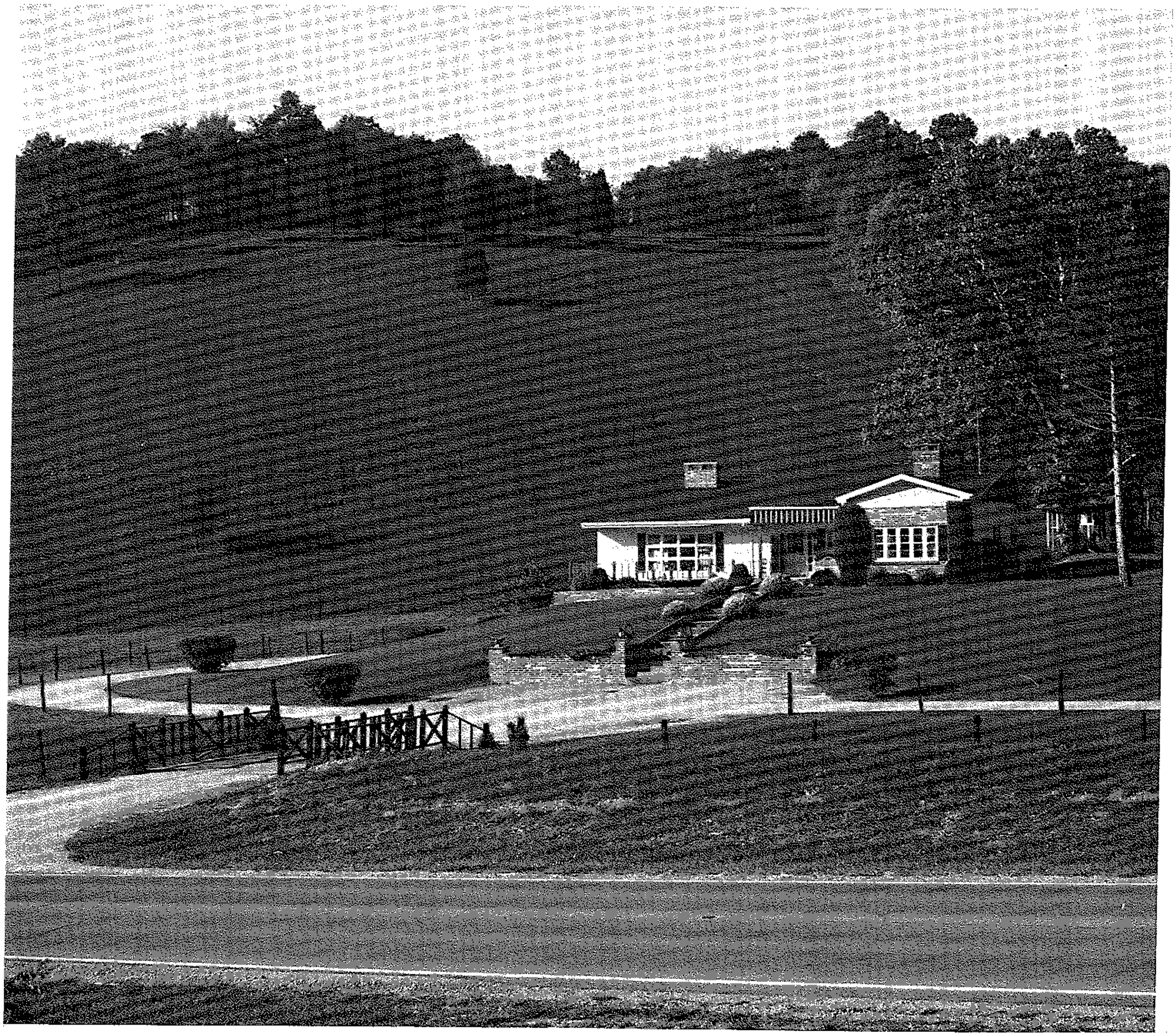
United States Department of Agriculture

Soil Conservation Service

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

Soil Survey of Adams County, Ohio



How To Use This Soil Survey

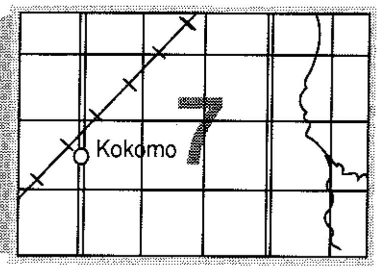
General Soil Map

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

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

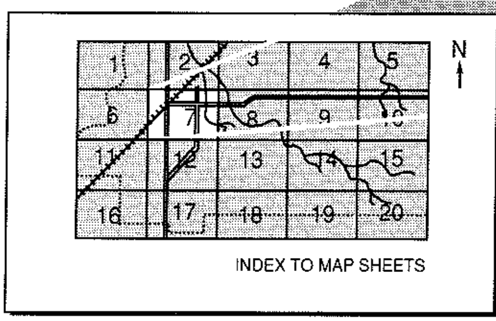
Detailed Soil Maps

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



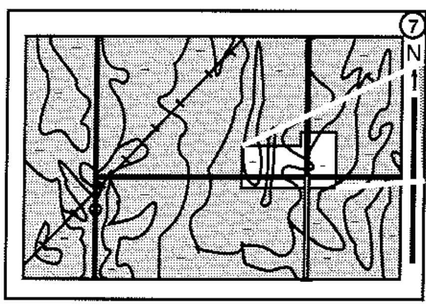
MAP SHEET

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

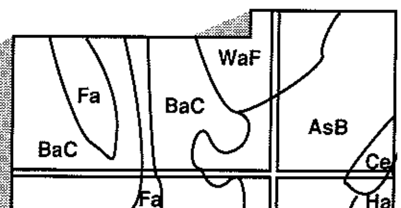


INDEX TO MAP SHEETS

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



MAP SHEET



AREA OF INTEREST

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

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

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

Major fieldwork for this soil survey was completed in 1986. Soil names and descriptions were approved in 1987. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1986. This survey was made cooperatively by the Soil Conservation Service; the Ohio Department of Natural Resources, Division of Soil and Water Conservation; and the Ohio Agricultural Research and Development Center. It was funded in part by the Adams County Commissioners. It is part of the technical assistance furnished to the Adams 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 Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: An area of Eden flaggy silty clay loam, 25 to 40 percent slopes, eroded, which is used mainly as pasture. The home and road are on Elkinsville soils.

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Issued January 1994

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Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Adams County, Ohio. 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 near the surface makes a soil poorly suited to basements or underground installations.

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

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State Conservationist
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Soil Survey of Adams County, Ohio

By T.E. Lucht and D.L. Brown, Ohio Department of Natural Resources, Division of Soil and Water Conservation

Fieldwork by T.E. Lucht, D.L. Brown, and R.T. Trivisonno, Ohio Department of Natural Resources, Division of Soil and Water Conservation

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

Adams County is in the southwestern part of Ohio (fig. 1). It is bordered by the Ohio River on the south. It has an area of 375,872 acres, or about 587 square miles. In 1980, it had a population of 24,328 *(15)*. In that year, West Union, the county seat, had a population of 2,790. The small incorporated villages in the county are Cherry Fork, Manchester, Peebles, Rome, Seaman, and Winchester.

This soil survey updates the survey of Adams County published in 1938 *(9)*. It provides additional information and has larger maps, which show the soils in greater detail.

Figure 1.—Location of Adams County in Ohio.

General Nature of the County

This section gives general information about Adams County. It describes climate; history; physiography, geology, relief, and drainage; farming; transportation facilities; and water supply.

Climate

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

Table 1 gives data on temperature and precipitation for the survey area as recorded at Ripley Experiment Farm in the period 1959 to 1981. Table 2 shows 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.

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 Soils Handbook" of the Soil Conservation Service. The soil survey maps made for conservation planning on individual farms before the start of the project soil survey were among the references used.

Before the fieldwork began, preliminary boundaries of slopes and landforms were plotted stereoscopically on aerial photographs 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 investigate the soils. In areas of the Jessup-Rossmoyne-Cincinnati general soil map unit and other areas where the soil pattern is very complex, the traverses were made at intervals as close as 200 yards. In areas of the steep hillsides in the Shelocta-Berks general soil map unit and in other areas where land use is less intensive, the traverses were made at intervals of about a quarter of a mile.

As the traverses were made, the soil scientists divided the landscape into segments that have different land use patterns and management requirements. For example, a hillside would be separated from a terrace and a gently sloping ridgetop would be separated from a strongly sloping side slope. In most areas soil examinations along the traverses were made at intervals of 100 to 300 yards, depending on the landscape and the soil pattern.

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

Soil mapping was recorded on 1972 photo base maps and was later transferred to film positive mylars of aerial photographs taken in 1982. The drainageways were mapped in the field. Most cultural features were recorded from visual observations, but some were transferred from United States Geological Survey 7½-minute topographic maps.

At the beginning of the survey, sample areas were selected to represent the major landscapes in the county. These areas were mapped at roughly half the rate used in the remainder of the county. Extensive notes were taken on the composition of map units in these preliminary study areas. As mapping progressed, these preliminary notes were modified and a final assessment of the composition of the individual map units was made. Transects were made to determine the composition of some map units, such as the Shelocta-Muse and Shelocta-Berks map units in the unglaciated part of the county.

Samples for chemical analysis, physical analysis, and engineering properties were taken from sites representing several of the soils in the county. 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, Soils and Foundation Section, Columbus, Ohio. A description of the laboratory procedures can be obtained on request from these laboratories. The results of 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 Soil Conservation Service, State Office, Columbus, Ohio.

General Soil Map Units

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

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

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

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

Soils on Unglaciated Uplands

These shallow to deep soils make up about 64 percent of the county. They are moderately well drained and well drained, nearly level to very steep soils on the tops and sides of ridges in the uplands. They are used primarily as woodland, pasture, or cropland. The slope, the hazard of erosion, and a shallow or moderate depth to bedrock are the main limitations.

1. Shelocta-Berks

Deep and moderately deep, moderately steep to very steep, well drained soils formed in colluvium and material weathered from siltstone, sandstone, and shale on uplands

This map unit is on moderately steep to very steep side slopes, in the less sloping areas on narrow ridgetops, and on foot slopes. The side slopes are uneven and have narrow benches. Some areas have active landslips. Stream valleys are generally narrow. Slopes range from 15 to 70 percent.

This map unit makes up about 16 percent of the county. It is about 45 percent Shelocta soils, 30 percent Berks soils, and 25 percent soils of minor extent.

Shelocta soils are deep, well drained, and moderately steep and steep and are on the lower side slopes and foot slopes. They are moderately permeable and have a moderate available water capacity. Berks soils are moderately deep, well drained, and moderately steep to very steep and are on the upper side slopes and ridgetops. They are moderately permeable or moderately rapidly permeable and have a very low available water capacity.

The most extensive minor soils in this map unit are Latham, Tilsit, Wernock, and Skidmore soils. Latham soils have more clay throughout than the major soils, Tilsit soils have more silt in the upper part, and Wernock soils have fewer coarse fragments throughout. Latham, Tilsit, and Wernock soils are on ridgetops. Skidmore soils formed in alluvium on narrow flood plains.

Most of this map unit is used as woodland. Buildings and local roads are generally confined to the ridgetops and stream valleys. Some of the wider, less sloping ridgetops are used as cropland or pasture. The soils on ridgetops are moderately well suited to cropland and some urban uses and are well suited to pasture and woodland. The steeper soils on side slopes are generally unsuited to cropland, pasture, and most urban uses. They are moderately well suited to woodland.

The slope and a severe or very severe hazard of erosion on both soils and the moderate depth to bedrock in the Berks soils are the major limitations. The north- and east-facing slopes are better sites for woodland than south- and west-facing slopes because of less evapotranspiration and cooler temperatures.

2. Shelocta-Muse

Deep, moderately steep and steep, well drained soils formed in colluvium weathered from sandstone, siltstone, and shale on uplands

This map unit is on uneven foot slopes and side slopes and in the less sloping areas on narrow benches. There are numerous active landslips. Stream valleys and ridgetops are generally narrow. Slopes range from 15 to 50 percent.

This map unit makes up about 11 percent of the county. It is about 45 percent Shelocta soils, 30 percent Muse soils, and 25 percent soils of minor extent.

Shelocta and Muse soils are deep, well drained, and moderately steep and steep and are on foot slopes and side slopes. Shelocta soils are moderately permeable and are dominantly on the upper two-thirds of colluvial foot slopes and on side slopes. Muse soils are slowly permeable and are dominantly on the lower one-third of colluvial foot slopes. The available water capacity is moderate in both soils.

The most extensive minor soils in this map unit are Berks, Trappist, Latham, Nolin, and Skidmore soils. The moderately deep Berks soils are on steep and very steep side slopes. Trappist soils and the moderately well drained Latham soils are on the less sloping ridgetops and benches. Nolin and Skidmore soils formed in alluvium on flood plains.

Most of this map unit is used as woodland. Some of the less sloping areas are used for pasture and hay. The moderately steep soils are well suited to pasture and are moderately well suited to hay. They are poorly suited to row crops and most urban uses. The steep soils are generally unsuited to row crops and most urban uses and are poorly suited to pasture. This map unit is well suited or moderately well suited to woodland.

The slope and a severe hazard of erosion on both soils and the slow permeability in the Muse soils are the major limitations. The north- and east-facing slopes are better sites for woodland than the south- and west-facing slopes because of less evapotranspiration and cooler temperatures.

3. Opequon-Bratton

Shallow and moderately deep, gently sloping to very steep, well drained soils formed in loess and material weathered from limestone on uplands

This map unit is on undulating ridgetops, shoulder slopes, and side slopes. Slopes range from 2 to 60 percent.

