perimeter drains can reduce the wetness by lowering the water table.

Some areas are used as a source of sand and gravel. Excavated ponds are very unlikely to hold water.

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

Tf—Tioga fine sandy loam, occasionally flooded. This deep, nearly level, well drained soil is on flood plains along the major streams. It is flooded for brief periods in winter and spring. Flooding occurs more often along Wakatomika Creek than in other watersheds. In most areas the soil is adjacent to stream channels and forms a natural levee that is higher in elevation than other soils on the flood plain. Most areas are 5 to 80 acres in size. Slopes range from 0 to 2 percent.

Typically, the surface layer is brown, very friable fine sandy loam about 20 inches thick. The subsoil is about 18 inches thick. It is brown and dark yellowish brown, very friable sandy loam and yellowish brown loamy sand. The underlying material to a depth of 60 inches or more is yellowish brown and dark brown, stratified loam and fine sandy loam. In some areas the subsoil and the upper part of the underlying material contain more clay. In other areas the surface layer is loam. Areas along Wakatomika Creek are frequently flooded.

Included with this soil in mapping are areas of the moderately well drained Lindside soils. These soils are in slight depressions and are generally in areas less than 2 acres in size. Also included are a few areas of Watertown and Chavies soils on low terraces that are not subject to flooding and areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 15 percent of most delineations.

Permeability is moderate or moderately rapid in the Tioga soil. Runoff is slow. The content of organic matter is moderate in the surface layer. The root zone is deep. The capacity to store and release plant nutrients is low. The depth to a seasonal high water table is controlled by the level of stream flow, but it is usually more than 4 feet. The potential for frost action is moderate.

Most areas are used for cultivated crops or for hay and pasture.

This soil is well suited to crops, especially corn and soybeans. Winter grain crops may be damaged by flooding. Conserving soil moisture is a management concern. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface conserves moisture and increases the rate of water infiltration. Banded or split applications of fertilizer can minimize the loss of nutrients, especially nitrogen, and help to prevent the pollution of ground water. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Land grading in a few areas allows surface water to drain faster. Keeping stream channels free of obstructions, such as logjams, helps to prevent flooding. Small levees have been constructed in some areas to minimize flooding. Streambank erosion is a major source of sediments that pollute the water. Streambanks can be stabilized by shaping, by planting shrubs, and by placing stone riprap in some places. Controlling weeds is a concern because weed seeds are carried in by floodwater. Winter cover crops protect the soil from scouring. In some areas, grass-lined floodwater channels are needed to handle peak flow and minimize scouring. Diversions at the base of slope breaks to the uplands or terraces minimize the damage caused by flash flooding.

This soil is well suited to hay and pasture. In areas used for hay, species that can tolerate droughtiness are the best suited. In newly seeded areas the damage caused by flooding can be minimized by seeding a companion crop, such as small grain, or by delaying seeding until after the flooding season. Finely tilled seedbeds are the most likely to be damaged by floodwater. Including legumes in the seeding mixture provides nitrogen for subsequent row crops. A wide variety of adapted forage plants can thrive on this soil. The early warming of the soil results in good spring pasture, but droughtiness limits production during the summer. Brief periods of flooding during the growing season reduce the quality of forage.

This soil is well suited to timber production. The flooding affects the planting, growth, and harvesting of trees. Native bottom-land hardwoods that can tolerate flooding grow well. Because the flooding is usually brief, most management activities can be performed during periods when the soil is not flooded.

This soil is unsuited to use as a site for buildings because of the flooding. Local roads and streets can be constructed on fill material above the expected level of flooding, but extensive filling results in increased flooding upstream.

This soil is generally unsuited to use as a site for septic tank absorption fields because of the flooding. The surfacing of effluent during periods of flooding is likely to pollute streams.

Excavated ponds are very unlikely to hold water and are subject to flood damage.

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

Ud—Udorthents, loamy, hilly. These soils are in areas where the landscape has been altered by cutting, filling, or leveling. They are mainly along highways and airport runways, in urban areas, and near dams. In areas that have been cut, the exposed surface is similar to the subsoil and underlying material of adjacent soils. In fill areas, the soil material is more varied and the fill material is a mixture of the subsoil and underlying material of nearby soils. The degree of compaction of the fill is highly variable. Slopes range from 1 to 40 percent but are dominantly 10 to 30 percent. Most areas are roughly rectangular and range from 5 to 40 acres in size.

Typically, the surface layer is brown silt loam about 2 inches thick. The underlying material to a depth of 60 inches or more is brown or yellowish brown clay loam or channery clay loam. The content of coarse fragments ranges from 5 to 35 percent. In areas around the Zanesville airport, the soils contain very few coarse fragments. Some areas of these soils are adjacent to Fairpoint soils and are reclaimed mine land. A few cuts are dominantly clay shale bedrock.

Included with these soils in mapping are long, narrow bedrock escarpments. Urban land covers much of the surface in some areas. Some areas, such as sanitary landfills, have a high proportion of unstable organic material, which will gradually decompose and settle. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 30 percent of most delineations.

Permeability and runoff are variable in the Udorthents. Available water capacity is low or very low because of the content of rock fragments and compaction. Hard rains tend to seal the surface in poorly vegetated areas. The root zone generally is moderately deep, but it is variable in some areas, depending on the degree of compaction.

Most areas are used for urban development. In some areas, trees or grasses, such as fescue, have been established after grading. The soils are generally unsuited to cultivated crops but are moderately suited to pasture and woodland.

Erosion is a major management concern in cut areas and on filled banks. Crusting reduces the rate of water infiltration and restricts the emergence and growth of plants. As the rate of water infiltration decreases, runoff and erosion increase. Planting grasses is the most common method of controlling erosion. Resurfacing with topsoil can increase the depth of the root zone and improve the moisture-holding capacity of the soils. Surface and subsurface drainage is needed in some areas.

The suitability of these soils as sites for buildings, roads, and septic tank absorption fields varies widely. Onsite evaluation is needed.

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

Ug—Udorthents, sandy, rolling. These soils are on glacial outwash terraces in areas of sand and gravel mining. Mining has removed or mixed the original soil material. Grading has removed steep banks and buried large stones. The surface has been blanketed with soil material after mining. Ponds are in former pits in some areas. Slopes range from 4 to 15 percent. Most areas are rectangular and range from 10 to 40 acres in size.

Typically, the surface layer is brown gravelly loam about 10 inches thick. The underlying material to a depth of 60 inches or more is very pale brown very gravelly sand and sand.

Included with these soils in mapping are areas of soils that do not have gravel in the surface layer and underlying material and areas of soils that have 35 to 60 percent gravel. Included areas make up about 25 percent of most delineations.

Permeability is very rapid in the Udorthents. Runoff is slow or medium. Available water capacity is very low. The content of organic matter also is very low.

Grasses and legumes have been planted in most areas, but a few areas are cultivated.

These soils are only moderately suited to cultivated crops and hay. Droughtiness and erosion are the major management concerns. The soils warm up and dry early in the spring, but they are droughty in summer. They are better suited to crops that mature early in the growing season than to full-season crops. Deep-rooted forage crops, such as alfalfa, are less affected by droughtiness. If the soils are cultivated, the hazard of erosion is moderate. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface conserves moisture and helps to control erosion. Including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways also reduce the hazard of erosion. Banded or split applications of fertilizer minimize the loss of nutrients, especially nitrogen, and help to prevent the pollution of ground water.

These soils are moderately suited to pasture or trees. Improving fertility and selecting adapted plant species are management concerns. Native or adapted species that can tolerate droughtiness and low fertility should be selected. Mulching around tree seedlings helps to retain moisture and increases growth.

The suitability of these soils as sites for buildings, roads, or sanitary facilities varies. Onsite investigation is needed. Excavated ponds are very unlikely to hold water unless the excavation extends below the water table.

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

Uh—Udorthents, sandy-skeletal, steep. These soils are in areas of sand and gravel mining on glacial outwash terraces. Mining has obliterated or mixed the natural soil layers. Slopes range from 20 to 60 percent. Small ponds are in the deeper excavations. Most areas are rectangular and range from 10 to 200 acres in size.

Typically, these soils are very pale brown very gravelly sand to a depth of 60 inches or more.

Included with these soils in mapping are areas of Rodman soils. Rodman soils have a surface layer that is darker than that of the Udorthents. Also included are bedrock outcrops and spoil piles of rock and loamy material. Included areas make up about 20 percent of most delineations.

Permeability is rapid in the Udorthents. Runoff also is rapid. Available water capacity is dominantly very low. The content of organic matter is very low. The content of rock fragments ranges from 30 to 80 percent. The capacity to store and release plant nutrients is very low.

Most areas support shrubs and trees that have reseeded naturally. Some areas are used as dumps.

These soils are unsuited to crops and pasture because of droughtiness, low fertility, and the slope. A permanent plant cover should be established. Native or adapted species that can tolerate low fertility and droughtiness should be selected. Blanketing the surface with topsoil helps to establish a plant cover.

The suitability of these soils as sites for buildings, roads, or septic tank absorption fields varies. Onsite investigation is needed to determine the suitability and limitations of a specific site. Excavated ponds are very unlikely to hold water unless the excavation extends below the water table.

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

Uk—Udorthents-Pits complex. This map unit is in areas that are being actively surface-mined for coal or limestone. Many of these areas will be reclaimed after the mining is completed. The Udorthents are gently sloping to very steep and are very channery or extremely channery. They are near pits. Pits are deep excavations made into bedrock to uncover the coal seam. Individual areas of this unit are about 60 percent Udorthents and 20 percent pits.