This map unit makes up about 20 percent of the county. It is about 35 percent Opequon soils, 30 percent Bratton soils, and 35 percent soils of minor extent.

Opequon soils are shallow, well drained, and strongly sloping to very steep and are on shoulder slopes and side slopes. They are moderately permeable or moderately slowly permeable. They have a very low available water capacity and a high shrink-swell potential. Bratton soils are moderately deep, well drained, and gently sloping and strongly sloping and are on ridgetops and shoulder slopes. They are moderately slowly permeable in the subsoil and rapidly permeable in the substratum. They have a low available water capacity and a moderate shrink-swell potential.

The most extensive minor soils in this map unit are Brushcreek, Lawshe, Crider, and Nicholson soils. Brushcreek and Lawshe soils are deep and are on colluvial foot slopes. Crider and Nicholson soils are on ridgetops. Crider soils have less clay than the major soils. Nicholson soils have a fragipan.

Most of this map unit is used as pasture, hayland, or woodland. Some areas are used as cropland or are abandoned cropland.

The Bratton soils are well suited, moderately well suited, or poorly suited to cropland; well suited or moderately well suited to pasture; and well suited to woodland. They are moderately well suited, poorly suited, or generally unsuited to most urban uses. The moderately steep to very steep Opequon soils are generally unsuited to cropland and most urban uses, poorly suited or generally unsuited to pasture, and poorly suited to woodland. The strongly sloping Opequon soils are poorly suited to cropland and are moderately well suited to pasture and woodland. They are generally unsuited to most urban uses.

The slope, hazard of erosion, depth to bedrock, and moderately slow permeability in areas of both soils and the high shrink-swell potential in the Opequon soils are the major limitations.

4. Faywood-Eden

Moderately deep, strongly sloping to very steep, well drained soils formed in material weathered from limestone and calcareous shale on uplands

This map unit is on steep and very steep side slopes and strongly sloping and moderately steep, narrow ridgetops. Stream valleys are generally narrow. Slopes range from 8 to 70 percent.

This map unit makes up about 15 percent of the county. It is about 60 percent Faywood soils, 30 percent Eden soils, and 10 percent soils of minor extent.

Faywood soils are moderately deep, well drained, and strongly sloping and moderately steep and are on ridgetops and side slopes. They are moderately slowly permeable or slowly permeable and have a low available water capacity and a moderate shrink-swell potential. Eden soils are moderately deep, well drained, and steep and very steep and are on side slopes. They are slowly permeable and have a low available water capacity.

The most extensive minor soils in this map unit are Nolin, Elkinsville, and Aaron soils. Nolin and Elkinsville soils have more silt in the upper part than the major soils. Nolin soils are on flood plains. Elkinsville soils are on terraces. Aaron soils are moderately well drained. They are on uplands.

Most of this map unit is used as woodland. The ridgetops, however, are more commonly used as cropland or pasture.

The Faywood soils are moderately well suited or poorly suited to cropland and most urban uses, well suited or moderately well suited to pasture, and well suited to woodland. The steep and very steep Eden soils are generally unsuited to cropland and urban uses, poorly suited or generally unsuited to pasture, and moderately well suited to woodland.

The slope, the hazard of erosion, the shrink-swell potential, the slow or moderately slow permeability, and the depth to bedrock are the major limitations.

5. Aaron-Lowell

Deep, nearly level to strongly sloping, moderately well drained and well drained soils formed in material weathered from limestone, siltstone, and calcareous shale on uplands

This map unit is on flats and ridgetops. Areas along streams are dissected. Stream valleys are generally narrow. Slopes range from 0 to 15 percent.

This map unit makes up about 2 percent of the county. It is about 55 percent Aaron soils, 35 percent Lowell soils, and 10 percent soils of minor extent.

Aaron soils are deep, moderately well drained, and nearly level and gently sloping and are on upland flats. They are slowly permeable and have a moderate available water capacity and a moderate shrink-swell potential. They have a seasonal high water table between depths of 18 and 36 inches during extended wet periods. Lowell soils are deep, well drained, and gently sloping and strongly sloping and are on upland ridgetops. They are moderately slowly permeable and have a moderate available water capacity and a moderate shrink-swell potential.

The most extensive minor soils in this map unit are Faywood, Nicholson, and Nolin soils. The moderately deep Faywood soils are on side slopes along streams. Nicholson soils have a fragipan. They are on uplands. Nolin soils have more silt in the lower part than the major soils. They are on narrow flood plains.

Most areas of the map unit are used as cropland. The nearly level and gently sloping Aaron and Lowell soils are well suited to row crops, pasture, hay, and woodland. The strongly sloping Lowell soils are moderately well suited to row crops and are well suited to pasture, hay, and woodland. This map unit is moderately well suited to building site development and to some other urban uses.

Seasonal wetness, the moderate shrink-swell potential, the depth to bedrock, and the slow or moderately slow permeability are the major limitations. The slope and a severe hazard of erosion in areas of the strongly sloping Lowell soils also are limitations.

Soils on Illinoian Till Plains

These deep soils make up about 26 percent of the county. They are well drained, moderately well drained, and somewhat poorly drained, nearly level to steep soils on side slopes and in other areas on till plains in the glaciated uplands. They are used primarily as cropland or pasture. The slope, the hazard of erosion, seasonal wetness, slow or moderately slow permeability, and a moderate or high shrink-swell potential are the major limitations.

6. Jessup-Rossmoyne-Cincinnati

Deep, nearly level to steep, well drained and moderately well drained soils formed in loess, glacial till, and material weathered from calcareous shale and limestone on uplands

This map unit is on broad, nearly level to gently sloping uplands near the strongly sloping to steep side slopes of stream valleys on the Illinoian till plain. The stream valleys are generally narrow. Slopes range from 1 to 35 percent.

This map unit makes up about 20 percent of the county. It is about 35 percent Jessup soils, 20 percent Rossmoyne soils, 10 percent Cincinnati soils, and 35 percent soils of minor extent.

Jessup soils are deep, well drained, and gently sloping to steep and are on narrow uplands and side slopes in the uplands. Permeability is slow, and the available water capacity is moderate. The shrink-swell potential also is moderate. Rossmoyne soils are deep, moderately well drained, and gently sloping and are on broad glacial till plains. They have a fragipan. Permeability is moderately slow or slow in the fragipan and moderate above the fragipan. The available water capacity is low above the fragipan. A seasonal high water table is between depths of 18 and 36 inches during extended wet periods. The shrink-swell potential is moderate. Cincinnati soils are deep, well drained, and gently sloping and strongly sloping and are on side slopes and in other areas on glacial till plains. They have a fragipan. Permeability is moderately slow or slow in the fragipan and moderate above the fragipan. The available water capacity is moderate. The shrink-swell potential also is moderate.

The most extensive minor soils in this map unit are

Avonburg, Loudon, Faywood, Eden, and Gessie soils. The somewhat poorly drained Avonburg soils are on nearly level flats. Loudon soils have more clay in the upper part than the major soils. They are on uplands. The moderately deep Faywood and Eden soils are on strongly sloping to steep side slopes. Gessie soils have more silt and sand in the subsoil than the major soils. They are on narrow flood plains.

Most of this map unit is used as cropland. The Rossmoyne and Cincinnati soils and the nearly level to strongly sloping Jessup soils are well suited or moderately well suited to cropland and woodland and are well suited to pasture. They are moderately well suited to building site development and to some other urban uses. The moderately steep and steep Jessup soils are poorly suited or generally unsuited to cropland and urban uses, moderately well suited or poorly suited to pasture, and well suited to woodland.

The slope, the hazard of erosion, seasonal wetness, the slow or moderately slow permeability, and the moderate shrink-swell potential are the major limitations.

7. Rossmoyne-Avonburg

Deep, nearly level and gently sloping, moderately well drained and somewhat poorly drained soils formed in loess and in the underlying glacial till on till plains

This map unit is on nearly level and gently sloping, broad flats on the Illinoian till plain. Slopes range from 0 to 6 percent.

This map unit makes up about 2 percent of the county. It is about 45 percent Rossmoyne soils, 20 percent Avonburg soils, and 35 percent soils of minor extent.

Rossmoyne soils are deep, moderately well drained, and nearly level and gently sloping and are on broad glacial till plains. They have a fragipan. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. The available water capacity is low above the fragipan. A seasonal high water table is between depths of 18 and 36 inches during extended wet periods. The shrink-swell potential is moderate. Avonburg soils are deep, somewhat poorly drained, and nearly level and are along drainageways on till plains. They have a fragipan. They are moderately permeable above the fragipan and very slowly permeable in the fragipan. The available water capacity is moderate above the fragipan. A seasonal high water table is between depths of 12 and 36 inches during extended wet periods. The shrink-swell potential is moderate.

The most extensive minor soils in this map unit are Cincinnati, Jessup, and Faywood soils. The well drained Cincinnati soils are in landscape positions similar to those of the Rossmoyne soils. Jessup soils are well drained and are in the higher positions on the till plains. They have more clay in the subsoil than the major soils. The moderately deep Faywood soils are in the more sloping areas along drainageways.

Most of this map unit is used as cropland. The major soils are generally well suited to cropland, pasture, and woodland. They are moderately well suited or poorly suited to urban uses. The Rossmoyne soils are better suited to urban uses than the Avonburg soils.

Seasonal wetness, the moderately slow or very slow permeability, and the moderate shrink-swell potential are the major limitations.

8. Jessup-Loudon

Deep, nearly level to steep, well drained and moderately well drained soils formed in loess, glacial till, and clayey material weathered from limestone and calcareous shale on uplands

This map unit is on nearly level to gently sloping uplands and strongly sloping to steep side slopes. Slopes range from 0 to 35 percent.

This map unit makes up about 4 percent of the county. It is about 40 percent Jessup soils, 30 percent Loudon soils, and 30 percent soils of minor extent.

The deep, well drained Jessup soils are on gently sloping uplands and the strongly sloping to steep side slopes dissecting the uplands. Loudon soils are deep, moderately well drained, and nearly level and gently sloping and are on uplands. Both soils are slowly permeable and have a moderate available water capacity. A seasonal high water table is between depths of 24 and 42 inches in the Loudon soils during extended wet periods. Both soils have a moderate shrink-swell potential.

The most extensive minor soils in this map unit are Rossmoyne, Cincinnati, Faywood, Eden, and Nolin soils. Cincinnati and Rossmoyne soils have a fragipan. They are in landscape positions similar to those of the Loudon soils. The moderately deep Faywood and Eden soils are on side slopes. Nolin soils have more silt in the subsoil than the major soils. They are on flood plains.

The less sloping areas on uplands are used dominantly as cropland. The side slopes are used dominantly as pasture or woodland. The Loudon soils and the gently sloping Jessup soils are well suited to cropland, pasture, and woodland. They are moderately well suited to building site development and to some other urban uses. The strongly sloping to steep Jessup soils are well suited to woodland; moderately well suited, poorly suited, or generally unsuited to cropland; and moderately well suited or poorly suited to pasture.

They are moderately well suited, poorly suited, or generally unsuited to urban uses.

The slope, the hazard of erosion, the slow permeability, seasonal wetness, and the moderate shrink-swell potential are the major limitations.

Soils on Valley Fills, Stream Terraces, and Flood Plains

These deep soils make up about 10 percent of the county. They are well drained, moderately well drained, and somewhat poorly drained, nearly level to strongly sloping soils in preglacial valleys and on terraces and flood plains. They are used dominantly as cropland or pasture. Flooding, seasonal wetness, moderately slow or very slow permeability, a moderate or high shrink-swell potential, the slope, and erosion are the major limitations.

9. Licking-Otwell-McGary Variant

Deep, nearly level to strongly sloping, moderately well drained and somewhat poorly drained soils formed in loess, old alluvium, and lacustrine sediments on terraces and in lake basins

This map unit is in nearly level to strongly sloping areas in the valleys of abandoned preglacial drainage systems. The valleys are 0.5 to 1.0 mile across. Slopes range from 0 to 15 percent.

This map unit makes up about 2 percent of the county. It is about 40 percent Licking soils, 15 percent Otwell soils, 15 percent McGary Variant soils, and 30 percent soils of minor extent.

Licking and Otwell soils are deep, moderately well drained, and gently sloping and strongly sloping and are on knolls and side slopes. Permeability is slow in the Licking soils. The Otwell soils have a fragipan. Permeability is moderately slow above the fragipan and very slow in the fragipan. The available water capacity is moderate in both soils. Both have a seasonal high water table between depths of 24 and 42 inches during extended wet periods. The shrink-swell potential is high in the Licking soils and moderate in the Otwell soils. McGary Variant soils are deep, somewhat poorly drained, and nearly level and are along drainageways. Permeability is slow or very slow in the subsoil and moderately rapid in the substratum. A seasonal high water table is within a depth of 12 inches during extended wet periods. The shrink-swell potential is high.

The most extensive minor soils in this map unit are Brushcreek, Skidmore, and Nolin soils. Brushcreek soils are on foot slopes. The well drained Skidmore soils are on alluvial fans. They have a higher content of coarse fragments in the subsoil than the major soils. The well drained Nolin soils are on flood plains. They have more silt in the subsoil than the major soils.

Most of this map unit is used as cropland or pasture. The Licking and Otwell soils are well suited, moderately well suited, or poorly suited to cropland; well suited or moderately well suited to pasture; and well suited to woodland. They are moderately well suited to building site development and to some other urban uses. If drained, the McGary Variant soils are well suited to cropland. They also are well suited to pasture and woodland. They are generally unsuited to building site development and to most other urban uses.

Flooding on the McGary Variant soils, seasonal wetness, the moderately slow or very slow permeability, and the moderate or high shrink-swell potential are the major limitations. The slope and a severe hazard of erosion in areas of the strongly sloping Licking and Otwell soils also are limitations.