Typically, Udorthents are ridges and cone-shaped piles 10 to 70 feet high that consist of a mixture of rock fragments and partially weathered fine earth material. The rock fragments are mainly sandstone, siltstone, and shale in surface-mined areas and are limestone in limestone quarries. The content of rock fragments, including large stones and boulders, ranges from about 20 to 80 percent.

Pits have a nearly level floor between the piles of Udorthents and the vertical highwalls of bedrock.

Included in mapping are moderately deep and deep natural soils in small scattered areas in pits or around the edges of pits. Some spoil piles are mostly black, carbonaceous shale. Also included are areas of loamy Udorthents, which are stockpiles of surface and subsoil material. These areas are in landscape positions above or below the mining activities. Included areas make up about 20 percent of most delineations.

Permeability is variable in the Udorthents but is generally moderate or moderately slow. Runoff is very rapid. Available water capacity is very low.

The hazard of erosion is very severe in areas of Udorthents where the surface is bare. Suitable plant cover is needed to control erosion. A number of abandoned limestone and sandstone quarries, which are adjacent to active quarries, support brush and trees and provide habitat for wildlife. In reclaimed areas where sandstone was quarried, grasses and trees that can tolerate the very low available water capacity and extremely acid reaction should be selected for planting. Species that can tolerate a high content of lime should be selected for planting in areas where limestone was quarried. Some areas are suited to crops and pasture if reclaimed. The degree of suitability depends on the quality of the reclamation and the final slope of the land.

The suitability of areas of this unit as sites for buildings or septic tank absorption fields is highly variable. Onsite investigation is needed to determine the potential and limitations for a proposed use. If reclamation is properly planned and implemented, many areas could be used as building sites after the soils have settled.

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

UsB—Urban land-Glenford complex, 2 to 8 percent slopes. This map unit consists of gently sloping areas of Urban land and Glenford soil. The areas of Urban land are covered by buildings and pavement. The deep, nearly level to strongly sloping, moderately well drained Glenford soil is in undisturbed areas on the terraces of former glacial lakes. Because of the patterns of urban development, most areas of this map unit are rectangular and range from 10 to 500 acres in size. They are about 50 percent Urban land and 25 percent Glenford soil.

In the areas of Urban land, the surface layer is impermeable because of concrete or bituminous pavement and building rooftops. A layer of coarse aggregate, crushed limestone, gravel, or sand about 6 to 12 inches thick is commonly beneath the surface. The underlying material is generally highly compacted earthfill or layers of stratified silt, clay, and fine sand.

Typically, the surface layer of the Glenford soil is brown silt loam about 9 inches thick. The subsoil is about 31 inches thick. The upper part is brown, friable silt loam; the next part is yellowish brown, mottled, friable silt loam; and the lower part is brown, mottled, firm silty clay loam. The underlying material to a depth of about 60 inches is brown, mottled, firm silt loam. In some places the subsoil contains more clay. In a few areas the subsoil has layers of loam and sandy loam or has a fragipan.

Included in mapping are areas of the poorly drained Sebring soils, areas of the somewhat poorly drained Fitchville soils, and areas of the well drained Alford soils. Sebring soils are in depressions. Fitchville soils are on flats. Alford soils are on elevated knolls. Also included are strongly sloping, dissected areas of Glenford or Markland soils and many areas of loamy Udorthents. Udorthents are near excavations for buildings. The excavated material is mixed or filled to such an extent that soil layers are not distinguishable. This material is commonly compacted, very firm silty clay loam or silt loam. Included soils make up about 25 percent of most delineations.

Plant growth and water infiltration are restricted by the impermeable surface in areas of Urban land.

Permeability is moderately slow in undisturbed areas of the Glenford soil. Runoff is medium. Available water capacity is high. Tilth is good, and the root zone is deep. Most areas have been drained by storm sewer systems, gutters, and drainage ditches. Undrained areas have a seasonal high water table at a depth of about 24 to 36 inches during extended wet periods. The Glenford soil is in open areas that are used for lawns, gardens, or parks. It is well suited to gardens, lawns, shrubs, and trees. The included areas of Udorthents are not well suited to lawns and gardens. Artificial drainage is beneficial in areas of the included Fitchville and Sebring soils.

The Glenford soil is only moderately suited to use as a site for buildings. The seasonal wetness and a moderate shrink-swell potential are the main limitations. Installing drains at the base of footings and coating exterior basement walls help to prevent wet basements. Backfilling along foundation walls with material that has a low shrink-swell potential can minimize the damage caused by shrinking and swelling. Runoff and erosion on construction sites can be controlled by maintaining a vegetative cover on the surface and reseeding exposed areas as soon as possible. Surface water from adjacent slopes should be diverted away from the building site.

The Glenford soil is only moderately suited to use as a site for septic tank absorption fields. The seasonal wetness and the restricted permeability are limitations. Using perimeter drains around septic tank absorption fields helps to lower the seasonal high water table. Enlarging the absorption field improves the absorption of effluent. Landscaping the areas used as septic tank absorption fields can provide good surface drainage away from the absorption field. In the steeper areas, distribution lines should be laid across the slope.

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

UtA—Urban land-Nolin complex, rarely flooded. This map unit consists of areas of Urban land and areas of Nolin soil that are intermingled in a pattern so intricate that they cannot be mapped separately. The areas of Urban land are covered by buildings and pavement. The deep, nearly level, well drained Nolin soil is on flood plains that receive sediments from overflowing streams. It is subject to rare flooding. Slopes range from 0 to 3 percent. Because of the pattern of urban development, most areas of this map unit are rectangular and range from 10 to 500 acres in size. They are about 50 percent Urban land and 30 percent Nolin soil.

In the areas of Urban land, the surface layer is impermeable because of concrete or bituminous pavement and building rooftops. A layer of coarse aggregate, crushed limestone, gravel, or sand about 6 to 12 inches thick is commonly beneath the surface. The underlying material is generally highly compacted earthfill or weathered siltstone or shale bedrock.

Typically, the surface layer of the Nolin soil is dark brown, friable silt loam about 7 inches thick. The underlying material to a depth of 60 inches or more is dark brown and yellowish brown, friable silt loam. In some areas the soil is moderately well drained. In other areas the soil has a higher content of sand. Some places have been excavated and filled to such an extent that soil layers are not distinguishable. In some areas the surface layer and subsoil are loam and sandy loam.

Included in mapping are small areas of the poorly drained Melvin and somewhat poorly drained Newark soils. These soils are in low areas. Many areas of Urban land have been filled to raise the surface above normal flood levels. Many areas along the Muskingum and Licking Rivers are protected by upstream flood-control dams and local levees. Included areas make up about 20 percent of most delineations.

Plant growth and water infiltration are restricted by the impermeable surface in areas of Urban land.

Permeability is moderate in the Nolin soil. Runoff is slow. Available water capacity is very high. The content of organic matter is moderate. The surface layer is friable. The infiltration rate is good, even when the surface is crusted. The root zone is deep. A seasonal high water table is at a depth of 3 to 6 feet during extended wet periods.

Small levees have been constructed in some areas to minimize flooding. Surface drains help to remove floodwater in a few low areas. Streambank erosion is a major source of sediments that cause water pollution. Stabilizing eroding streambanks is difficult in most areas, but clearing the channel of debris and planting willows on the streambanks are effective measures in some areas.

Open areas of this map unit are generally too small to be used as cropland, but they are well suited to lawns and gardens.

The Nolin soil is well suited to timber production, but only a small acreage is used as woodland. Most open areas are too small to be used as commercial woodlots. Flooding affects the planting, growth, and harvesting of trees. Native bottom-land hardwoods grow well. Because the flooding is usually brief, most management activities can be performed during periods when the soil is not flooded.

The Nolin soil is poorly suited to use as a site for buildings because of the flooding. Buildings and roads can be elevated on fill material above the level of flooding, but the fill partially blocks the natural floodway and increases the level and duration of flooding upstream.

The Nolin soil is only moderately suited to use as a site for septic tank absorption fields. Elevating the field can reduce the hazard of flood damage and increases the depth to the water table. Perimeter drains can be used to lower the water table. Excavated ponds are unlikely to hold water and are subject to flood damage.

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

UvB—Urban land-Watertown complex, 1 to 15 percent slopes. This map unit consists of areas of Urban land and areas of Watertown soil that are intermingled in such an intricate pattern that they cannot be mapped separately. The Urban land is covered by buildings or pavement. The deep, nearly level to strongly sloping, well drained Watertown soil is on terraces of glacial outwash. Because of the pattern of urban development, most areas of this map unit are rectangular and range from 10 to 500 acres in size. They are about 50 percent Urban land and 25 percent Watertown soil.

In areas of the Urban land, the surface layer is impermeable because of concrete or bituminous pavement and building rooftops. A layer of coarse aggregate, crushed limestone, gravel, or sand about 6 to 12 inches thick is commonly beneath the surface. The underlying material is generally highly compacted earthfill or stratified layers of sand and gravel.

Typically, the surface layer of the Watertown soil is dark brown, very friable sandy loam about 10 inches thick. The subsoil is about 43 inches thick. The upper part is brown sandy loam, and the lower part is brown sandy loam, loamy sand, and gravelly loamy sand. The underlying material to a depth of 60 inches or more is brown loamy sand and gravelly loamy sand. Many areas around buildings have been excavated and filled to such an extent that the soil layers cannot be distinguished. Some areas have a surface layer of loam or silt loam.

Included in mapping are a few areas of Rodman and Chili soils. Rodman soils are on steep or very steep slopes between terraces and flood plains. Chili soils are more gravelly in the surface layer and subsoil than the Watertown soil. Included soils make up about 25 percent of most delineations.

Plant growth and water infiltration are restricted by the paved surfaces in areas of Urban land.

Permeability is moderately rapid in the subsoil of the Watertown soil and is very rapid in the underlying material. Runoff is medium. Available water capacity is low. The root zone is deep.

The Watertown soil is used for lawns and gardens. It is only moderately suited to lawns, trees, shrubs, and vegetable and flower gardens because of droughtiness. It is poorly suited to use as a site for water impoundments because of the very rapidly permeable underlying material and the hazard of seepage.

Included areas of cut and fill land are not well suited to lawns and gardens. Exposed subsoil material has fair or poor tilth. Adding organic material to the soil improves tilth.

The Watertown soil is well suited to use as a site for buildings. Maintaining a vegetative cover on the surface helps to minimize runoff and reduces the hazard of erosion on construction sites. Stockpiling surface soil and using it to blanket the surface during final grading help to reestablish the plant cover. Caving is a hazard in excavations.

The Watertown soil is only moderately suited to use as a site for septic tank absorption fields. The limited thickness of soil material that can provide an adequate filter is a management concern. The underlying material is a poor filter, and untreated effluent that reaches this material can pollute ground water. Where possible, sanitary facilities should be connected to central sewers. Leach lines in septic tank absorption fields should be installed across the slope and as close to the surface as possible.

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

UwC—Urban land-Wellston complex, 5 to 15 percent slopes. This map unit is on upland ridgetops in areas where considerable urban development has occurred. The Urban land consists of areas covered by buildings or pavement. The deep, well drained Wellston soil is in undisturbed areas. Areas of the Urban land and the Wellston soil are intermingled in such a complex pattern that it was not possible to separate them in mapping. Because of the pattern of urban development, most areas of this map unit are rectangular and range from 10 to 300 acres in size. They are about 50 percent Urban land and 25 percent Wellston soil.

In areas of the Urban land, the surface is impermeable because of concrete or bituminous pavement and building rooftops. Commonly, a layer of coarse aggregate, crushed limestone, gravel, or sand about 6 to 12 inches thick is beneath the surface. The underlying material is generally highly compacted earthfill or weathered siltstone or shale bedrock.

Typically, the surface layer of the Wellston soil is brown, friable silt loam about 7 inches thick. The subsoil is about 47 inches thick. The upper part is brown, firm silty clay loam and friable or firm silt loam. The lower part is yellowish brown, firm silty clay loam and clay loam. The underlying material to a depth of 60 inches or more is channery clay loam and channery sandy loam. In some areas the subsoil is deeper and consists of silt loam that does not contain rock fragments.

Included in mapping are areas of Keene, Zanesville, Gilpin, and Rigley soils. The moderately well drained Keene and Zanesville soils are in low or seepy areas. The moderately deep Gilpin and Rigley soils are on shoulder slopes. They are sandier than the Wellston soil. Also included are the loamy Udorthents, which have been excavated and filled to such an extent that the original soil layers are not distinguishable. Udorthents are commonly compacted, very firm silty clay loam or clay loam. Included soils make up about 25 percent of most delineations.

Plant growth and water infiltration are restricted by pavement in areas of Urban land.

Permeability is moderate in the Wellston soil. Available water capacity is high. Runoff is medium or rapid. The potential for frost action is high.

Most areas are used for residential or commercial development. Undeveloped areas are vacant lots, parks, or lawns. The Wellston soil is well suited to lawns and trees. Mulching helps to control erosion.

The Wellston soil is well suited to use as a site for buildings. The slope and the depth to bedrock are limitations. Maintaining as much cover as possible on construction sites helps to control erosion, especially in strongly sloping areas. Constructing driveways across the slope also helps to control erosion.

The Wellston soil is moderately suited to use as a site for septic tank absorption fields. The slope and the depth to bedrock are limitations. Unfiltered effluent that seeps into the fractured bedrock can pollute ground water. Leach lines should be as close to the surface as possible. Providing suitable cover material helps to overcome the limited depth to bedrock. Laying the lines on the contour helps to prevent the surfacing of effluent.

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

WaB—Watertown sandy loam, 1 to 8 percent slopes. This deep, nearly level and gently sloping, well drained soil is on glacial outwash terraces. Slopes are long and smooth. Individual areas are irregular in shape and range from 6 to 160 acres in size.

Typically, the surface layer is dark yellowish brown, very friable sandy loam about 12 inches thick. The subsoil is about 30 inches thick. The upper part is yellowish brown, friable sandy loam, and the lower part is brown, very friable loamy sand. The underlying material to a depth of 80 inches or more is yellowish brown, loose gravelly coarse sand and brown, loose very gravelly coarse sand. In some areas the surface layer is loam or loamy sand. In places the subsoil is fine sandy loam and loamy fine sand. In some nearly level areas, the surface layer is darker. In many areas the subsoil is less acid.

Included with this soil in mapping are areas of the well drained Chili soils. These soils have more gravel and slightly more clay in the subsoil than the Watertown soil. Also included are small areas of moderately well drained soils and areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 20 percent of most delineations.

Permeability is moderately rapid in the upper part of the subsoil of the Watertown soil. It is rapid in the lower part of the subsoil and in the underlying material. Runoff is slow or medium. Available water capacity is low. The content of organic matter is moderately low in the surface layer. The root zone is deep. The capacity to store and release plant nutrients is low.

Most areas are used for crops. Some areas are used for residential or commercial development. A few areas are used as woodland.

This soil is well suited to crops. Wheat, corn, and forage plants are the main crops. Conserving moisture is the main management concern. The hazard of erosion is moderate in cultivated areas. The soil dries early in the spring and is well suited to irrigation. Plants commonly show evidence of moisture stress in summer. The soil is better suited to crops that mature early in the growing season than to crops that mature late in summer. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface conserves moisture and increases the rate of water infiltration. Returning crop residue to the surface and applying barnyard manure increase the content of organic matter. Banded or split applications of fertilizer minimize the loss of nutrients, especially nitrogen, and help to prevent the pollution of ground water.

This soil is only moderately suited to hay and pasture. Deep-rooted forage plants that can tolerate droughtiness are the best suited. The early warming of the soil results in good spring pasture, but droughtiness limits production later in the growing season.

This soil is well suited to timber production, but only a small acreage is used as woodland. No major limitations affect the planting, growth, or harvesting of trees. Species that can tolerate droughtiness should be selected for planting.

This soil is well suited to use as a site for buildings. Maintaining as much vegetative cover as possible on construction sites reduces the hazard of erosion. Stockpiling the surface soil and using it to blanket the surface during final grading help to reestablish the plant cover. Caving is a hazard in excavations.

This soil is well suited to use as a site for septic tank absorption fields. The limited thickness of soil material that can provide an adequate filter is a management concern. The soil material in the lower part of the subsoil and the underlying material is a poor filter, and untreated effluent that reaches this material can pollute ground water. Leach lines in septic tank absorption fields should be as close to the surface as possible and should be backfilled with more absorbent soil material.

There are few natural pond sites, and excavated ponds are very unlikely to hold water.

This soil is recognized as farmland of local importance. The land capability classification is IIIs. The pasture and hayland suitability group is B-1. The woodland ordination symbol is 4A.

WaC—Watertown sandy loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on glacial outwash terraces. It is on short slopes between benches. Slopes are short, but sheet and rill erosion is common. Most areas are long and narrow and range from 6 to 20 acres in size.

Typically, the surface layer is brown, friable sandy loam about 8 inches thick. The subsoil is about 30 inches thick. The upper part is dark brown, friable sandy loam. The lower part is dark yellowish brown, very friable loamy sand. The underlying material to a depth of 60 inches or more is yellowish brown, loose gravelly loamy coarse sand. In some areas the surface layer is loamy sand or loam. In places the subsoil is fine sandy loam and loamy fine sand. In many areas the soil is less acid.

Included with this soil in mapping are small areas of Chili and Chavies soils. These soils contain more gravel and slightly more clay in the subsoil than the Watertown soil. Also included are small areas of moderately well drained soils and small areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 20 percent of most delineations.

Permeability is moderately rapid in the subsoil of the Watertown soil. Runoff is medium or rapid. The content of organic matter is low. The root zone is moderately deep. Available water capacity is low. The capacity to store and release plant nutrients also is low.

Most areas are used for crops. A few areas are used as pasture.

This soil is only moderately suited to crops. Wheat, corn, and forage plants are the main crops. The hazard of erosion is moderate. The soil responds well to management practices that reduce surface runoff, increase the rate of water infiltration, and retain plant nutrients. The soil dries early in the spring and is well suited to irrigation. Plants commonly show evidence of moisture stress in summer. The soil is better suited to crops that mature early in the growing season than to full-season crops. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface conserves moisture and increases the rate of water infiltration. Deep-rooted forage crops, such as alfalfa, are less affected by droughtiness than other crops. Tilling on the contour and including small grain and forage plants in the cropping system help to control erosion and runoff. Returning crop residue to the surface and applying barnyard manure increase the content of organic matter. Banded or split applications of fertilizer minimize the loss of nutrients, especially nitrogen, and help to prevent the pollution of ground water. Grassed waterways help to control erosion in areas where runoff water is concentrated.