10. Elkinsville-Sciotoville

Deep, nearly level and gently sloping, well drained and moderately well drained soils formed in old alluvium on terraces

This map unit is on terraces along the Ohio River. It is in relatively narrow areas that are roughly parallel to the river. Slopes range from 1 to 6 percent.

This map unit makes up about 2 percent of the county. It is about 60 percent Elkinsville soils, 15 percent Sciotoville soils, and 25 percent soils of minor extent.

Elkinsville soils are deep and well drained and are in nearly level and gently sloping areas. Permeability is moderate. The available water capacity is high. The shrink-swell potential is moderate. Sciotoville soils are deep and moderately well drained and are in nearly level and gently sloping areas. They have a fragipan. Permeability is moderate above the fragipan and slow or moderately slow in the fragipan. The available water capacity is moderate. A seasonal high water table is between depths of 18 and 36 inches during extended wet periods.

The most extensive minor soils in this map unit are Otwell, Peoga, Plainfield, and Nolin soils. Otwell soils are on the higher terraces. They have a fragipan. The poorly drained Peoga soils are in depressional areas. Plainfield soils are more sandy throughout than the major soils. They are on slight rises. Nolin soils are characterized by less subsoil development than the major soils. They are on flood plains.

Most of this map unit is used as cropland or pasture. The major soils are well suited to cropland, pasture, and woodland. They are well suited, moderately well suited, or poorly suited to most urban uses. The

Elkinsville soils are better suited to urban uses than the Sciotoville soils.

Seasonal wetness and the slow or moderately slow permeability in the Sciotoville soils and the moderate shrink-swell potential in the Elkinsville soils are the major limitations. The hazard of erosion on both soils also is a management concern.

11. Nolin-Gessie

Deep, nearly level, well drained soils formed in recent alluvium on flood plains

This map unit is on relatively narrow flood plains. The soils are subject to flooding. Slopes range from 0 to 3 percent.

This map unit makes up about 6 percent of the county. It is about 65 percent Nolin soils, 10 percent Gessie soils, and 25 percent soils of minor extent.

Nolin and Gessie soils are deep, well drained, and nearly level and are on flood plains. Permeability is moderate or moderately rapid in the Nolin soils and moderate in the Gessie soils. The available water capacity is high in both soils. The Nolin soils are occasionally flooded, and the Gessie soils are frequently flooded.

The most extensive minor soils in this map unit are Omulga, Otwell, Williamsburg, Licking, and Sardinia soils. All of these soils are characterized by more subsoil development than the major soils. Also, Omulga and Otwell soils have a fragipan. Licking, Omulga, Sardinia, and Williamsburg soils are on terraces. Otwell soils are in lake basins.

Most of this map unit is used as cropland or pasture. The major soils are well suited to cropland, pasture, and woodland. They are generally unsuited to urban uses. Flooding is the major hazard affecting most uses. Surface crusting also is a management concern in areas where the soils are used as cropland.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases.* Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Bratton silt loam, 2 to 8 percent slopes, is a phase of the Bratton series.

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

A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Brushcreek-Lawshe complex, 12 to 25 percent slopes, eroded, is an example.

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

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

This survey includes *miscellaneous areas.* Such areas have little or no soil material and support little or no vegetation. Pits, quarry, 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.

Some soil boundaries and soil names in this survey do not fully match those in previously published surveys of adjoining counties. Most differences result from a better knowledge of soils or from modification and refinement of series concepts. Some differences result from variations in the dominance of different soils in map units consisting of soils of two or more series and from variations in the range in slope allowed in the map units in different surveys.

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

Soil Descriptions

AaA—Aaron silt loam, 0 to 2 percent slopes. This deep, nearly level, moderately well drained soil is in the uplands. Most areas are smooth and are characterized by little undulation. They are irregularly shaped and range from 25 to more than 500 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, firm silty clay loam. The lower part is yellowish brown, mottled, firm silty clay and clay. The substratum is yellowish brown, mottled, firm silty clay about 10 inches thick. Limestone bedrock is at a depth of about 58 inches. In some areas the soil is well drained.

Included with this soil in mapping are small areas of Nicholson soils on slight rises. These soils have a fragipan. They make up about 15 percent of most mapped areas.

Permeability is slow in the Aaron soil. The root zone is deep. The available water capacity is moderate. Runoff is slow. The organic matter content is moderate in the surface layer. A seasonal high water table is between depths of 18 and 36 inches during extended wet periods.

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

This soil is well suited to corn, soybeans, and small grain and can be cropped intensively. The seasonal wetness and maintenance of tilth are the main management concerns. Randomly spaced subsurface drains are needed to remove excess water in some areas. No-till cropping systems or other kinds of conservation tillage minimize crusting and improve tilth.

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

This soil is well suited to trees. The trees can be logged when the soil is frozen or during the drier parts of the year.

This soil is moderately well suited to building site development. The seasonal wetness and a moderate shrink-swell potential are limitations on sites for dwellings. The soil is better suited to dwellings without basements than to dwellings with basements. Waterproofing basement walls and installing drains at the base of footings help to prevent wetness in basements. The adverse effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete and by backfilling around foundations with material that has a low shrink-swell potential.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and the slow permeability. Installing perimeter drains around the absorption fields lowers the seasonal high water table. Installing the fields in suitable fill material or increasing the size of the fields helps to overcome the restricted permeability.

The damage to local roads and streets caused by low strength and frost action can be prevented by installing a drainage system and by providing suitable base material.

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

AaB—Aaron silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is in the uplands. Most slopes are uniform. Most areas are irregularly shaped and range from 15 to more than 400 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 38 inches thick. The upper part is yellowish brown, firm silty clay. The lower part is yellowish brown, mottled, firm silty clay and clay. Interbedded shale and limestone bedrock is at a depth of about 45 inches. In some areas the soil is well drained.

Included with this soil in mapping are small areas of Nicholson soils on slight rises. These soils have a fragipan. They make up about 15 percent of most mapped areas.

Permeability is slow in the Aaron soil. The root zone is deep. The available water capacity is moderate. Runoff is medium. The organic matter content is moderate in the surface layer. A seasonal high water table is between depths of 18 and 36 inches during extended wet periods.

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

This soil is well suited to corn, soybeans, and small grain. It can be cropped frequently, but erosion is a moderate hazard. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Grassed waterways, contour farming, meadow crops, and cover crops also help to control erosion.

This soil is well suited to grasses and legumes for pasture and hay. Controlling erosion and maintaining stands of the key forage species are management concerns. Overgrazing or grazing when the soil is wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

This soil is well suited to trees. The trees can be logged when the soil is frozen or during the drier parts of the year.

This soil is moderately well suited to building site development. The seasonal wetness and a moderate shrink-swell potential are limitations on sites for dwellings. The soil is better suited to dwellings without basements than to dwellings with basements. Waterproofing basement walls and installing drains at the base of footings help to prevent wetness in basements. The adverse effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete and by backfilling around foundations with material that has a low shrink-swell potential.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and the slow permeability. Installing perimeter drains around the absorption fields lowers the seasonal high water table. Installing the fields in suitable fill material or increasing the size of the fields helps to overcome the restricted permeability.

The damage to local roads and streets caused by low strength and frost action can be minimized by providing suitable base material.

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

AvA—Avonburg silt loam, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil is on till plains. Most slopes are uniform. Most areas are irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 11 inches thick. The subsurface layer is yellowish brown, mottled, friable silt loam about 5 inches thick. The subsoil is about 58 inches thick. The upper part is a fragipan of yellowish brown, mottled, firm and very firm, brittle silty clay loam. The lower part is light olive brown and yellowish brown, mottled, firm clay loam.

Included with this soil in mapping are small areas of the moderately well drained Rossmoyne soils on slight rises. Also included are small areas of soils that do not have a fragipan. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate above the fragipan in the Avonburg soil and very slow in the fragipan. The rooting depth is restricted mainly to the 16- to 36-inch zone above the fragipan. The available water capacity is moderate. Runoff is slow. The organic matter content is moderately low in the surface layer. A perched seasonal high water table is between depths of 12 and 36 inches during extended wet periods.

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

If drained, this soil is well suited to corn, soybeans, and small grain and can be cropped intensively. The seasonal wetness is the main management concern. It delays spring planting in most years. Excess water is commonly removed by surface and subsurface drains. Subsurface drains are more effective if they are installed above the very slowly permeable fragipan. The soil is subject to surface crusting after hard rains. No-till cropping systems or other kinds of conservation tillage minimize crusting and improve tilth.

This soil is well suited to grasses and legumes for hay and pasture but is poorly suited to grazing early in the spring. Grazing when the soil is wet causes compaction. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. The species selected for planting should be those that are tolerant of wetness. Selecting seedlings that have been transplanted once reduces the seedling mortality rate. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced can reduce the windthrow hazard.

This soil is poorly suited to building site development. The seasonal wetness is a limitation on sites for dwellings. Waterproofing basement walls and installing drains at the base of footings help to prevent wetness in basements.

This soil is poorly suited to septic tank absorption fields. The seasonal wetness and the very slow permeability are limitations. Installing perimeter drains around the absorption fields lowers the seasonal high water table. Increasing the size of the absorption fields and mounding the absorption fields help to overcome the restricted permeability.

Low strength and the potential for frost action can result in damage to local roads and streets. Installing a drainage system and providing suitable base material help to prevent this damage.

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

BkD—Berks silt loam, 15 to 25 percent slopes. This moderately deep, moderately steep, well drained soil is on the tops of ridges in the uplands. Most slopes are uniform. 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 subsoil is yellowish brown, friable channery and very channery silt loam about 31 inches thick. Siltstone bedrock is at a depth of about 36 inches. In some areas the subsoil has a lower content of coarse fragments.

Included with this soil in mapping are small areas of the deep Shelocta soils on side slopes. These soils make up about 15 percent of most mapped areas.

Permeability is moderate or moderately rapid in the Berks soil. The root zone is moderately deep. The available water capacity is very low. Runoff is rapid. The organic matter content is moderately low in the surface layer.

Most areas are wooded. Some areas have been cleared and are used as hayland or pasture.

This soil is poorly suited to corn, soybeans, and small grain because of the very low available water capacity, the slope, and a severe hazard of erosion. No-till cropping systems or other kinds of conservation tillage, grassed waterways, contour stripcropping, a cropping system that includes meadow crops, cover crops, and incorporation of crop residue into the soil help to control erosion and runoff.

This soil is moderately well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes compaction. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

This soil is moderately well suited to trees. Constructing logging roads and skid trails on the contour facilitates the use of equipment. Selecting seedlings that have been transplanted once or mulching around seedlings reduces the seedling mortality rate. Coves and north- and east-facing slopes are better sites for woodland than south- and west-facing slopes because of less evaporation and cooler temperatures, both of which result from less exposure to the drying effects of the prevailing wind and the sun.

This soil is poorly suited to building site development because of the slope and the bedrock at a depth of 20 to 40 inches. Buildings should be designed so that they conform to the natural slope of the land. The bedrock limits excavation, but it is commonly rippable. Erosion is a hazard on construction sites, but it can be controlled by removing as little vegetation as possible, mulching, and establishing a temporary plant cover.

This soil is poorly suited to septic tank absorption fields because of the slope and the bedrock at a depth of 20 to 40 inches. Installing the leach lines on the contour minimizes lateral seepage of the effluent. The filtering capacity can be improved by installing the absorption fields in suitable fill material.

Building local roads and streets on the contour and seeding road cuts help to control erosion.

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

BnB—Bratton silt loam, 2 to 8 percent slopes. This moderately deep, gently sloping, well drained soil is on the tops of ridges in the uplands. Most slopes are uniform. Areas are elongated and range from 5 to more than 100 acres in size.

Typically, the surface layer is yellowish brown, friable silt loam about 8 inches thick. The subsoil is about 25 inches thick. The upper part is strong brown, friable silt clay loam; the next part is yellowish red, firm silty clay and clay; and the lower part is strong brown, firm clay. The substratum is brownish yellow and pale yellow, friable sandy loam about 2 inches thick. Limestone bedrock is at a depth of about 35 inches. In some areas the soil is deeper over bedrock.

Included with this soil in mapping are small areas of the shallow Opequon soils along drainageways. Also included are numerous sinkholes about 20 feet across and 10 to 15 feet deep. Inclusions make up about 15 percent of most mapped areas.

Permeability is moderately slow in the subsoil of the Bratton soil and rapid in the thin substratum above the bedrock. The root zone is moderately deep. The available water capacity is low. Runoff is medium. The organic matter content is moderately low in the surface layer.

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

This soil is well suited to corn, soybeans, and small grain. Control of erosion and maintenance of tilth and the organic matter content are the major management concerns. The hazard of erosion is moderate in cultivated areas. The surface layer crusts after hard rains. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Contour farming, winter cover crops, grassed waterways, and incorporation of crop residue into the soil help to control erosion, maintain the content of organic matter, and minimize crusting.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

This soil is well suited to trees (fig. 2). Frequent, light thinning and harvesting increase the vigor of the stand and reduce the windthrow hazard.

This soil is moderately well suited to building site development. The bedrock at a depth of 20 to 40 inches and a moderate shrink-swell potential are limitations on sites for dwellings, especially dwellings with basements. The soil is better suited to dwellings without basements than to dwellings with basements. The adverse effects

Figure 2.—A wooded area of Bratton silt loam, 2 to 8 percent slopes.

of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by extending foundations to the bedrock, and by backfilling around the foundations with material that has a low shrink-swell potential.

This soil is poorly suited to septic tank absorption fields. The bedrock at a depth of 20 to 40 inches, the hazard of ground-water pollution caused by inadequate filtration of the effluent, and the moderately slow permeability are severe limitations. Installing the absorption fields in suitable fill material elevates the fields a sufficient distance above the bedrock and improves the filtering capacity. The moderately slow permeability is not very restrictive in the absorption fields.