This soil is only moderately suited to pasture. The early warming of the soil results in good pasture, but droughtiness limits production during the summer. Plants seeded in early spring become better established than those seeded later in the growing season because of the droughtiness. Seeding cover crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion.

This soil is well suited to timber production, but only a small acreage is used as woodland. No major limitations affect the planting, growth, or harvesting of trees. Species that can tolerate drought should be selected for planting.

This soil is well suited to use as a site for buildings. The slope is a moderate limitation. Designing buildings so that they conform to the natural slope of the land reduces the need for land shaping. Caving is a hazard in excavations.

This soil is only moderately suited to use as a site for septic tank absorption fields. The thickness of subsoil material that can adequately filter the effluent is a concern. The underlying material is a poor filter, and untreated effluent that reaches this sandy material could pollute ground water. Leach lines in septic tank absorption fields should be installed across the slope and as close to the surface as possible. Maintaining as much vegetative cover as possible on construction sites helps to prevent erosion. Stockpiling the surface soil and using it to blanket the surface during final grading help to reestablish plant cover.

This soil is recognized as farmland of local importance. The land capability classification is IIIe. The pasture and hayland suitability group is B-1. The woodland ordination symbol is 4A.

WhB—Wellston silt loam, 2 to 8 percent slopes. This deep, gently sloping, well drained soil is on knolls and in saddles on ridgetops. Slopes are smooth and convex. Individual areas are 3 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 41 inches thick. The upper part is brown, friable silt loam and firm silty clay loam, and the lower part is yellowish brown, firm silty clay loam. Soft, weathered sandstone is at a depth of about 48 inches. In many places the silty material is more than 60 inches thick.

Included with this soil in mapping are small areas of

Rigley, Gilpin, Keene, and Zanesville soils. Rigley soils are more sandy than the Wellston soil. The moderately deep Gilpin soils are on shoulder slopes. The moderately well drained Keene and Zanesville soils are at the center of the broader ridgetops. Included soils make up about 20 percent of most delineations.

Permeability is moderate in the Wellston soil. Surface runoff is medium. Available water capacity is high. The content of organic matter is moderate in the surface layer. The root zone is deep. The capacity to store and release plant nutrients is moderate. The potential for frost action is high.

Most areas are used for crops or pasture. A small acreage is wooded.

This soil is well suited to cultivated crops, including specialty crops. The hazard of erosion is moderate in cultivated areas. The soil dries rapidly and warms up early in the spring. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, and tilling on the contour reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction.

This soil is well suited to hay and pasture. It is suited to a wide variety of forage plants. Acidity in the root zone is a limitation that affects some legumes. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover of vegetation on the surface in the fall and including grasses in the seeding mixture can minimize the damage caused by frost heave. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

This soil is well suited to timber production. No major limitations affect the planting or growth of trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Removing vines and the less desirable trees and shrubs helps to control plant competition.

This soil is well suited to use as a site for buildings. Areas of this soil are some of the best building sites in the uplands.

This soil is well suited to use as a site for septic tank absorption fields. The depth to bedrock limits the thickness of soil material that can adequately filter the effluent. Unfiltered effluent that seeps into the fractured bedrock can pollute ground water. Shallow leach lines that are covered by suitable material help to overcome the limited depth to bedrock. Laying the leach lines on the contour helps to prevent the surfacing of effluent.

There are few natural pond sites. Excavations for ponds are likely to extend into shattered rock, which cannot hold water unless it is blanketed with clay.

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

WhC2—Wellston silt loam, 8 to 15 percent slopes, eroded. This deep, strongly sloping, well drained soil is on shoulder slopes and broad ridgetops. A few areas are on benches. Slopes are generally smooth but are mildly dissected by a few shallow drainageways. Erosion has removed part of the original surface layer. Most areas are 4 to 20 acres in size.

Typically, the surface layer is yellowish brown, friable silt loam about 5 inches thick. The subsoil is about 39 inches thick. The upper part is brown, friable silt loam, and the lower part is yellowish brown, firm channery silty clay loam. The underlying material is light olive brown, firm channery clay loam and sandy loam about 4 inches thick. Soft, weathered sandstone is at a depth of about 48 inches. In many places the silty material is more than 60 inches thick. A few areas are severely eroded.

Included with this soil in mapping are small areas of Rigley and Gilpin soils. Rigley soils are more sandy than the Wellston soil. Gilpin soils are moderately deep. Also included are Keene soils in small areas where clay shale is beneath the subsoil. Included soils make up about 20 percent of most delineations.

Permeability is moderate in the Wellston soil. Runoff is medium. Available water capacity is moderate or high. The content of organic matter is moderately low in the surface layer. The root zone is deep. The capacity to store and release plant nutrients is moderate. The potential for frost heave is high.

Most areas are used for cultivated crops. Some areas are used as pasture or are wooded.

This soil is only moderately suited to cultivated crops. Many areas are eroded, and controlling further erosion is the main management concern. The hazard of erosion is severe in cultivated areas. The soil dries rapidly and warms up early in spring. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction.

This soil is well suited to hay and pasture. It is suited to a wide variety of forage plants. Acidity in the root zone is a limitation that affects some legumes. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover of vegetation on the surface in the fall and including grasses in the seeding mixture can minimize the damage caused by frost heave. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

This soil is well suited to timber production. No major limitations affect the planting or growth of trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Removing vines and the less desirable trees and shrubs helps to control plant competition.

This soil is well suited to use as a site for buildings. The slope is the major management concern. Maintaining as much cover as possible on the surface helps to control erosion on construction sites. Constructing driveways across the slope also helps to control erosion.

This soil is only moderately suited to use as a site for septic tank absorption fields. The slope and the depth to bedrock are management concerns. Unfiltered effluent that seeps into the fractured bedrock can pollute ground water. Leach lines should be as close to the surface as possible. Providing suitable cover material helps to overcome the limited depth to bedrock. Laying out the leach lines on the contour helps to prevent the surfacing of effluent.

Excavations for ponds in the included draws are likely to expose shattered rock, which cannot hold water unless it is blanketed with clay.

This soil is recognized as farmland of local importance. The land capability classification is IIIe. The pasture and hayland suitability group is A-6. The woodland ordination symbol is 4A.

WmB—Westgate silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is on broad ridgetops and wide benches. Slopes are smooth and convex. Most areas are 5 to 20 acres in size.

Typically, the surface layer is brown, very friable silt loam about 7 inches thick. The subsoil is about 59 inches thick. The upper part is strong brown, friable silt loam and silty clay loam. It is mottled at a depth of more than 28 inches. The lower part of the subsoil is yellowish red, firm silty clay, clay, and silty clay loam. It is mottled. The underlying material is yellowish red, olive yellow, and dusky red, firm silty clay loam about 9 inches thick. Soft, weathered clay shale bedrock is at a depth of about 75 inches. In some areas, weathered siltstone is at a depth of more than 40 inches. In other areas the underlying material is gray or brown clay shale. Areas where the mantle of silt is thicker commonly have a fragipan.

Included with this soil in mapping are small areas of Lowell and Guernsey soils. Lowell soils are more clayey than the Westgate soil. Also included are Upshur soils, which are in a few areas where the mantle of silt is thin. Included soils make up about 20 percent of most delineations.

Permeability is moderate in the upper part of the subsoil in the Westgate soil and slow in the lower part. Runoff is medium. Available water capacity is high. The content of organic matter is moderately low in the surface layer. The root zone is deep. The water table is perched in the lower part of the subsoil in late winter and in spring and during other wet periods. The capacity to store and release plant nutrients is moderate. The potential for frost action is high. The shrink-swell potential is high in the lower part of the subsoil.

Most areas are used as cropland or pasture.

This soil is well suited to cultivated crops, including specialty crops. The hazard of erosion is moderate in cultivated areas. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Subsurface drains can reduce wetness in scattered low or seepy areas.

This soil is well suited to hay and pasture. It is suited to a wide variety of forage plants. Acidity in the root zone is a limitation that affects some legumes. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover of vegetation on the surface in the fall and including grasses in the seeding can reduce the damage caused by frost heave. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

This soil is well suited to timber production. No major limitations affect the planting or growth of trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Removing vines and the less desirable trees and shrubs helps to control plant competition.

This soil is only moderately suited to use as a site for buildings. The seasonal wetness is a limitation, especially on sites for buildings with basements. The high shrink-swell potential in the lower part of the subsoil also is a limitation. Installing drains around footings can lower the water table. Reinforcing walls with concrete, supporting the walls with a large spread footing, and backfilling around foundations with granular material that has a low shrink-swell potential help to prevent the damage caused by shrinking and swelling.

This soil is only moderately suited to use as a site for septic tank absorption fields. The seasonal wetness and the restricted permeability in the lower part of the subsoil are limitations. Perimeter drains can reduce the wetness by lowering the water table. Enlarging the absorption field or using a double field helps to overcome the restricted permeability.

There are few natural pond sites. Excavated ponds are likely to hold water if the excavations do not extend below the clayey beds into the siltstone. Onsite investigation is needed to determine the thickness of the clayey beds.

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

WmC2—Westgate silt loam, 6 to 15 percent slopes, eroded. This deep, strongly sloping, moderately well drained soil is on dissected benches, knolls, and shoulder slopes on ridgetops. Most areas are long and narrow. Slopes are mainly smooth, but a few areas are dissected by small drainageways. Erosion has removed part of the original surface layer. Most areas are 5 to 30 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 50 inches thick. The upper part is yellowish brown and brown, friable silt loam and firm silty clay loam. The lower part is dark reddish brown, firm clay and silty clay. The underlying material is dark reddish brown, firm shaly silty clay loam and olive siltstone about 17 inches thick. Soft, weathered shale bedrock is at a depth of about 75 inches. In some areas the subsoil has less clay in the lower part.

Included with this soil in mapping are small areas of Guernsey, Upshur, and Zanesville soils. The moderately well drained Guernsey soils have more clay in the upper part of the subsoil than the Westgate soil. The well drained Upshur soils have a thinner mantle of silt than the Westgate soil. Zanesville soils have a fragipan. Included soils make up about 20 percent of most delineations.

Permeability is moderate in the upper part of the subsoil in the Westgate soil and is slow in the lower part. Runoff is rapid. Available water capacity is high. The content of organic matter is moderately low in the surface layer. The root zone is deep. The water table is perched in the lower part of the subsoil in late winter and in spring and during other wet periods. The shrink-swell potential is high in the lower part of the subsoil. The potential for frost action is high. The capacity to store and release plant nutrients is moderate.

Most areas are used as cropland. Some areas are used as pasture. A few areas are wooded.

This soil is only moderately suited to cultivated crops. Many areas are significantly eroded, and controlling further erosion is the main management concern. The hazard of erosion is severe in cultivated areas. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Using subsurface drains in seepy areas increases crop production in most years.

This soil is well suited to hay and pasture. It is suited to a wide variety of forage plants. Acidity in the root zone is a limitation that affects some legumes. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover of vegetation on the surface in the fall and including grasses in the seeding mixture can minimize the damage caused by frost heave. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

This soil is well suited to timber production. No major limitations affect the planting or growth of trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is only moderately suited to use as a site for buildings because of the slope, the seasonal wetness, and the high shrink-swell potential. Backfilling along foundations with material that has a low shrink-swell potential and reinforcing walls and foundations can minimize the damage caused by shrinking and swelling. Installing drains around footings helps to control the seasonal wetness. Maintaining as much plant cover as possible and reseeding or mulching can help to control erosion on construction sites.

This soil is poorly suited to use as a site for septic tank absorption fields because of the slope, the seasonal wetness, and the restricted permeability. Perimeter drains can be used to lower the seasonal high water table. The absorption of effluent can be improved by enlarging the absorption field or by using a double absorption field. Laying the distribution lines across the slope can prevent the surfacing of effluent.

Areas where this soil is on both sides of a small draw have some potential as pond sites. Care should be taken not to excavate into siltstone below the clay beds. Onsite investigation is needed to determine the thickness of the clay beds.

This soil is recognized as farmland of local importance. The land capability classification is IIIe. The pasture and hayland suitability group is A-6. The woodland ordination symbol is 4A.

WtC2—Westmoreland silt loam, 8 to 15 percent slopes, eroded. This deep, strongly sloping, well drained soil is on knolls and shoulder slopes on ridgetops. Areas of this soil also occur as narrow bands around hillsides. Slopes are generally smooth, but some are dissected by small drainageways. Erosion has removed part of the original surface layer. Most areas range from 2 to 20 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 30 inches thick. The upper part is brown, firm silty clay loam; the next part is yellowish brown, firm clay loam; and the lower part is brown, firm channery and very channery clay loam. Below this is a thin layer of soft, weathered siltstone. Hard siltstone bedrock is at a depth of about 40 inches. In some areas the soil has a thicker mantle of silt. Severely eroded areas have a few gullies and have a higher content of coarse fragments in the surface layer. In places the soil is moderately deep over bedrock.

Included with this soil in mapping are areas of the moderately well drained Coshocton soils. These soils are mainly on the lower parts of slopes. They make up about 20 percent of most delineations.

Permeability is moderate in the Westmoreland soil. Runoff is rapid. Available water capacity is low. The content of organic matter is moderately low in the surface layer. The root zone is deep. The capacity to store and release plant nutrients is moderate.

Most areas are used as cropland or pasture. Corn, small grain, and hay are the principal crops. Some areas are wooded.

This soil is only moderately suited to cultivated crops. Many areas are eroded, and controlling further erosion is the main management concern. The hazard of erosion is severe in cultivated areas. Improving fertility and conserving moisture also are management concerns. The soil dries rapidly and warms up early in spring. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface helps to control erosion and conserves moisture. Including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways also reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction.

This soil is well suited to hay and pasture. It is suited to a wide variety of forage plants. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

This soil is well suited to timber production. No major limitations affect the planting or growth of trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is well suited to use as a site for buildings, but the slope and the depth to bedrock are management concerns. Removing as little vegetation as possible, mulching, or establishing a temporary plant cover helps to control erosion on construction sites. Building local roads and streets on the contour and seeding road cuts reduce the hazard of erosion. Because of the limited depth to bedrock in some areas, basement excavations are likely to extend into the upper layers of rock. In most areas these layers are weathered bedrock, which can be excavated with power equipment.

This soil is moderately suited to use as a site for septic tank absorption fields. The slope, the depth to bedrock, and the restricted permeability are management concerns. Enlarging the absorption field helps to overcome the restricted permeability. Using shallow leach lines that are covered with suitable material helps to overcome the limited depth to bedrock. Laying the leach lines on the contour helps to prevent the surfacing of effluent.

Ponds can be developed in some of the drainageways that cross areas of this soil. Excessive seepage is the main hazard if excavations extend into layers of porous or shattered rock. Careful onsite investigation is needed to determine the depth to bedrock.

This soil is recognized as farmland of local importance. The land capability classification is IIIe. The pasture and hayland suitability group is A-1. The woodland ordination symbol is 4A.

WtD2—Westmoreland silt loam, 15 to 25 percent slopes, eroded. This deep, moderately steep, well drained soil is on nose slopes, side slopes, and dissected upland hillsides. Slopes are broken by many small drainageways. Erosion has removed part of the original surface layer. Gullies and scars are common. Most areas are long and narrow or oblong and range from 5 to 80 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is grayish brown and yellowish brown, friable silt loam about 8 inches thick. The upper part of the subsoil is yellowish brown and dark yellowish brown, firm channery silty clay loam about 21 inches thick. The lower part is brown very channery silty clay loam about 6 inches thick. The underlying material is about 12 inches thick. It is brown very channery silt loam and soft, weathered siltstone. Hard siltstone bedrock is at a depth of about 50 inches. Some areas are severely eroded, and a few areas are not eroded. Stones and gullies are common in the severely eroded areas. In areas on narrow ridges, the mantle of silt is thicker. In areas where sandstone is dominant, the surface layer and subsoil are more sandy. As much as one-third of some areas is moderately deep over bedrock. The lower parts of slopes are generally much deeper over bedrock.

Included with this soil in mapping are small areas of Berks and Coshocton soils. The moderately deep Berks soils are on the steeper parts of slopes. The moderately well drained Coshocton soils are on the narrow, less sloping benches. Seeps and springs are in areas of the Coshocton soils. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 20 percent of most delineations.

Permeability is moderate in the Westmoreland soil. Runoff is rapid. Available water capacity is low. The content of organic matter is moderately low in the surface layer. The root zone is deep. The capacity to store and release plant nutrients is moderate.

Most areas are used as woodland or pasture. A few areas are cultivated. Some wooded areas are grazed.

This soil is poorly suited to cultivated crops. Many areas are eroded, and controlling further erosion is the main management concern. If the soil is cultivated, the hazard of erosion is very severe. Maintaining a permanent plant cover is the best means of controlling erosion. Improving fertility and conserving moisture also are management concerns. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways reduce the hazard of erosion. Conservation tillage systems also conserve moisture. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction.

This soil is moderately suited to hay and pasture. It is suited to a wide variety of forage plants. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

This soil is only moderately suited to timber production. The aspect of the slope affects the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. The slope limits the use of planting and logging equipment. Establishing roads and skid trails on the contour, establishing water bars, and maintaining a vegetative cover help to control erosion. Removing vines and the less desirable trees and shrubs helps to control plant competition.

This soil is only moderately suited to use as a site for buildings. The slope is the main management concern. Designing the buildings so that they conform to the contour of the land reduces the need for excavation and land shaping. Removing as little vegetation as possible, adding mulch, and establishing a temporary plant cover help to control erosion on construction sites. Building local roads and streets on the contour and seeding road cuts reduce the hazard of erosion. Because of the limited depth to bedrock in some places, basement excavations may extend into the upper layers of rock. In most areas these layers are weathered and can be excavated with power equipment.

This soil is poorly suited to use as a site for septic tank absorption fields. The slope is the major management concern. Installing leach lines on the contour helps to prevent the surfacing of effluent. Enlarging the absorption field helps to overcome the restricted permeability.

Draws in areas of this soil have some potential as sites for ponds. Excessive seepage is the main hazard if excavations extend into layers of porous or shattered rock. Careful onsite investigation is needed.

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

WtE—Westmoreland silt loam, 25 to 40 percent slopes. This deep, steep, well drained soil is on dissected hillsides. Slopes are long and complex and have many intermittent drainageways that form a dendritic pattern. Slopes are both convex and concave. They have spurs, ridges, and crests in convex areas, and they have coves, ravines, and hollows in concave areas. Outcrops of siltstone and sandstone are common along streams. Individual areas of this soil range from 10 to 500 acres in size.