The damage to local roads and streets caused by low strength can be prevented by providing suitable base material.

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

BrC2—Bratton-Opequon complex, 8 to 15 percent slopes, eroded. These strongly sloping, well drained soils are on shoulder slopes in the uplands. The Bratton soil is moderately deep, and the Opequon soil is shallow. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Slopes are typically uneven and are dissected by minor drainageways. Most areas range from 5 to 50 acres in size and are irregularly shaped. They are about 45 percent Bratton soil and 40 percent Opequon soil. The two soils occur in a random pattern as areas so intricately mixed that mapping them separately was not practical.

Typically, the Bratton soil has a surface layer of yellowish brown, friable silt loam about 5 inches thick. The subsoil is about 28 inches thick. It is strong brown, firm silty clay in the upper part and reddish brown, firm clay in the lower part. Limestone bedrock is at a depth of about 33 inches. In some areas the soil is deeper over bedrock.

Typically, the Opequon soil has a surface layer of dark yellowish brown, friable silty clay loam about 7 inches thick. The subsoil is yellowish red and reddish brown, firm clay about 12 inches thick. Limestone bedrock is at a depth of about 19 inches. Some areas have sinkholes.

Included with these soils in mapping are small areas of the deep Crider soils on the less sloping parts of the landscape. Also included, on the upper part of the slopes, are some areas of severely eroded soils that have a surface layer of silty clay in which tilth is poor. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately slow in the upper part of the subsoil in the Bratton soil and rapid in the lower part, directly above the bedrock. It is moderate or moderately slow in the Opequon soil. The root zone is moderately deep in the Bratton soil and shallow in the Opequon soil. The available water capacity is low in the Bratton soil and very low in the Opequon soil. Runoff is rapid on both soils. The organic matter content is moderately low in the surface layer. The shrink-swell potential is moderate in the Bratton soil and high in the Opequon soil.

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

These soils are poorly suited to corn, soybeans, and small grain. The hazard of erosion is severe in cultivated areas. The soils can be planted to corn, soybeans, and small grain about one-third of the time if conservation practices are used. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Including grasses and legumes in the cropping system and using crop residue as mulch help to control erosion and maintain tilth and the organic matter content. Grassed waterways help to prevent gully erosion in areas where runoff concentrates. Cover crops and contour stripcropping help to control erosion.

These soils are moderately well suited to grasses and legumes for hay and pasture. If the soils are plowed during seedbed preparation or the pasture is overgrazed, erosion is a severe hazard. No-till seeding, cover crops, or companion crops during periods when seedlings are becoming established help to control erosion. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to control erosion and maintain stands of the key forage species. The slope limits the use of equipment in some areas. Maintaining stands of deep-rooted legumes is difficult because of the restricted root zone.

The Bratton soil is well suited to trees, and the Opequon soil is moderately well suited. Selecting seedlings that have been transplanted once or mulching can reduce the seedling mortality rate on the Opequon soil. Harvesting procedures that do not leave the remaining trees widely spaced can reduce the windthrow hazard on both soils. The clayey texture in the subsoil of the Opequon soil limits the use of wheeled planting, mowing, spraying, and logging equipment. Tracked equipment can be used. The hazard of erosion on the Opequon soil can be reduced by constructing logging roads and skid trails on or nearly on the contour, establishing water bars, or establishing a plant cover.

These soils are generally unsuitable as sites for buildings and septic tank absorption fields because of the depth to bedrock, the shrink-swell potential, the moderately slow or moderate permeability, and low strength. Because it is deeper over bedrock and has a lower shrink-swell potential, the Bratton soil is better suited to these uses than the Opequon soil.

The land capability classification is IVe. The woodland ordination symbol is 4D in areas of the Bratton soil and 3C in areas of the Opequon soil. The pasture and hayland suitability group is F-1 in areas of the Bratton soil and E-1 in areas of the Opequon soil.

BsC2—Brushcreek silt loam, 6 to 12 percent slopes, eroded. This deep, strongly sloping, moderately well drained soil is on foot slopes below very steep hillsides in the uplands. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Seeps are in a few areas. Slopes are uneven. Most areas are long and narrow and range from 10 to 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 27 inches thick. The upper part is yellowish brown, firm silty clay loam and silty clay, and the lower part is yellowish brown, mottled, firm channery silty clay loam. The substratum is light olive gray, firm channery silty clay loam about 23 inches thick. Interbedded, calcareous, soft shale and limestone bedrock is at a depth of about 56 inches.

Included with this soil in mapping are small areas of the moderately well drained Aaron soils on toe slopes. Also included are some gullied areas. Inclusions make up about 15 percent of most mapped areas.

Permeability is slow in the Brushcreek soil. The root zone is deep. The available water capacity is moderate. Runoff is medium. The organic matter content is moderate in the surface layer. A seasonal high water table is between depths of 18 and 36 inches during extended wet periods. The shrink-swell potential is high.

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

This soil is moderately well suited to corn, soybeans, and small grain. The hazard of erosion is severe in cultivated areas. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface and include meadow crops, grassed waterways, contour stripcropping, and cover crops also help to control erosion. Tilling within the optimum moisture range minimizes compaction.

This soil is well suited to grasses and legumes for hay and pasture. Restricted grazing during wet periods minimizes compaction and helps to prevent excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, and mowing for weed control help to keep the pasture in good condition and control erosion.

This soil is well suited to trees. Frequent, light thinning and harvesting increase the vigor of the stand and reduce the windthrow hazard.

This soil is poorly suited to building site development because of the seasonal wetness, the high shrink-swell potential, and the slope. Foundation drains and protective exterior wall coatings help to prevent wetness in basements. The adverse effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete and by backfilling around foundations with material that has a low shrink-swell potential. Buildings should be designed so that they conform to the natural slope of the land. Cutting and filling increase the hazard of hillside slippage, but diverting surface water away from foundations reduces this hazard.

This soil is poorly suited to septic tank absorption fields because of the slow permeability and the slope. Increasing the size of the field helps to overcome the restricted permeability. Installing the leach lines on the contour minimizes lateral seepage of the effluent.

The damage to local roads and streets caused by shrinking and swelling can be minimized by providing suitable base material.

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

BtD2—Brushcreek-Lawshe complex, 12 to 25 percent slopes, eroded. These deep, moderately steep, moderately well drained soils are on colluvial foot slopes in the uplands. The Brushcreek soil is commonly on the upper two-thirds of concave foot slopes. The Lawshe soil is dominant on the lower one-third. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Slopes are dominantly 12 to 25 percent. They generally are uneven and have landslips. Most areas are elongated and range from 10 to 400 acres in size. They are about 55 percent Brushcreek soil and 30 percent Lawshe soil. The two soils occur as areas so intricately mixed that mapping them separately was not practical.

Typically, the Brushcreek soil has a surface layer of brown, friable silt loam about 6 inches thick. The subsoil is about 27 inches thick. The upper part is yellowish brown, firm silty clay loam and silty clay. The lower part is yellowish brown, mottled, firm channery silty clay loam. The substratum is light olive gray, mottled, firm channery silty clay loam about 23 inches thick. Interbedded, calcareous, soft shale and limestone bedrock is at a depth of about 56 inches.

Typically, the Lawshe soil has a surface layer of very dark grayish brown, friable silty clay loam about 6 inches thick. The subsurface layer is very dark grayish brown, firm silty clay about 6 inches thick. The subsoil is brown, yellowish brown, and light olive brown, mottled, firm and very firm silty clay about 25 inches thick. The substratum is gray, mottled silty clay about 13 inches thick. Interbedded, calcareous, soft shale bedrock that has thin strata of limestone is at a depth of about 50 inches.

Included with these soils in mapping are small areas of the well drained Jessup soils on toe slopes and the shallow Opequon soils on the upper shoulder slopes. Also included are some gullied areas. Inclusions make up about 15 percent of most mapped areas.

Permeability is slow in the Brushcreek soil and very slow in the Lawshe soil. Both soils have a deep root zone. The available water capacity is moderate. Runoff is rapid. The organic matter content is moderate in the surface layer of the Brushcreek soil and high in the surface layer of the Lawshe soil. During extended wet periods, the Brushcreek soil has a seasonal high water

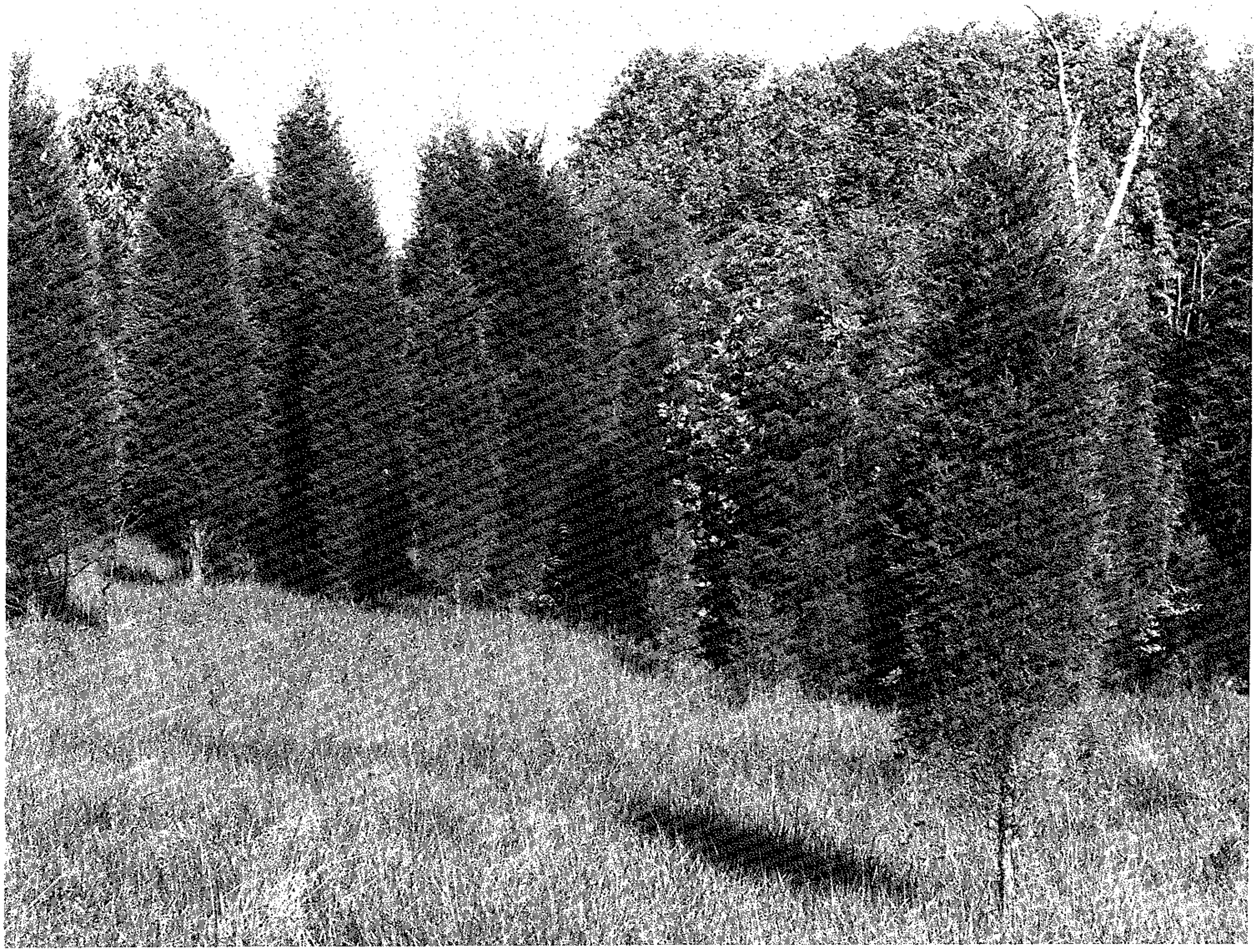

Figure 3.—Eastern redcedar trees on an unimproved pasture in an area of Brushcreek-Lawshe complex, 12 to 25 percent slopes, eroded.

table between depths of 18 and 36 inches and the Lawshe soil has one between depths of 12 and 36 inches. The shrink-swell potential is high in both soils.

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

These soils are generally unsuited to corn, soybeans, small grain, and hay because of the slope and the hazard of erosion. They are poorly suited to pasture. Unimproved pastures commonly have volunteer eastern redcedar trees (fig. 3). If the pasture is overgrazed or the soils are plowed during seedbed preparation, the hazard of erosion is very severe. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. The slope limits the use of equipment in most areas.

These soils are well suited to trees. Constructing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion. Selecting seedlings that have been transplanted once can reduce the seedling mortality rate. Frequent, light thinning and harvesting increase the vigor of the stand and reduce the windthrow hazard.

These soils are generally unsuitable as sites for buildings and septic tank absorption fields because of the slope, the seasonal wetness, the slow or very slow permeability, the high shrink-swell potential, and the hazard of slippage in areas of the Brushcreek soil (fig. 4). Minimizing cutting and filling reduces the hazard of slippage. Local roads and streets should be constructed on the contour.

The land capability classification is VIe. The woodland ordination symbol in areas of the Brushcreek soil is 4R on north aspects and 3R on south aspects.In areas of the Lawshe soil, it is 3R on north and south aspects. The pasture and hayland suitability group is F-5 in areas of both soils.

CkB—Cincinnati silt loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is on till plains. Most slopes are uniform. Most areas are irregularly shaped and range from 10 to 25 acres in size.