Typically, the surface and subsurface layers are very dark grayish brown and brown, friable silt loam. They have a combined thickness of about 9 inches. The subsoil is about 36 inches thick. The upper part is yellowish brown, friable and firm silt loam, and the lower part is brown, friable channery silt loam. The underlying material is firm, brown silty clay loam about 15 inches thick. Soft, weathered, light olive brown siltstone bedrock is at a depth of about 60 inches. In some areas the soil is moderately deep over bedrock. In some places the subsoil is channery sandy loam or loamy sand. In other places the surface layer is sandy loam.

Included with this soil in mapping are small areas of Wellston soils, the moderately deep Berks soils, and the moderately well drained Clarksburg and Coshocton soils. Wellston and Berks soils are on shoulders and spurs. Wellston soils are more silty than the Westmoreland soil. Clarksburg and Coshocton soils are on foot slopes. They formed in colluvium. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 20 percent of most delineations.

Permeability is moderate in the Westmoreland soil. Runoff is very rapid. Available water capacity is moderate. The content of organic matter is moderate in the surface layer. The root zone is deep. The capacity to store and release plant nutrients is moderate. The shrink-swell potential is moderate in the subsoil.

Most areas are wooded. Many areas are old pastures that are reverting to brush and trees. A few areas that have smooth slopes are used for hay.

This soil is generally unsuited to cultivated crops because of the slope and a very severe hazard of erosion.

This soil is poorly suited to hay and pasture. The slope restricts the use of farm equipment. A wide variety of forage plants can grow on this soil, but seeding them and applying fertilizer are difficult. If the soil is plowed, the hazard of erosion is very severe. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

This soil is only moderately suited to timber production. The aspect of the slope affects the planting and growth of trees. The slope limits the use of planting and logging equipment. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Establishing roads and skid trails on the contour, establishing water bars, and maintaining a vegetative cover help to control erosion. Removing vines and the less desirable trees and shrubs helps to control plant competition.

This soil is poorly suited to use as a site for buildings because of the slope. Excavations for buildings commonly extend into rock and can increase the hazard of slippage. Sites for structures that are built into the side of a hill or bank commonly require less excavation than other sites. Removing as little vegetation as possible can help to control erosion on construction sites.

This soil is generally unsuited to use as a site for septic tank absorption fields because of the slope. Effluent is likely to surface and pollute streams.

Ponds can be developed in some of the draws that cross areas of this soil. Excessive seepage is the main hazard if excavations extend into layers of porous or shattered rock. Careful onsite investigation is needed to determine the location of the rock layers. The bottom of the draws is sloping, and a high fill commonly is needed to create an impoundment of any size.

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

WuC2—Westmoreland-Guernsey silt loams, 8 to 15 percent slopes, eroded. These deep, strongly sloping soils are on dissected ridgetops and hillsides and on benches. The Westmoreland soil is on moderately steep slopes, and the Guernsey soil is on narrow, gently sloping benches. The two soils occur as alternating bands associated with strata of different kinds of bedrock. In some places they are intermingled. Slopes are complex and have knolls, shoulders, and coves. Erosion has removed most of the original surface layer, and gullies and scars are common along intermittent drainageways. Seep spots are numerous. Most areas of these soils range from 3 to 50 acres in size. They are about 45 percent Westmoreland soil and 35 percent Guernsey soil.

The Westmoreland soil is well drained. Typically, the surface layer is dark brown, friable silt loam about 5 inches thick. The subsoil is yellowish brown, firm channery silty clay loam about 42 inches thick. The underlying material is yellowish brown, very firm very channery silt loam about 10 inches thick. Siltstone bedrock is at a depth of about 57 inches. In many areas the bedrock is at a depth of less than 40 inches. In some places on narrow ridges, the mantle of silt is thicker.

The Guernsey soil is moderately well drained. Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is yellowish brown, firm silty clay loam and silty clay about 30 inches thick. It is mottled. The underlying material to a depth of 60 inches or more is light olive gray, very firm shaly silty clay loam. In severely eroded areas the surface layer is silty clay loam.

Included with these soils in mapping are small areas of the moderately well drained Coshocton, Westgate, and Keene soils. These included soils are wetter than the Westmoreland soil and have a lower content of clay than the Guernsey soil. They make up about 20 percent of most delineations.

Permeability is moderate in the Westmoreland soil and is moderately slow or slow in the Guernsey soil. Runoff is medium or rapid on the Westmoreland soil and is rapid on the Guernsey soil. Available water capacity is moderate in both soils. The content of organic matter is moderately low in the surface layer. The root zone is deep. A seasonal high water table is perched in the lower part of the subsoil of the Guernsey soil during extended wet periods. The capacity to store and release plant nutrients is moderate in the Westmoreland soil and high in the Guernsey soil. The shrink-swell potential is high in the Guernsey soil.

Most areas are used as cropland. Many areas are used as pasture. Some areas support trees. Corn, small grain, and hay are the main crops.

These soils are only moderately suited to cultivated crops. Many areas are significantly eroded, and controlling further erosion is the main management concern. The hazard of erosion is severe in cultivated areas. Improving fertility and conserving moisture also are management concerns. Tilth is fair or poor in eroded areas of the Guernsey soil. If the soils are cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Using subsurface drains in seepy areas increases crop production in most years.

These soils are well suited to hay and pasture. A wide variety of forage plants can be grown. Frost heave in areas of the Guernsey soil can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover of vegetation on the surface in the fall or seeding a grass-legume mixture can minimize the damage caused by frost heave. If the soils are plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

These soils are well suited to timber production. No major limitations affect the planting or growth of trees. The soils have low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Adequate soil-root contact should be maintained in the more eroded areas of the Guernsey soil, where the surface layer is silty clay loam. Removing vines and the less desirable trees and shrubs helps to control plant competition.

These soils are only moderately suited to use as sites for buildings. Bedrock is at a depth of only 40 inches in some areas of the Westmoreland soil. Basement excavations in these areas are likely to extend into weathered bedrock, but the bedrock can be excavated with power equipment. The shrink-swell potential and the seasonal wetness of the Guernsey soil are limitations on sites for dwellings. Removing as little vegetation as possible, mulching, or establishing a temporary plant cover helps to control erosion on construction sites. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. Reinforcing walls, supporting the walls with a large spread footing, and backfilling around foundations with granular material that has a low shrink-swell potential help to prevent the damage caused by shrinking and swelling. Cutting and filling increase the hazard of hillside slippage in areas of the Guernsey soil, but installing artificial drains reduces this hazard. If possible, buildings should be constructed in areas of the Westmoreland soil.

These soils are moderately suited or poorly suited to use as sites for septic tank absorption fields. The Westmoreland soil is better suited to septic tank absorption fields than the Guernsey soil. Installing the leach lines on the contour helps to prevent the surfacing of effluent. Using suitable fill material helps to overcome the limited depth to bedrock in areas of the

Westmoreland soil. Perimeter drains can reduce the wetness in areas of the Guernsey soil. Enlarging the absorption field helps to overcome the restricted permeability, especially in areas of the Guernsey soil.

Ponds can be developed in some of the drainageways and seeps in areas of these soils. If excavation exposes layers of porous or shattered rock, excessive seepage is likely. Onsite investigation is needed to determine the location and depth of the rock layers. The soil material is generally good for fill, but the Guernsey soil packs well only if it is used at the proper moisture content.

These soils are recognized as farmland of local importance. The land capability classification is IIIe. The pasture and hayland suitability group is A-1 for the Westmoreland soil and A-6 for the Guernsey soil. The woodland ordination symbol is 4A for both soils.

WuD2—Westmoreland-Guernsey silt loams, 15 to 25 percent slopes, eroded. These deep, moderately steep soils are on dissected hillsides and benches. Slopes are irregular and have many gullies and landslide scars. Erosion has removed part of the original surface layer. Seeps are common. The two soils occur as alternating bands that are associated with different bedrock strata. Most areas are long and narrow or are oblong and range from 10 to 50 acres in size. They are about 45 percent Westmoreland soil and 35 percent Guernsey soil.

The Westmoreland soil is well drained. Typically, the surface layer is dark brown, friable silt loam about 9 inches thick. The subsoil is about 31 inches thick. The upper part is yellowish brown, friable silty clay loam, channery silty clay loam, and channery silt loam. The lower part is yellowish brown, mottled, friable channery clay loam. The underlying material is brown, mottled, firm very channery clay loam about 20 inches thick. Siltstone bedrock is at a depth of about 60 inches.

The Guernsey soil is moderately well drained. Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is about 44 inches thick. It is mottled. The upper part is brown, firm clay loam and silty clay. The lower part is yellowish brown, firm silty clay loam and silty clay. The underlying material is light olive brown, firm channery silty clay loam about 3 inches thick. Siltstone bedrock is at a depth of about 55 inches. In some areas the depth to bedrock is greater. In many severely eroded areas, the surface layer is silty clay loam.

Included with these soils in mapping are small areas of Berks, Lowell, and Upshur soils. The moderately deep Berks soils are on the upper part of hillsides. Lowell and Upshur soils are on benches. They have more clay than the Westmoreland soil and are better drained than the Guernsey soil. Also included are areas in the flood pools of the Dillon Lake dam and the Wills Creek dam that are subject to controlled flooding. Included areas make up about 20 percent of most delineations.

Permeability is moderate in the Westmoreland soil and moderately slow or slow in the Guernsey soil. Runoff is rapid on the Westmoreland soil and very rapid on the Guernsey soil. Available water capacity is moderate in both soils. The content of organic matter is moderately low in the surface layer. The root zone is deep. A seasonal high water table is perched in the lower part of the subsoil in areas of the Guernsey soil during extended wet periods. The capacity to store and release plant nutrients is moderate in both soils.