Typically, the surface layer is dark yellowish brown, friable silt loam about 9 inches thick. The subsoil is about 51 inches thick. The upper part is yellowish brown, friable silt loam and firm silty clay loam; the next part is a fragipan of yellowish brown, mottled, very firm, brittle silty clay loam; and the lower part is yellowish

Figure 4.—Slippage of the Brushcreek soil in an area of Brushcreek-Lawshe complex, 12 to 25 percent slopes, eroded.

brown, mottled, firm silty clay loam and clay loam. In some areas the soil is moderately well drained.

Included with this soil in mapping are small areas of the well drained Jessup soils on the more sloping parts of the landscape. These soils contain more clay in the subsoil than the Cincinnati soil and do not have a fragipan. They make up about 15 percent of most mapped areas.

Permeability is moderate above the fragipan in the Cincinnati soil and moderately slow or slow in the fragipan. A seasonal high water table is between depths of 30 and 48 inches from January through April. The root zone is moderately deep. The available water capacity is moderate. Runoff is medium. The organic matter content is moderate in the surface layer.

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

This soil is well suited to corn, soybeans, and small grain. The hazard of erosion is moderate when the soil is cultivated. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface, contour farming, winter cover crops, grassed waterways, and incorporation of crop residue into the plow layer help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for pasture and hay. Controlling erosion and maintaining stands of the key forage species are management concerns. Overgrazing or grazing when the soil is wet causes compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

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

This soil is only moderately well suited to building site development because of the seasonal wetness. It is better suited to dwellings without basements than to dwellings with basements. Foundation drains and protective exterior wall coatings help to prevent wetness in basements.

This soil is poorly suited to septic tank absorption fields. The seasonal wetness and the moderately slow or slow permeability are limitations. Installing perimeter drains around the absorption fields lowers the seasonal high water table. Increasing the size of the fields helps to overcome the restricted permeability.

The damage to local roads and streets caused by low strength and frost action can be minimized by installing a drainage system and by providing suitable base material.

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

CkC2—Cincinnati silt loam, 6 to 12 percent slopes, eroded. This deep, strongly sloping, well drained soil is on side slopes along drainageways on till plains. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are irregularly shaped and have uniform slopes. They range from 10 to 25 acres in size.

Typically, the surface layer is dark yellowish brown, friable silt loam about 9 inches thick. The subsoil is about 51 inches thick. The upper part is yellowish brown, friable silt loam and firm silty clay loam; the next part is a fragipan of yellowish brown, mottled, very firm, brittle silty clay loam; and the lower part is yellowish brown, mottled, firm silty clay loam and clay loam. In some areas the soil is moderately well drained.

Included with this soil in mapping are small areas of the well drained Jessup soils along drainageways. These soils contain more clay in the subsoil than the Cincinnati soil and do not have a fragipan. Also included are sinkholes as much as 10 feet deep and 100 feet in diameter. Inclusions make up about 15 percent of most mapped areas.

Permeability is moderate above the fragipan in the Cincinnati soil and moderately slow or slow in the fragipan. A seasonal high water table is between depths of 30 and 48 inches from January through April. The root zone is moderately deep. The available water capacity is moderate. Runoff is medium. The organic matter content is moderate in the surface layer.

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

This soil is moderately well suited to corn, soybeans, and small grain. The erosion hazard is severe in cultivated areas. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface and include grasses and legumes, contour stripcropping, winter cover crops, grassed waterways, and incorporation of crop residue into the plow layer help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Controlling erosion and maintaining stands of the key forage species are management concerns. Overgrazing or grazing when the soil is wet causes compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

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

This soil is only moderately well suited to building site development because of the seasonal wetness and the slope. Foundation drains and protective exterior wall coatings help to prevent wetness in basements. Buildings should be designed so that they conform to the natural slope of the land.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and the moderately slow or slow permeability. Installing perimeter drains around the absorption fields lowers the seasonal high water table. Increasing the size of the fields helps to overcome the restricted permeability.

The damage to local roads and streets caused by low strength and frost action can be minimized by installing a drainage system and by providing suitable base material.

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

CrB—Crider silt loam, 1 to 6 percent slopes. This deep, nearly level and gently sloping, well drained soil is in the uplands. Most slopes are uniform. Most areas range from 5 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 12 inches thick. The subsoil is about 68 inches thick. The upper part is yellowish brown, friable silt loam. The lower part is strong brown, firm silty clay loam and silty clay. In some areas the soil has less silt.

Included with this soil in mapping are small areas of Bratton soils along drainageways. These soils contain more clay than the Crider soil and are moderately deep over limestone bedrock. Also included are sinkholes as much as 20 feet in diameter and 10 feet deep. Inclusions make up about 20 percent of most mapped areas.

Permeability is moderate in the Crider soil. The root zone is deep. The available water capacity is high. Runoff is medium. The organic matter content is moderate in the surface layer.

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

This soil is well suited to corn, soybeans, and small grain. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. The surface layer crusts after hard rains. Tillage systems that leave crop residue on the surface, contour farming, grassed waterways, and winter cover crops help to control erosion, maintain tilth, and minimize crusting.

This soil is well suited to grasses and legumes for pasture and hay. Restricted grazing during wet periods minimizes compaction and helps to control erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and mowing for weed control help to keep the pasture in good condition and control erosion.

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

This soil is well suited to building site development and septic tank absorption fields. Replacing the topsoil and subsoil with suitable base material minimizes the damage to local roads and streets caused by low strength and frost action.

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

EgE2—Eden flaggy silty clay loam, 25 to 40 percent slopes, eroded. This moderately deep, steep, well drained soil is on side slopes in the uplands. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are elongated and have convex slopes. They range from 30 to 200 acres in size.

Typically, the surface layer is brown, firm flaggy silty clay loam about 5 inches thick. The subsoil is about 11 inches of light olive brown and yellowish brown, firm flaggy clay and flaggy silty clay. The substratum is light olive brown, firm very flaggy clay about 13 inches thick. Fractured limestone bedrock interbedded with shale is at a depth of about 29 inches. In some areas the soil has fewer coarse fragments.

Included with this soil in mapping are small, narrow areas of the deep Lowell soils on ridgetops. These soils make up about 15 percent of most mapped areas.

Permeability is slow in the Eden soil. The root zone is moderately deep. The available water capacity is low. Runoff is rapid. The organic matter content is moderately low in the surface layer.

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

This soil is generally unsuited to corn, soybeans, small grain, and hay because of the slope and a severe hazard of erosion. It is poorly suited to pasture. The hazard of erosion is very severe if the soil is cultivated during seedbed preparation or if pastured areas are overgrazed. Controlling erosion and maintaining stands of the key forage species are management concerns. Overgrazing or grazing when the soil is too wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

This soil is moderately well suited to trees.

Constructing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion. Selecting seedlings that have been transplanted once reduces the seedling mortality rate. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced can reduce the windthrow hazard.

This soil is generally unsuited to building site development and septic tank absorption fields because of the slope, the depth to bedrock, and the content of coarse fragments. Local roads should be built across the slope.

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

EgF2—Eden flaggy silty clay loam, 40 to 70 percent slopes, eroded. This moderately deep, very steep, well drained soil is on side slopes in the uplands. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most slopes are convex. Most areas are elongated and range from 50 to 300 acres in size.

Typically, the surface layer is dark yellowish brown, firm flaggy silty clay loam about 7 inches thick. The subsoil is yellowish brown and light olive brown, firm flaggy silty clay about 18 inches thick. The substratum is yellowish brown, firm very flaggy silty clay about 9 inches thick. Fractured limestone bedrock interbedded with shale is at a depth of about 34 inches. In some areas the soil has fewer coarse fragments.

Included with this soil in mapping are small areas of the deep Lowell soils on ridgetops. These soils make up about 15 percent of most mapped areas.

Permeability is slow in the Eden soil. The root zone is moderately deep. The available water capacity is low. Runoff is rapid. The organic matter content is moderately low in the surface layer.

Most areas are wooded. This soil is generally unsuited to corn, soybeans, small grain, hay, and pasture because of the slope and the hazard of erosion.

This soil is moderately well suited to trees. Constructing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion. Selecting seedlings that have been transplanted once reduces the seedling mortality rate. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced can reduce the windthrow hazard.

This soil is generally unsuited to building site development and septic tank absorption fields because of the slope, the depth to bedrock, and the content of coarse fragments. Local roads should be built across the slope.

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

EkB—Elkinsville silt loam, 1 to 6 percent slopes. This deep, nearly level and gently sloping, well drained soil is on low terraces. Most slopes are uniform. Most areas are elongated and range from 5 to 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 39 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is yellowish brown, friable very fine sandy loam. The substratum to a depth of about 80 inches is yellowish brown, friable very fine sandy loam.

Included with this soil in mapping are small areas of the moderately well drained Sciotoville soils in the lower landscape positions. These soils have a fragipan. Also included are the poorly drained Peoga soils in drainageways. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the Elkinsville soil. The root zone is deep. The available water capacity is high. Runoff is medium. The organic matter content is moderate in the surface layer.

Most areas are used as cropland or pasture. This soil is well suited to corn, soybeans, and small grain. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. The surface layer crusts after hard rains. Cropping systems that leave crop residue on the surface, winter cover crops, and incorporation of crop residue into the plow layer help to control erosion, maintain tilth, and minimize crusting.

This soil is well suited to grasses and legumes for hay and pasture. Restricted grazing during wet periods minimizes damage to the plant cover, compaction, and soil loss. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition and control erosion.

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

This soil is well suited to building site development and septic tank absorption fields. A moderate shrink-swell potential is a limitation on sites for dwellings. The adverse effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete and by backfilling around foundations with material that has a low shrink-swell potential.

The damage to local roads and streets caused by low strength and frost action can be minimized by providing suitable base material.

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

FaC2—Faywood silt loam, 8 to 15 percent slopes, eroded. This moderately deep, strongly sloping, well drained soil is on ridgetops and side slopes in the uplands. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are elongated and have uniform, convex slopes. They range from 5 to 75 acres in size.

Typically, the surface layer is yellowish brown, friable silt loam about 5 inches thick. The subsoil is yellowish brown, firm silty clay about 21 inches thick. Limestone bedrock is at a depth of about 26 inches. In some areas the soil is deeper over bedrock. In other areas it has a higher content of coarse fragments.

Included with this soil in mapping are small areas of the deep Jessup soils on side slopes. These soils formed in glacial till over clay. Also included are some areas of severely eroded soils that are gullied. Included soils make up about 15 percent of most mapped areas.

Permeability is slow or moderately slow in the Faywood soil. The root zone is moderately deep. The available water capacity is low. Runoff is medium. The organic matter content is moderately low in the surface layer.

Most areas are used as cropland or pasture (fig. 5). A few areas are wooded.

This soil is moderately well suited to corn, soybeans, and small grain. The hazard of erosion is severe in cultivated areas. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface, contour stripcropping, grassed waterways, and cover crops help to control erosion and maintain tilth and the organic matter content. Tilling within the optimum moisture range minimizes compaction and clodding.

This soil is well suited to grasses and legumes for hay and pasture. Controlling erosion and maintaining stands of the key forage species are management concerns. Overgrazing or grazing when the soil is too wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

This soil is well suited to trees. The trees can be logged when the soil is frozen or during the drier parts of the year.

This soil is moderately well suited to building site development. The bedrock at a depth of 20 to 40 inches, a moderate shrink-swell potential, and the slope are limitations on sites for dwellings. The soil is better suited to dwellings without basements than to dwellings with basements. The adverse effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by extending foundations to the bedrock, and by backfilling around the foundations with material that has a low shrink-swell potential. Buildings should be designed so that they conform to the natural slope of the land.

This soil is poorly suited to septic tank absorption fields because of the bedrock at a depth of 20 to 40 inches and the slow or moderately slow permeability. Installing the absorption fields in suitable fill material elevates the fields a sufficient distance above the bedrock. Increasing the size of the absorption fields helps to overcome the restricted permeability.

The damage to local roads and streets caused by low strength can be minimized by providing suitable base material.

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

FbD2—Faywood silty clay loam, 15 to 25 percent slopes, eroded. This moderately deep, moderately steep, well drained soil is on side slopes in the uplands. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are elongated and have uniform, convex slopes. They range from 5 to 50 acres in size.

Typically, the surface layer is yellowish brown, friable silty clay loam about 6 inches thick. The subsoil is yellowish brown and light yellowish brown, firm clay about 22 inches thick. The substratum is light olive brown and brown, firm channery clay about 6 inches thick. Limestone bedrock interbedded with shale is at a depth of about 34 inches. In some areas the soil is deeper over bedrock.

Included with this soil in mapping are small areas of the deep Jessup soils on side slopes. These soils formed in glacial till over clay. Also included are some areas of severely eroded soils that are gullied. Included soils make up about 15 percent of most mapped areas.

Permeability is slow or moderately slow in the Faywood soil. The root zone is moderately deep. The available water capacity is low. Runoff is rapid. The

Figure 5.—An area of Faywood silt loam, 8 to 15 percent slopes, eroded, which is used mainly as cropland or pasture.

organic matter content is moderately low in the surface layer.

Most areas are used as hayland, pasture, or cropland. A few areas are wooded.

This soil is poorly suited to corn, soybeans, and small grain. It can be cropped occasionally, but erosion is a severe hazard. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface and include meadow crops, grassed waterways, contour stripcropping, cover crops, and incorporation of crop residue into the plow layer help to control runoff and erosion and maintain tilth and the organic matter content.

This soil is moderately well suited to grasses and legumes for hay and pasture. Controlling erosion and maintaining stands of the key forage species are management concerns. Overgrazing or grazing when the soil is too wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

This soil is well suited to trees. Constructing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion.

This soil is poorly suited to building site development. The slope and the bedrock at a depth of 20 to 40 inches are limitations on sites for dwellings. Any development should be on the less sloping parts of the landscape.

This soil is poorly suited to septic tank absorption fields because of the slope, the bedrock at a depth of 20 to 40 inches, and the slow or moderately slow permeability. Installing the leach lines on the contour minimizes lateral seepage of the effluent. Installing the absorption fields in suitable fill material elevates the fields a sufficient distance above the bedrock. Increasing the size of the absorption fields helps to overcome the restricted permeability.

Building local roads and streets on the contour and seeding road cuts help to control erosion. Providing suitable base material helps to prevent the road damage caused by low strength.

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

Ge—Gessie loam, frequently flooded. This deep, nearly level, well drained soil is on flood plains. Areas are elongated and are 20 to 100 acres in size. Slopes are uniform. They range from 0 to 2 percent.

Typically, the surface layer is brown, friable loam about 11 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown and brown, friable silt loam and loam. In some areas the soil has more silt, and in other areas it has bedrock within a depth of 60 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Newark soils in the slightly lower positions on the flood plains. These soils make up about 10 percent of most mapped areas.

Permeability is moderate in the Gessie soil. The root zone is deep. The available water capacity is high. Runoff is slow. The organic matter content is moderately low in the surface layer.

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

This soil is well suited to corn and soybeans and can be cropped intensively. Winter small grain can be damaged by flooding. The soil is better suited to crops that are planted after the normal period of flooding than to crops that are planted early in the spring. No-till cropping systems or other kinds of conservation tillage that leave crop residue on the surface help to maintain tilth and minimize surface crusting.

This soil is well suited to grasses and legumes for hay and pasture. Restricted grazing during wet periods minimizes damage to the plant cover. Proper stocking rates, pasture rotation, timely deferment of grazing, and mowing for weed control help to keep the pasture in good condition.

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

This soil is generally unsuited to building site development and septic tank absorption fields because of the flooding. It is a good source of topsoil. If suitable fill material is added, local roads and streets can be constructed above the expected high level of flooding.

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

JeB—Jessup silt loam, 1 to 8 percent slopes. This deep, nearly level and gently sloping, well drained soil is in the glaciated uplands. Most slopes are uniform. Most areas are irregularly shaped and range from 5 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsurface layer is yellowish brown and light yellowish brown, very friable silt loam about 5 inches thick. The subsoil is about 52 inches thick. The upper part is yellowish brown, friable and firm silty clay loam; the next part is yellowish brown, firm silty clay and clay; and the lower part is light olive brown, olive, and light olive gray, firm silty clay and clay. Soft shale that has thin strata of limestone is at a depth of about 64 inches. In some areas the soil is moderately well drained.

Included with this soil in mapping are small areas of the moderately well drained Rossmoyne soils on the more nearly level parts of the landscape. These soils have a fragipan. They make up about 15 percent of most mapped areas.

Permeability is slow in the Jessup soil. The root zone is deep. The available water capacity is moderate. Runoff is medium. The organic matter content is moderate in the surface layer.

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

This soil is well suited to corn, soybeans, and small grain. It can be cropped frequently, but erosion is a moderate hazard. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface and include meadow crops, contour farming, grassed waterways, cover crops, and incorporation of crop residue into the plow layer help to control erosion and maintain tilth and the organic matter content.

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

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

This soil is only moderately well suited to building site development. The main limitation is a moderate shrink-swell potential. The adverse effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete and by backfilling around foundations with material that has a low shrink-swell potential.

This soil is poorly suited to septic tank absorption fields because of the slow permeability. The absorption fields can be improved if they are installed in suitable fill material and are enlarged.

The damage to local roads and streets caused by low strength can be minimized by providing suitable base material.

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

JeC2—Jessup silt loam, 8 to 15 percent slopes, eroded. This deep, strongly sloping, well drained soil is on side slopes in the glaciated uplands. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are elongated and have uniform slopes. They range from 10 to 200 acres in size.

Typically, the surface layer is yellowish brown, friable silt loam about 8 inches thick. The subsoil is about 39 inches thick. The upper part is strong brown and yellowish brown, firm silty clay loam and clay, and the lower part is light olive brown, firm clay. Soft shale bedrock that has thin strata of limestone is at a depth of about 47 inches. In some areas the soil is moderately deep over bedrock.

Included with this soil in mapping are small areas of the moderately well drained Loudon soils on the less sloping parts of the landscape. Also included, on the less sloping parts of the landscape, are Cincinnati soils, which have a fragipan. Included soils make up about 15 percent of most mapped areas.

Permeability is slow in the Jessup soil. The root zone is deep. The available water capacity is moderate. Runoff is medium. The organic matter content is moderately low in the surface layer.

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

This soil is moderately well suited to corn, soybeans, and small grain. The hazard of erosion is severe in cultivated areas. Controlling erosion and maintaining tilth and the organic matter content are major management concerns. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface and include grasses and legumes, grassed waterways, contour stripcropping, cover crops, and incorporation of crop residue into the soil also help to control erosion.

This soil is well suited to grasses and legumes for hay and pasture. Controlling erosion and maintaining stands of the key forage species are management concerns. Grazing when the soil is wet causes compaction and excessive runoff. The no-till seeding method reduces the hazard of erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and mowing for weed control help to keep the pasture in good condition and control erosion.

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

This soil is moderately well suited to building site development. It is limited mainly by a moderate shrink-swell potential and the slope. The adverse effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete and by backfilling around foundations with material that has a low shrink-swell potential. Buildings should be designed so that they conform to the natural slope of the land.

This soil is poorly suited to septic tank absorption fields because of the slow permeability. The absorption fields can be improved if they are installed in suitable fill material and are enlarged.

The damage to local roads and streets caused by low strength can be minimized by providing suitable base material.

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

JeD2—Jessup silt loam, 15 to 25 percent slopes, eroded. This deep, moderately steep, well drained soil is on side slopes in the glaciated uplands. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are elongated and have uniform, slightly convex slopes. They range from 5 to 100 acres in size.

Typically, the surface layer is yellowish brown, friable silt loam about 8 inches thick. The subsoil is about 39 inches thick. The upper part is strong brown and yellowish brown, firm silty clay loam and clay, and the lower part is light olive brown, firm clay. Soft shale bedrock that has thin strata of limestone is at a depth of about 47 inches. In some areas the soil is moderately deep over bedrock.

Included with this soil in mapping are small areas of Cincinnati soils on the less sloping parts of the landscape. These soils have less clay in the subsoil than the Jessup soil and have a fragipan. They make up about 10 percent of most mapped areas.

Permeability is slow in the Jessup soil. The root zone is deep. The available water capacity is moderate. Runoff is rapid. The organic matter content is moderately low in the surface layer.

Most areas are used as hayland or pasture. Some areas are used as cropland. A few areas are wooded.

This soil is poorly suited to corn, soybeans, and small grain. The hazard of erosion is severe in cultivated areas. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface and include grasses and legumes, grassed waterways, contour stripcropping, cover crops, and incorporation of crop residue into the plow layer help to control erosion and maintain tilth and the organic matter content.

This soil is moderately well suited to grasses and legumes for hay and pasture. Grazing when the soil is wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

This soil is well suited to trees. Constructing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion. Selecting seedlings that have been transplanted once reduces the seedling mortality rate. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced can reduce the windthrow hazard.

This soil is poorly suited to building site development. The slope and a moderate shrink-swell potential are severe limitations on sites for dwellings. Any development should be on the less sloping parts of the landscape. Buildings should be designed so that they conform to the natural slope of the land. The adverse effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete and by backfilling around foundations with material that has a low shrink-swell potential.

This soil is poorly suited to septic tank absorption fields because of the slow permeability and the slope. The absorption fields can be improved if they are installed in suitable fill material and are enlarged. Installing the leach lines on the contour minimizes lateral seepage of the effluent.

Providing suitable base material minimizes the damage to local roads and streets caused by low strength. Because of the slope, the roads and streets should be constructed on the contour.

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

JeE2—Jessup silt loam, 25 to 35 percent slopes, eroded. This deep, steep, well drained soil is on side slopes in the glaciated uplands. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are elongated and have uniform, slightly convex slopes. They range from 5 to 50 acres in size.

Typically, the surface layer is yellowish brown, friable silt loam about 8 inches thick. The subsoil is about 39 inches thick. The upper part is strong brown and yellowish brown, firm silty clay loam and clay, and the lower part is light olive brown, firm clay. Soft shale bedrock that has thin strata of limestone is at a depth of about 47 inches. In some areas the soil is shallower over bedrock.

Included with this soil in mapping are small areas of Cincinnati soils on the less sloping parts of the landscape. These soils have a fragipan and have less clay in the subsoil than the Jessup soil. They make up about 10 percent of most mapped areas.

Permeability is slow in the Jessup soil. The root zone is deep. The available water capacity is moderate. Runoff is rapid. The organic matter content is moderately low in the surface layer.

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

This soil is generally unsuited to corn, soybeans, small grain, and hay because of the slope and the hazard of erosion. This hazard is very severe if the soil is cultivated during seedbed preparation.

This soil is poorly suited to pasture. Controlling erosion and maintaining stands of the key forage species are management concerns. Grazing when the soil is wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

This soil is well suited to trees. Constructing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion. Selecting seedlings that have been transplanted once reduces the seedling mortality rate. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced can reduce the windthrow hazard.

This soil is generally unsuited to building site development and septic tank absorption fields because of the slope, the slow permeability, and a moderate shrink-swell potential. Local roads should be constructed on the contour.

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

LbC—Latham silt loam, 8 to 15 percent slopes. This moderately deep, strongly sloping, moderately well drained soil is on the tops of ridges in the uplands. Most areas are elongated and have uniform slopes. They range from 10 to 25 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 29 inches thick. The upper part is strong brown, friable silty clay loam and firm silty clay. The lower part is strong brown and light olive brown, mottled, firm silty clay and shaly silty clay. Soft, thinly bedded shale bedrock is at a depth of about 35 inches.

Included with this soil in mapping are small areas of the well drained Berks and Wernock soils in the slightly higher landscape positions. These soils have less clay than the Latham soil. Also, Berks soils have a higher content of coarse fragments in the subsoil. Included soils make up about 15 percent of most mapped areas.

Permeability is slow in the Latham soil. The root zone is moderately deep. The available water capacity is low. Runoff is medium. The organic matter content is moderately low in the surface layer. A seasonal high water table is between depths of 18 and 36 inches during extended wet periods. The shrink-swell potential is high.

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

This soil is poorly suited to corn, soybeans, and small grain. The hazard of erosion is severe in cultivated areas. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface and include grasses and legumes, grassed waterways, contour stripcropping, cover crops, and incorporation of crop residue into the plow layer help to control erosion and maintain tilth and the organic matter content.

This soil is moderately well suited to grasses and legumes for hay and pasture. Controlling erosion and maintaining stands of the key forage species are management concerns. Overgrazing or grazing when the soil is too wet can cause compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

This soil is well suited to trees. The trees can be logged when the soil is frozen or during the drier parts of the year. Selecting seedlings that have been transplanted once reduces the seedling mortality rate. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced can reduce the windthrow hazard.

This soil is poorly suited to building site development. The seasonal wetness, the high shrink-swell potential, the bedrock at a depth of 20 to 40 inches, and the slope are limitations on sites for dwellings. Perimeter drains and exterior wall coatings help to prevent wetness in basements. The adverse effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by extending foundations to the bedrock, and by backfilling around the foundations with material that has a low shrink-swell potential. The bedrock limits excavation, but it is commonly rippable. Buildings should be designed so that they conform to the natural slope of the land.

This soil is poorly suited to septic tank absorption fields. The bedrock at a depth of 20 to 40 inches, the hazard of ground-water pollution caused by inadequate filtration of the effluent, and the seasonal wetness are management concerns. Installing the absorption fields in suitable fill material elevates the fields a sufficient distance above the bedrock and improves the filtering capacity. Installing perimeter drains around the fields lowers the seasonal high water table.

The damage to local roads and streets caused by shrinking and swelling, frost action, and low strength can be minimized by providing suitable base material.

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

LbD2—Latham silt loam, 15 to 25 percent slopes, eroded. This moderately deep, moderately steep, moderately well drained soil is on ridgetops and benches in the uplands. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are elongated and have irregular slopes. They are 10 to 60 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is about 29 inches of strong brown and yellowish red, firm clay and shaly clay. It is mottled in the lower part. Shale bedrock is at a depth of about 37 inches.

Included with this soil in mapping are small areas of the well drained Berks and deep Shelocta soils on side slopes. Also included are the shallow Colyer soils in narrow strips on shoulder slopes. Included soils make up about 15 percent of most mapped areas.

Permeability is slow in the Latham soil. The root zone is moderately deep. The available water capacity is low. Runoff is rapid. The organic matter content is moderately low in the surface layer. A seasonal high water table is between depths of 18 and 36 inches during extended wet periods. The shrink-swell potential is high.

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

This soil is generally unsuited to corn, soybeans, small grain, and hay because of the slope and a severe hazard of erosion.

This soil is poorly suited to grasses for pasture. Erosion is a severe hazard if the soil is plowed during seedbed preparation or if pastured areas are overgrazed. Controlling erosion and maintaining stands of the key forage species are the main management concerns. Overgrazing or grazing when the soil is too wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

This soil is moderately well suited to trees. Constructing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion. Selecting seedlings that have been transplanted once reduces the seedling mortality rate. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced can reduce the windthrow hazard. North- and east-facing slopes are better sites for woodland than south- and west-facing slopes because of less evaporation and cooler temperatures, both of which result from less exposure to the drying effects of the prevailing wind and the sun.

This soil is generally unsuitable as a site for buildings, septic tank absorption fields, and local roads and streets. It is severely limited as a site for these uses by the slope, the seasonal wetness, the bedrock at a depth of 20 to 40 inches, the slow or very slow permeability, slippage, the high shrink-swell potential, low strength, frost action, and the hazard of ground-water pollution.