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

These soils are poorly suited to cultivated crops. Many areas are significantly eroded, and controlling further erosion is the main management concern. The hazard of erosion is very severe in cultivated areas. Improving fertility and conserving moisture also are management concerns. Maintaining a permanent plant cover is the best means of controlling erosion. If the soils are cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Tilth is fair or poor in the more eroded areas of the Guernsey soil. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Using subsurface drains in seepy areas of the Guernsey soil increases crop production in most years.

These soils are only moderately suited to hay and pasture. Most of the commonly grown forage plants are suitable for planting. Frost heave in areas of the Guernsey soil can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover of vegetation on the surface in the fall or including grasses in the seeding mixture can minimize the damage caused by frost heave. If the soils are tilled, the hazard of erosion is severe. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

These soils are only moderately suited to timber production. The slope limits the use of planting and logging equipment. The aspect of the slope affects the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The soils have low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Establishing roads and skid trails on the contour, establishing water bars, and maintaining a vegetative cover help to control erosion. Using planting techniques that spread the roots of seedlings and that increase soil-root contact can reduce the seedling mortality rate in areas of the Guernsey soil. Using seedlings that have been transplanted once or adding mulch can reduce the seedling mortality rate on south-facing slopes. Removing vines and the less desirable trees and shrubs helps to control plant competition.

These soils are poorly suited to use as sites for buildings because of the slope and the hazard of slippage. The high shrink-swell potential is also a limitation in areas of the Guernsey soil. The Westmoreland soil is better suited to building sites than the Guernsey soil. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover can reduce the hazard of erosion on construction sites. Bedrock is at a depth of only 40 inches in some areas of the Westmoreland soil. These areas are better suited to dwellings without basements than to dwellings with basements. Reinforcing walls with concrete, supporting the 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 in areas of the Guernsey soil. Cutting and filling increase the hazard of hillside slippage in areas of the Guernsey soil, but installing drains in the seepy areas reduces this hazard. Buildings should be designed so that they conform to the natural slope of the land.

The Westmoreland soil is poorly suited to use as a site for septic tank absorption fields, and the Guernsey soil is generally unsuited. The slope is a limitation on both soils, and the seasonal wetness and the restricted permeability are limitations in areas of the Guernsey soil. Installing leach lines on the contour helps to prevent the surfacing of effluent. Using suitable fill material helps to overcome the limited depth to bedrock in areas of the Westmoreland soil. Perimeter drains can reduce the wetness in areas of the Guernsey soil. Enlarging the absorption field helps to overcome the restricted permeability.

Ponds can be developed in some of the small draws in areas of these soils. The bottom of these draws has a considerable grade, and a high fill is needed to create an impoundment of any size. The soil material is generally good fill if packed well and used under the proper moisture conditions. Layers of porous or shattered rock that permit excessive seepage are on the sides of many draws. Careful onsite investigation is needed to determine the location and depth of these rock layers.

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

WuE2—Westmoreland-Guernsey silt loams, 25 to 40 percent slopes, eroded. These deep, steep soils are on dissected hillsides and benches. Slopes are irregular and have many gullies and landslide scars. Erosion has removed much of the original surface layer. Seeps are common. Most areas are long and narrow and range from 20 to 120 acres in size. They are about 45 percent Westmoreland soil and 35 percent Guernsey soil. The two soils occur as alternating bands across the slope.

The Westmoreland soil is well drained. Typically, the surface layer is dark grayish brown, friable silt loam about 3 inches thick. The subsoil is yellowish brown, friable silt loam and channery silty clay loam about 40 inches thick. The underlying material is brown, friable very channery silt loam about 17 inches thick. Siltstone bedrock is at a depth of about 60 inches.

The Guernsey soil is moderately well drained. Typically, the surface layer is dark grayish brown, friable silt loam about 5 inches thick. The subsoil is about 45 inches thick. The upper part is yellowish brown, friable silty clay loam. The lower part is yellowish brown and grayish brown, mottled, firm silty clay. The underlying material to a depth of 60 inches or more is light gray, firm silty clay loam.

Included with these soils in mapping are small areas of Berks, Rigley, Clarksburg, Omulga, Glenford, Newark, and Lobdell soils. The moderately deep Berks soils and the deep Rigley soils are on the upper part of hillsides. Rigley soils have less clay, more sandstone fragments, and more sand in the subsoil than the Westmoreland and Guernsey soils. The moderately well drained Clarksburg, Omulga, and Glenford soils are on foot slopes. Newark and Lobdell soils are on narrow flood plains and are subject to flooding. Included soils make up about 20 percent of most delineations.

Permeability is moderate in the Westmoreland soil and moderately slow or slow in the Guernsey soil. Runoff is very rapid on both soils. Available water capacity is moderate. The content of organic matter is moderately low in the surface layer. The root zone is deep. A seasonal high water table is perched in the lower part of the subsoil of the Guernsey soil during extended wet periods.

Most areas are wooded. Some areas are used as pasture.

These soils are generally unsuited to cultivated crops and hay because of the slope and a very severe hazard of erosion. Maintaining a permanent plant cover on the surface is the best means of controlling erosion.

These soils are poorly suited to pasture. The slope limits the use of farm equipment. A wide variety of forage plants can be grown, but seeding and applying fertilizer are difficult because of the slope. Frost heave in areas of the Guernsey soil can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover of vegetation on the surface in the fall or including grasses in the seeding mixture can minimize the damage caused by frost heave. If the soils are tilled, the hazard of erosion is very severe. Seeding companion crops, adding mulch, or using no-till seeding methods can reduce the hazard of erosion.

These soils are only moderately suited to timber production. The aspect of the slope affects the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The slope limits the use of planting and logging equipment. Also, the soils have low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. Establishing roads and skid trails on the contour, establishing water bars, and maintaining a vegetative cover help to control erosion. Using planting techniques that spread the roots of seedlings and that increase soil-root contact can reduce the seedling mortality rate in areas of the Guernsey soil. Using seedlings that have been transplanted once or adding mulch can reduce the seedling mortality rate on south-facing slopes. Removing vines and the less desirable trees and shrubs helps to control plant competition.

These soils are generally unsuited to use as sites for buildings or for septic tank absorption fields because of the slope. The seasonal wetness, a hazard of slippage, the restricted permeability, and the high shrink-swell potential of the Guernsey soil also are limitations. Cutting and filling increase the hazard of hillside slippage in areas of the Guernsey soil. Installing subsurface drains in the seepy areas reduces the hazard of slippage.

Ponds can be developed in some of the draws in areas of these soils. The bottom of these draws has a considerable grade, and a high fill commonly is needed to create an impoundment of any size. The soil material generally is good fill if packed and used at the right moisture content. Layers of porous or shattered rock that permit excessive seepage are on the sides of many draws. Onsite investigation is needed to determine the location of these layers.

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

WvD—Westmoreland-Urban land complex, 15 to 35 percent slopes. This map unit consists of areas of Urban land and Westmoreland soil that are intermingled in such an intricate pattern that they cannot be mapped separately. The deep, moderately steep and steep, well drained Westmoreland soil is on dissected hillsides. It is dominant in the open areas. The Urban land consists of areas that are covered by buildings or pavement. Because of the pattern of urban development, most areas of this map unit are rectangular and range in size from 10 to 100 acres. They are about 50 percent Westmoreland soil and 20 percent Urban land.

Typically, the surface layer of the Westmoreland soil is dark brown, friable silt loam about 9 inches thick. The subsoil is about 31 inches thick. The upper part is yellowish brown, friable silty clay loam, channery silty clay loam, and channery silt loam. The lower part is yellowish brown, mottled, friable channery clay loam. The underlying material is brown, mottled, firm very channery clay loam about 20 inches thick. Siltstone bedrock is at a depth of about 60 inches. In some places the surface layer and the subsoil are channery sandy loam.

In the areas of Urban land, the surface is impermeable because of concrete or bituminous pavement and building rooftops. Commonly, a layer of coarse aggregate, crushed limestone, gravel, or sand about 6 to 12 inches thick is beneath the surface. The underlying material is generally highly compacted earthfill or is excavated material weathered from siltstone or shale.

Included in mapping are small areas of Coshocton, Berks, and Guernsey soils. The moderately well drained Coshocton soils are on the lower concave slopes and in coves. The moderately deep Berks soils are on steep slopes. The moderately well drained Guernsey soils are more clayey in the subsoil than the Westmoreland soil. Also included are many areas of the loamy Udorthents that have been graded or excavated to such an extent that soil layers cannot be distinguished. Included areas make up about 30 percent of most delineations.

Permeability is moderate in the Westmoreland soil. Runoff is rapid on the Westmoreland soil. It is very rapid in areas of Urban land. Available water capacity is moderate in the Westmoreland soil. The content of organic matter is moderately low in the surface layer.

Plant growth and water infiltration are restricted in areas of Urban land.

Many areas are used for residential development. Undeveloped areas are used as woodland or pasture.

Open areas of the Westmoreland soil are generally unsuited to cultivation because of the slope and a very severe hazard of erosion. Maintaining a permanent plant cover is the best means of controlling erosion.

Open areas of the Westmoreland soil are poorly suited to pasture. A wide variety of adapted forage plants can be grown, but seeding and applying fertilizer are difficult because of the slope. If the soil is plowed, the hazard of erosion is very severe. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

Open areas of this map unit are only moderately suited to timber production. The aspect of the slope affects the planting and growth of trees. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more available water than other sites because they are less exposed to the sun and prevailing winds. The Westmoreland soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface. The slope limits the use of planting and logging equipment. Establishing roads and skid trails on the contour, establishing water bars, and maintaining a vegetative cover help to control erosion. Using planting techniques that spread the roots of seedlings and that increase soil-root contact can reduce the seedling mortality rate. Using seedlings that have been transplanted once or adding mulch can reduce the seedling mortality rate on south-facing slopes. Removing vines and the less desirable trees and shrubs helps to control plant competition.

Open areas of the Westmoreland soil are poorly suited to use as sites for buildings because of the slope. Erosion on construction sites can be severe. Sites for structures that are built into the side of a hill or bank require less excavation and are better suited than other sites.

The Westmoreland soil is generally unsuited to use as a site for septic tank absorption fields because of the slope. Sanitary facilities should be connected to central sewers if possible, or an aerator or other alternative system should be used.

The suitability of areas of this map unit for ponds is extremely variable. Detailed onsite investigation is needed. Sites below areas of urban development commonly receive more runoff than those below undeveloped areas. The location of a proposed site should be considered when ponds are designed.

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

ZnB—Zanesville silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained and well drained soil is on knolls and in saddles on ridgetops. Slopes are generally smooth and 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 60 inches thick. The upper part is yellowish brown and dark yellowish brown, friable silt loam that is mottled at a depth of more than 23 inches. The next part is a compact fragipan of yellowish brown, mottled, very firm and brittle silt loam and silty clay loam. The lower part of the subsoil is brownish yellow silty clay loam and clay loam. The underlying material to a depth of 80 inches or more is yellowish brown, friable and firm loam and channery loam. In some areas the underlying material has thin layers of silty clay loam and sandy loam. In many areas, the subsoil does not have a fragipan or the fragipan is at a lower depth.

Included with this soil in mapping are areas of Alford, Aaron, Keene, Wellston, and Westgate soils. These soils are in landscape positions similar to those of the Zanesville soil. They do not have a fragipan. They make up about 20 percent of most delineations.

Permeability is moderate above the fragipan in the Zanesville soil and moderately slow or slow in the fragipan. Runoff is medium in cultivated areas. Available water capacity is moderate. The plow layer has a high content of silt and a moderately low content of organic matter. The rooting depth is mainly restricted to the layers above the fragipan. A seasonal high water table is in the lower part of the subsoil during wet periods. The capacity to store and release plant nutrients is moderate. The potential for frost action is high.

This soil is used mainly for cultivated crops. Some areas are used for residential or commercial development.

This soil is well suited to cultivated crops, including specialty crops. The hazard of erosion is moderate in cultivated areas. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Subsurface drains can reduce wetness in scattered areas.

Figure 14.—White pine in an area of Zanesville silt loam, 2 to 6 percent slopes.

This soil is well suited to hay and pasture. The root development of some species is restricted by the fragipan. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover of vegetation on the surface in the fall or seeding a grass-legume mixture can minimize the damage caused by frost heave. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion. Grazing when the surface layer is soft and wet can damage the sod and causes compaction of the surface layer.

This soil is well suited to timber production. No major limitations affect the planting or growth of trees (fig. 14). The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface.

This soil is only moderately suited to use as a site for buildings. Seasonal wetness is the main limitation. Installing drains around footings and coating exterior walls help to prevent wet basements. Backfilling the drains with gravel helps to intercept seepage along the top of the fragipan.

This soil is only moderately suited to use as a site for septic tank absorption fields. The restricted permeability in the fragipan and the seasonal wetness are limitations. Perimeter drains can reduce the wetness by lowering the water table. Enlarging the absorption area or installing a double absorption field system helps to overcome the restricted permeability. Included areas of Alford and Wellston soils are better sites for absorption fields.

There are few natural pond sites. The watershed area is limited because of the ridgetop landscape position of the soil. In some areas the underlying material is suitable for an excavated pond. Other areas have shattered rock. Careful onsite investigation is needed.

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

ZnC2—Zanesville silt loam, 6 to 15 percent slopes, eroded. This deep, strongly sloping, moderately well drained and well drained soil is on knolls and shoulder slopes on ridgetops. Slopes are long and smooth. Erosion has removed part of the original surface layer. Most areas range from 3 to 60 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 41 inches thick. It is mottled. The upper part, to a depth of about 30 inches, is yellowish brown and dark yellowish brown, friable silt loam. The lower part is a compact fragipan of yellowish brown, firm and very firm clay loam. The underlying material to a depth of 80 inches or more is yellowish brown, mottled, firm silty clay loam. In many areas the fragipan is not continuous or is at a lower depth. In other areas the lower part of the subsoil is more clayey.

Included with this soil in mapping are small areas of Alford, Wellston, Keene, Westgate, Gilpin, and Westmoreland soils. Alford, Wellston, Keene, and Westgate soils do not have a fragipan. Narrow bands of Gilpin and Westmoreland soils are on shoulder slopes or knolls. Gilpin soils are moderately deep. Westmoreland soils are more loamy than the Zanesville soil. Included soils make up about 25 percent of most delineations.

Permeability is moderate above the fragipan in the Zanesville soil and moderately slow or slow in the fragipan. Runoff is rapid. Available water capacity is moderate. The content of organic matter is low or moderately low in the surface layer. The rooting depth is mainly restricted to the layers above the fragipan. A seasonal high water table is at a depth of 2 to 3 feet during extended wet periods. The potential to store and release plant nutrients is moderate. The potential for frost action is high.

Most areas are used for cultivated crops or for hay and pasture.

This soil is only moderately suited to cultivated crops. Many areas are significantly eroded, and controlling further erosion is the main management concern. The hazard of erosion is severe in cultivated areas. Improving fertility and conserving moisture also are management concerns. If the soil is cultivated, surface crusting after rains reduces the rate of water infiltration and retards the emergence of seedlings. Using a system of conservation tillage, such as no-till farming, that leaves crop residue on the surface, including grasses and legumes in the cropping system, planting cover crops, tilling on the contour, stripcropping, and establishing grassed waterways reduce the hazard of erosion. Limiting fieldwork when the surface layer and subsoil are too wet helps to minimize compaction. Subsurface drains are beneficial in seepy areas.

This soil is well suited to hay and pasture. The root development of some species is restricted by the fragipan. Frost heave can damage deep-rooted legumes, especially in pure stands. Leaving a protective cover of vegetation on the surface in the fall or including grasses in the seeding mixture can minimize the damage caused by frost heave. If the soil is plowed, the hazard of erosion is moderate. Seeding companion crops, adding mulch, or using no-till seeding methods reduces the hazard of erosion.

This soil is well suited to timber production. No major limitations affect the planting or growth of trees. The soil has low strength when wet and cannot support heavy equipment. Spreading aggregate on haul roads or log landings helps to stabilize the surface.

This soil is only moderately suited to use as a site for buildings. The slope and the seasonal wetness are management concerns. Installing drains around footings and coating exterior basement walls help to prevent wet basements. Backfilling drains with gravel helps to intercept water seeping along the top of the fragipan. Maintaining as much vegetative cover as possible on construction sites helps to control erosion. Buildings should be designed so that they conform to the natural slope of the land.

This soil is poorly suited to use as a site for septic tank absorption fields. The restricted permeability, the seasonal wetness, and the slope are management concerns. Installing the absorption field in suitable fill material, enlarging the field, or using a double field can increase the absorption of effluent. Perimeter drains can be used to lower the seasonal high water table. Laying the leach lines across the slope helps to prevent the surfacing of effluent. Included areas of Alford and Wellston soils are better suited to use as sites for septic tank absorption fields.

Some areas where this soil is on both sides of a small draw have potential as pond sites, but the watershed area commonly is limited on these sites. The upper layers of the soil do not pack well and are poor fill. In some places the lower layers are good fill, but in other places shattered rock is within a depth of 6 feet. Careful onsite investigation is needed.

This soil is recognized as farmland of local importance. The land capability classification is IIIe. The pasture and hayland suitability group is F-3. The woodland ordination symbol is 4A.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

More than 88,000 acres in the survey area, or about 21 percent of the total acreage, meets the soil requirements for prime farmland. Although some of this acreage requires a drainage system or protection from flooding, most of the acreage is currently used for crop production. In Muskingum County, the areas of prime farmland are mainly confined to lacustrine and outwash terraces, the flood plains along major valleys, and the broader ridgetops in the uplands. A small acreage is on benches and narrow ridgetops.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to mining and to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

Prime farmland areas are relatively scarce in Muskingum County. Areas on the flood plains are subject to periodic flooding. Economic losses could result if these lands are converted to urban uses. The soils in glacial lake valleys have poor natural drainage and low strength. These limitations result in design problems if the land in these areas is used for buildings or for sewage disposal systems. Prime farmland in these areas is best used for agricultural production.

An alternative for land developers is the use of reclaimed strip-mine areas. These areas have potential for industrial and residential development. The land surface in some of the reclaimed areas is significantly smoother and flatter than the original surface.

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 and all soils that are frequently flooded during the growing season qualify as prime farmland only in areas where these limitations have been overcome by drainage measures or flood control. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Prime farmland soils that are affected by mining are subject to special reclamation requirements, which are designed to restore the mined areas to their original productivity.

Almost 91,000 acres in Muskingum County, or about 22 percent of the total acreage, does not meet the standards for prime farmland but is considered farmland of local importance. This land may be more susceptible to erosion or flooding or may be wetter or droughtier than prime farmland. The soils in Muskingum County that are considered farmland of local importance are identified in the detailed soil map unit descriptions.