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

LkB—Licking silt loam, 1 to 6 percent slopes. This deep, nearly level and gently sloping, moderately well drained soil is on high terraces along streams. Most areas are elongated and have uniform slopes. They range from 5 to 20 acres in size.

Typically, the surface layer is yellowish brown, friable silt loam about 8 inches thick. The subsoil is about 40 inches thick. The upper part is yellowish brown, firm silty clay loam. The lower part is yellowish brown, strong brown, and brown, mottled, firm silty clay and clay. The substratum to a depth of about 70 inches is dark brown, mottled, firm clay.

Included with this soil in mapping are small areas of Otwell soils in the higher landscape positions. These soils have more silt than the Licking soil and have a fragipan. They make up about 15 percent of most mapped areas.

Permeability is slow in the Licking soil. The root zone is deep. The available water capacity is moderate. Runoff is medium. The organic matter content is moderate in the surface layer. A seasonal high water table is between depths of 24 and 42 inches during extended wet periods. The shrink-swell potential is high.

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

This soil is well suited to corn, soybeans, and small grain. It can be cropped frequently, but erosion is a moderate hazard. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. The surface layer crusts after hard rains. Tillage systems that leave crop residue on the surface, contour farming, winter cover crops, grassed waterways, and incorporation of crop residue into the plow layer help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Controlling erosion and maintaining stands of the key forage species are management concerns. Overgrazing or grazing when the soil is wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

This soil is well suited to trees. Harvesting techniques that do not isolate the remaining trees or leave them widely spaced can reduce the windthrow hazard.

This soil is moderately well suited to building site development. The seasonal wetness and the high shrink-swell potential are limitations on sites for dwellings. Waterproofing basement walls and installing drains at the base of footings help to prevent wetness in basements. The adverse effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete and by backfilling around foundations with material that has a low shrink-swell potential.

This soil is poorly suited to septic tank absorption fields because of the slow permeability and the seasonal wetness. Installing the fields in suitable fill material or increasing the size of the fields helps to overcome the restricted permeability. Installing perimeter drains around the fields lowers the seasonal high water table.

Providing suitable base material can minimize the damage to local roads and streets caused by shrinking and swelling, low strength, and frost action.

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

LkC2—Licking silt loam, 6 to 15 percent slopes, eroded. This deep, strongly sloping, moderately well drained soil is on high terraces along streams. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are elongated and have uniform slopes. They range from 5 to 100 acres in size.

Typically, the surface layer is dark yellowish brown, friable silt loam about 9 inches thick. The subsoil is about 37 inches of yellowish brown, mottled, firm clay, silty clay, and silty clay loam. The substratum to a depth of about 60 inches is light olive brown, firm silty clay.

Included with this soil in mapping are small areas of Otwell soils in the higher landscape positions. These soils have more silt than the Licking soil and have a fragipan. They make up about 15 percent of most mapped areas.

Permeability is slow in the Licking soil. The root zone is deep. The available water capacity is moderate. Runoff is medium. The organic matter content is moderate in the surface layer. A seasonal high water table is between depths of 24 and 42 inches during extended wet periods. The shrink-swell potential is high.

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

This soil is poorly suited to corn, soybeans, and small grain. The hazard of erosion is severe in cultivated areas. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface and include grasses and legumes, grassed waterways, contour stripcropping, cover crops, and incorporation of crop residue into the plow layer help to control erosion and maintain tilth and the organic matter content.

This soil is moderately well suited to grasses and legumes for hay and pasture. Controlling erosion and maintaining stands of the key forage species are management concerns. Overgrazing or grazing when the soil is too wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

This soil is well suited to trees. Harvesting techniques that do not leave the remaining trees widely spaced can reduce the windthrow hazard.

This soil is moderately well suited to building site development. The seasonal wetness, the high shrink-swell potential, and the slope are limitations on sites for dwellings. Waterproofing basement walls and installing drains at the base of footings help to prevent wetness in basements. The adverse effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete and by backfilling around foundations with material that has a low shrink-swell potential. Buildings should be designed so that they conform to the natural slope of the land.

This soil is poorly suited to septic tank absorption fields because of the slow permeability and the seasonal wetness. Installing the fields in suitable fill material or increasing the size of the fields helps to overcome the restricted permeability. Installing perimeter drains around the fields lowers the seasonal high water table.

Providing suitable base material minimizes the damage to local roads and streets caused by shrinking and swelling, low strength, and frost action.

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

LkD2—Licking silt loam, 15 to 25 percent slopes, eroded. This deep, moderately steep, moderately well drained soil is on high terraces along streams. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are elongated and have uniform, slightly convex slopes. They range from 5 to 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 5 inches thick. The subsoil is about 31 inches of yellowish brown, friable silty clay loam and firm silty clay and clay. It is mottled in the lower part. The substratum to a depth of about 60 inches is yellowish brown, firm clay.

Included with this soil in mapping are small areas of Otwell soils in the higher landscape positions. These soils have more silt than the Licking soil and have a fragipan. Also included are some areas of soils that are susceptible to slippage. Included soils make up about 15 percent of most mapped areas.

Permeability is slow in the Licking soil. The root zone is deep. The available water capacity is moderate. Runoff is rapid. The organic matter content is moderately low in the surface layer. A seasonal high water table is between depths of 24 and 42 inches during extended wet periods. The shrink-swell potential is high.

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

This soil is generally unsuited to corn, soybeans, small grain, and hay because of the slope and the hazard of erosion. It is poorly suited to pasture. If the pasture is overgrazed or is plowed during seedbed preparation, the hazard of erosion is very severe. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

This soil is well suited to trees. Constructing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced can reduce the windthrow hazard.

This soil is poorly suited to building site development because of the high shrink-swell potential, the slope, and the seasonal wetness. The adverse effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete and by backfilling around foundations with material that has a low shrink-swell potential. Buildings should be designed so that they conform to the natural slope of the land. Perimeter drains and exterior wall coatings help to prevent wetness in basements.

This soil is poorly suited to septic tank absorption fields because of the slow permeability, the slope, and the seasonal wetness. Installing the fields in suitable fill material or increasing the size of the fields helps to overcome the restricted permeability. Installing the leach lines on the contour minimizes lateral seepage of the effluent. Installing perimeter drains around the absorption fields lowers the seasonal high water table.

The included soils that are susceptible to slippage are generally unsuited to building site development, septic tank absorption fields, and local roads and streets.

Providing suitable base material minimizes the damage to local roads and streets caused by shrinking and swelling, low strength, and frost action. Because of the slope, the roads and streets should be built on the contour.

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

LoA—Loudon silt loam, 0 to 2 percent slopes. This deep, nearly level, moderately well drained soil is on glaciated uplands. Most areas are irregularly shaped and have uniform slopes. They range from 20 to more than 200 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 39 inches thick. The upper part is yellowish brown, friable and firm silt loam and silty clay loam. The lower part is strong brown and yellowish brown, mottled, firm silty clay and clay. The substratum is yellowish brown, mottled, firm silty clay loam about 10 inches thick. Interbedded, soft shale and limestone bedrock is at a depth of about 58 inches. In some areas the soil is well drained.

Included with this soil in mapping are small areas of Rossmoyne soils. These soils are in landscape positions similar to those of the Loudon soil. They have a fragipan and are commonly deeper over bedrock than the Loudon soil. They make up about 15 percent of most mapped areas.

Permeability is slow in the Loudon soil. The root zone is deep. The available water capacity is moderate. Runoff is slow. The organic matter content is moderate in the surface layer. A seasonal high water table is between depths of 24 and 42 inches during extended wet periods.

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

This soil is well suited to corn, soybeans, and small grain and can be cropped intensively. The seasonal wetness and maintenance of tilth are management concerns. Natural drainage is generally adequate for most crops, but randomly spaced surface drains are needed in some areas. No-till cropping systems or other kinds of conservation tillage minimize crusting and improve tilth.

This soil is well suited to grasses and legumes for pasture and hay. Maintaining stands of the key forage species is a management concern. Overgrazing or grazing when the soil is wet causes compaction. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition.

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

This soil is moderately well suited to building site development. The seasonal wetness and a moderate shrink-swell potential are limitations on sites for dwellings. The soil is better suited to dwellings without basements than to dwellings with basements. Waterproofing basement walls and installing drains at the base of footings help to prevent wetness in basements. The adverse effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete and by backfilling around foundations with material that has a low shrink-swell potential.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and the slow permeability. The absorption fields can be improved if perimeter drains are installed and the fields are installed in suitable fill material or are enlarged.

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

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

LoB—Loudon silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is on glaciated uplands. Most areas are irregularly shaped and have uniform slopes. They range from 20 to more than 200 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 56 inches thick. The upper part is yellowish brown, mottled, friable and firm silt loam and silty clay loam. The lower part is yellowish brown, mottled, firm silty clay. Light olive brown, soft shale bedrock is at a depth of about 64 inches. In some areas the soil is well drained.

Included with this soil in mapping are small areas of Rossmoyne soils. These soils are in landscape positions similar to those of the Loudon soil. They have a fragipan and are commonly deeper over bedrock than the Loudon soil. They make up about 15 percent of most mapped areas.

Permeability is slow in the Loudon soil. The root zone is deep. The available water capacity is moderate. Runoff is medium. The organic matter content is moderate in the surface layer. A seasonal high water table is between depths of 24 and 42 inches during extended wet periods.

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

This soil is well suited to corn, soybeans, and small grain. It can be cropped frequently, but erosion is a moderate hazard. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface and include meadow crops, grassed waterways, contour farming, cover crops, and incorporation of crop residue into the plow layer help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for pasture and hay. Controlling erosion and maintaining stands of the key forage species are management concerns. Overgrazing or grazing when the soil is wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

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

This soil is moderately well suited to building site development. The seasonal wetness and a moderate shrink-swell potential are limitations on sites for dwellings. The soil is better suited to dwellings without basements than to dwellings with basements. Waterproofing basement walls and installing drains at the base of footings help to prevent wetness in basements. The adverse effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete and by backfilling around foundations with material that has a low shrink-swell potential.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and the slow permeability. The absorption fields can be improved if perimeter drains are installed and the fields are installed in suitable fill material or are enlarged.

Providing suitable base material minimizes the damage to local roads and streets caused by low strength and frost action.

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

LoC2—Loudon silt loam, 6 to 15 percent slopes, eroded. This deep, strongly sloping, moderately well drained soil is on glaciated uplands. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are elongated and have uniform slopes. They range from 5 to 20 acres in size.

Typically, the surface layer is yellowish brown, friable silt loam about 8 inches thick. The subsoil is about 50 inches of yellowish brown, mottled, firm silty clay loam and clay. Soft shale bedrock that has thin strata of limestone is at a depth of about 58 inches. In some areas the soil is well drained.

Included with this soil in mapping are small areas of Rossmoyne soils. These soils are in landscape positions similar to those of the Loudon soil. They have a fragipan and are commonly deeper over bedrock than the Loudon soil. They make up about 15 percent of most mapped areas.

Permeability is slow in the Loudon soil. The root zone is deep. The available water capacity is moderate. Runoff is medium. The organic matter content is moderate in the surface layer. A seasonal high water table is between depths of 24 and 42 inches during extended wet periods.

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

This soil is moderately well suited to corn, soybeans, and small grain. The hazard of erosion is severe in cultivated areas. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface and include grasses and legumes, grassed waterways, contour stripcropping, cover crops, and incorporation of crop residue into the plow layer help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Controlling erosion and maintaining stands of the key forage species are management concerns. Grazing when the soil is wet causes compaction and excessive runoff. The no-till seeding method reduces the hazard of erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and mowing for weed control help to keep the pasture in good condition and control erosion.

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

This soil is moderately well suited to building site development. The seasonal wetness, a moderate shrink-swell potential, and the slope are limitations on sites for dwellings. Waterproofing basement walls and installing drains at the base of footings help to prevent wetness in basements. The adverse effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete and by backfilling around foundations with material that has a low shrink-swell potential. Buildings should be designed so that they conform to the natural slope of the land.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and the slow permeability. The absorption fields can be improved if perimeter drains are used to lower the seasonal high water table. Installing the fields in suitable fill material or increasing the size of the fields helps to overcome the restricted permeability.

Providing suitable base material minimizes the damage to local roads and streets caused by low strength and frost action.

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

LwB—Lowell silt loam, 2 to 8 percent slopes. This deep, gently sloping, well drained soil is on the tops of ridges in the uplands. Most areas are elongated and have uniform slopes. They range from 3 to 20 acres in size.

Typically, the surface layer is dark yellowish brown, friable silt loam about 6 inches thick. The subsoil is about 37 inches thick. The upper part is strong brown, friable silty clay loam and firm silty clay. The lower part is yellowish brown, olive yellow, and olive, firm silty clay. Limestone bedrock is at a depth of about 43 inches. In some areas the soil is moderately deep over bedrock and has a thicker mantle of silty material. In other areas it is moderately well drained.

Included with this soil in mapping are small areas of the well drained Crider soils in the slightly lower landscape positions. These soils have less clay in the subsoil than the Lowell soil. They make up about 15 percent of most mapped areas.

Permeability is moderately slow in the Lowell soil. The root zone is deep. The available water capacity is moderate. Runoff is medium. The organic matter content is moderate in the surface layer.

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

This soil is well suited to corn, soybeans, and small grain. It can be cropped frequently, but erosion is a moderate hazard. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Tillage systems that leave crop residue on the surface, contour farming, winter cover crops, grassed waterways, and incorporation of crop residue into the plow layer help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for pasture and hay. Controlling erosion and maintaining the key forage species are management concerns. Grazing when the soil is wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

This soil is well suited to trees. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is moderately well suited to building site development. A moderate shrink-swell potential and the depth to bedrock are limitations on sites for dwellings. Designing walls that have pilasters and are reinforced with concrete and backfilling around foundations with material that has a low shrink-swell potential can minimize the structural damage caused by the shrinking and swelling. The soil is better suited to dwellings without basements than to dwellings with basements because of the depth to bedrock.

This soil is poorly suited to septic tank absorption fields because of the moderately slow permeability. The absorption fields can be improved if they are enlarged or are installed in suitable fill material.

Providing suitable base material minimizes the damage to local roads and streets caused by low strength.

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

LwC2—Lowell silt loam, 8 to 15 percent slopes, eroded. This deep, strongly sloping, well drained soil is on the tops of ridges in the uplands. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are elongated and have uniform slopes. They range from 5 to 40 acres in size.

Typically, the surface layer is yellowish brown, friable silt loam about 8 inches thick. The subsoil is strong brown and yellowish brown, firm clay about 52 inches thick. Limestone bedrock is at a depth of about 60 inches.

Included with this soil in mapping are small areas of the shallow Opequon soils. These soils are along drainageways. They make up about 15 percent of most mapped areas.

Permeability is moderately slow in the Lowell soil. The root zone is deep. The available water capacity is moderate. Runoff is medium. The organic matter content is moderate in the surface layer.

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

This soil is moderately well suited to corn, soybeans, and small grain. The hazard of erosion is severe in cultivated areas. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface and include grasses and legumes, grassed waterways, contour stripcropping, cover crops, and incorporation of crop residue into the plow layer help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Controlling erosion and maintaining stands of the key forage species are management concerns. Grazing when the soil is wet causes compaction and excessive runoff. The no-till seeding method reduces the hazard of erosion. Proper stocking rates, pasture rotation, and mowing for weed control help to keep the pasture in good condition and control erosion.

This soil is well suited to trees. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is moderately well suited to building site development. A moderate shrink-swell potential, the depth to bedrock, and the slope are limitations on sites for dwellings. The adverse effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete and by backfilling around foundations with material that has a low shrink-swell potential. The soil is better suited to dwellings without basements than to dwellings with basements because of the depth to bedrock. Buildings should be designed so that they conform to the natural slope of the land.

This soil is poorly suited to septic tank absorption fields because of the moderately slow permeability. The absorption fields can be improved if they are enlarged or are installed in suitable fill material.

Providing suitable base material minimizes the damage to local roads and streets caused by low strength.

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

McA—McGary Variant silty clay loam, 0 to 3 percent slopes, rarely flooded. This deep, nearly level, somewhat poorly drained soil is in drainageways in old glacial lake basins. Most areas are elongated and have slightly concave slopes. They range from 5 to 35 acres in size.

Typically, the surface layer is grayish brown, friable silty clay loam about 10 inches thick. The subsoil is about 45 inches thick. The upper part is grayish brown and yellowish brown, mottled, firm silty clay loam and silty clay. The lower part is gray, mottled, firm silty clay. The substratum is yellowish brown, very friable sandy loam about 2 inches thick. Limestone bedrock is at a depth of about 57 inches. In some areas the surface layer is darker.

Included with this soil in mapping are small areas of the well drained, moderately deep Bratton soils. Also included are the well drained Otwell soils, which are more silty than the McGary Variant soil. Included soils are in the higher landscape positions. They make up about 15 percent of most mapped areas.

Permeability is slow or very slow in the subsoil of the McGary Variant soil and moderately rapid in the substratum. The root zone is deep in drained areas. Available water capacity is moderate. The organic matter content is moderate in the surface layer. A seasonal high water table is within a depth of 12 inches during extended wet periods. The shrink-swell potential is high.

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

If drained, this soil is well suited to corn, soybeans, and small grain. The seasonal wetness is the main management concern. It delays spring planting in most years (fig. 6). Excess water is commonly removed by surface and subsurface drains. The surface layer crusts after hard rains. No-till cropping systems or other kinds of conservation tillage minimize crusting and improve tilth. Tillage systems that leave crop residue on the surface, winter cover crops, and incorporation of crop residue into the soil help to maintain tilth and minimize crusting.

This soil is well suited to grasses and legumes for hay and pasture, but it is poorly suited to grazing in the spring. Overgrazing or grazing when the soil is too wet causes compaction. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods can help to keep the pasture in good condition.

This soil is well suited to trees. Water-tolerant species should be selected for planting. Selecting seedlings that have been transplanted once reduces the seedling mortality rate. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced can reduce the windthrow hazard.

This soil is generally unsuited to building site development and septic tank absorption fields. Flooding, the seasonal wetness, the slow or very slow permeability, the high shrink-swell potential, and low strength are the major management concerns.

Installing a drainage system and providing suitable base material can help to prevent the damage to local roads and streets caused by seasonal wetness, shrinking and swelling, and low strength. If suitable fill material is added, the roads and streets can be constructed above the expected high level of flooding.

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

Ne—Newark silt loam, frequently flooded. This deep, nearly level, somewhat poorly drained soil is on flood plains. Areas are elongated and range from 5 to 40 acres in size. Slopes are uniform. They range from 0 to 2 percent.

Typically, the surface layer is yellowish brown, friable silt loam about 9 inches thick. The subsoil is grayish brown, light brownish gray, and yellowish brown, mottled, friable and firm silty clay loam about 25 inches thick. The substratum to a depth of about 67 inches is yellowish brown, mottled, firm silty clay loam.

Included with this soil in mapping are small areas of the well drained Nolin soils in the higher landscape positions. These soils make up about 15 percent of most mapped areas.

Permeability is moderate in the Newark soil. The root zone is deep in drained areas. The available water capacity is high. Runoff is very slow. The organic matter content is moderate in the surface layer. A seasonal high water table is between depths of 6 and 18 inches during extended wet periods.

This soil is used mainly as pasture. Some areas are used as cropland. A few areas are wooded.

If drained, this soil is well suited to corn and soybeans. The flooding can damage winter wheat. The flooding and the seasonal wetness are the main management concerns. The soil stays wet for extended periods. The wetness significantly delays planting in most years and reduces the number of days when the soil is suitable for fieldwork. Surface drains help to remove excess water.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet causes compaction and damages the pasture. Also, floodwater deposits sediments on hayland and pasture. This deposition reduces the quality of the forage.

This soil is well suited to trees. Water-tolerant species should be selected for planting.

This soil is generally unsuited to building site development and septic tank absorption fields because of the frequent flooding and the seasonal wetness.

Figure 6.—An area of McGary Variant silty clay loam, 0 to 3 percent slopes, rarely flooded. Seasonal wetness is the main limitation if this soil is used as cropland.

If suitable fill material is added, local roads and streets can be constructed above the expected high level of flooding. Installing a drainage system and providing suitable base material help to prevent the road damage caused by seasonal wetness, low strength, and frost action.

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

NkB—Nicholson silt loam, 1 to 6 percent slopes. This deep, nearly level and gently sloping, moderately well drained soil is on the tops of ridges in the uplands. Most areas are irregularly shaped and have smooth, uniform slopes. They range from 5 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 10 inches thick. The subsoil is about 50 inches thick. The upper part is yellowish brown, friable silt loam and silty clay loam; the next part is a fragipan of yellowish brown, mottled, very firm, brittle silty clay loam; and the lower part is strong brown, mottled, firm silty clay and gravelly clay. Hard limestone bedrock is at a depth of about 60 inches.

Included with this soil in mapping are small areas of Lowell soils on the more sloping parts of the landscape and the moderately well drained Aaron soils in the slightly lower landscape positions. Lowell and Aaron soils do not have a fragipan. They make up about 15 percent of most mapped areas.

Permeability is moderate above the fragipan in the Nicholson soil and slow in the fragipan. The rooting depth is restricted mainly to the moderately deep zone above the fragipan. The available water capacity is moderate. Runoff is medium. The organic matter content is moderate in the surface layer. A seasonal high water table is between depths of 18 and 30 inches during extended wet periods.

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

This soil is well suited to corn, soybeans, and small grain. It can be cropped frequently, but the hazard of erosion is moderate in cultivated areas. The soil is subject to surface crusting. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface, contour farming, winter cover crops, and grassed waterways also help to control erosion. Incorporating crop residue into the plow layer helps to maintain tilth and the organic matter content and minimizes crusting.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet causes compaction and excessive runoff. Deep-rooted legumes are subject to frost heaving. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

This soil is well suited to trees. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced can reduce the windthrow hazard.

This soil is moderately well suited to building site development. The wetness is a limitation on sites for dwellings. The soil is better suited to dwellings without basements than to dwellings with basements. Foundation drains and protective exterior wall coatings help to prevent wetness in basements.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and the slow permeability. Installing perimeter drains around the absorption field lowers the seasonal high water table. Increasing the size of the absorption area and installing the field in suitable fill material help to overcome the restricted permeability.

The damage to local roads and streets caused by low strength and frost action can be minimized by providing suitable base material.

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

No—Nolin silt loam, occasionally flooded. This deep, nearly level, well drained soil is on flood plains. Areas are elongated and range from 10 to 200 acres in size. Slopes are uniform. They range from 0 to 3 percent.

Typically, the surface layer is brown, friable silt loam about 10 inches thick. The subsoil is dark yellowish brown, friable silt loam about 35 inches thick. The substratum to a depth of about 80 inches is dark yellowish brown, friable silt loam. In some areas the soil is moderately well drained.

Included with this soil in mapping are small areas of the somewhat poorly drained Newark soils. These soils are in the lower landscape positions near streams and backwater areas. Also included are some areas that are frequently flooded. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the Nolin soil. The root zone is deep. The available water capacity is high. Runoff is slow. The organic matter content is moderate in the surface layer.

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

This soil is well suited to corn and soybeans and can be cropped intensively (fig. 7). Winter wheat can be damaged by flooding. The flooding occurs mainly during winter and spring. Incorporating crop residue into the soil helps to maintain tilth and minimizes surface crusting.

This soil is well suited to grasses and legumes for hay and pasture. Restricted grazing during wet periods helps to prevent damage to the plant cover and minimizes surface compaction. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to trees. The trees can be logged during the drier parts of the year.

This soil is generally unsuited to building site development and septic tank absorption fields because of the occasional flooding.

If suitable fill material is added, local roads and streets can be constructed above the expected high level of flooding. Providing suitable base material helps to prevent the road damage caused by low strength and frost action.

Figure 7.—An intensively cropped area of Nolin silt loam, occasionally flooded. Eden and Brushcreek soils are on the wooded slopes in the background.

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

OmB—Omulga silt loam, 1 to 6 percent slopes. This deep, nearly level and gently sloping, moderately well drained soil is on high terraces in abandoned preglacial valleys. Most areas are irregularly shaped and have smooth, uniform slopes. They range from 3 to 30 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 52 inches thick. The upper part is yellowish brown, mottled, firm silt loam and silty clay loam; the next part is a fragipan of yellowish brown and strong brown, mottled, very firm, brittle silty clay loam; and the lower part is yellowish brown, mottled, firm silty clay loam.

Included with this soil in mapping are small areas of soils that do not have a fragipan. Also included are small areas of somewhat poorly drained soils on the more nearly level parts of the landscape. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate above the fragipan in the Omulga soil and slow in the fragipan. The rooting depth is restricted mainly to the moderately deep zone above the fragipan. The available water capacity is moderate. Runoff is medium. The organic matter content is moderately low in the surface layer. A seasonal high water table is between depths of 24 and 42 inches during extended wet periods.

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

This soil is well suited to corn, soybeans, and small grain. It can be cropped frequently, but erosion is a moderate hazard. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface and include meadow crops, grassed waterways, contour farming, cover crops, and incorporation of crop residue into the plow layer help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Controlling erosion and maintaining stands of the key forage species are management concerns. Overgrazing or grazing when the soil is wet causes compaction and excessive runoff. Deep-rooted legumes are subject to frost heaving. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

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

This soil is moderately well suited to building site development. The wetness and a moderate shrink-swell potential are limitations on sites for dwellings. Because of the seasonal wetness, the soil is better suited to dwellings without basements than to dwellings with basements. Foundation drains and protective exterior wall coatings help to prevent wetness in basements. Backfilling along basement walls and foundations with material that has a low shrink-swell potential can minimize the structural damage caused by shrinking and swelling.

This soil is poorly suited to septic tank absorption fields. The seasonal wetness and the slow permeability are severe limitations. Installing perimeter drains around the absorption fields lowers the seasonal high water table. Increasing the size of the absorption fields or installing alternating absorption fields helps to overcome the restricted permeability.

The damage to local roads and streets caused by low strength and frost action can be minimized by providing suitable base material.

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

OmC2—Omulga silt loam, 6 to 15 percent slopes, eroded. This deep, strongly sloping, moderately well drained soil is on high terraces in abandoned preglacial valleys. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are elongated or irregularly shaped and have smooth, uniform slopes. They range from 3 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 52 inches thick. The upper part is yellowish brown and strong brown, mottled, firm silty clay loam; the next part is a fragipan of yellowish brown and strong brown, mottled, very firm, brittle silty clay loam; and the lower part is yellowish brown, mottled, firm silty clay loam.

Included with this soil in mapping are small areas of soils that do not have a fragipan. Also included are small areas of somewhat poorly drained soils on the more nearly level parts of the landscape. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate above the fragipan in the Omulga soil and slow in the fragipan. The rooting depth is restricted mainly to the moderately deep zone above the fragipan. The available water capacity is moderate. Runoff is medium. The organic matter content is moderately low in the surface layer. A seasonal high water table is between depths of 24 and 42 inches during extended wet periods.

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

This soil is moderately well suited to corn, soybeans, and small grain. The hazard of erosion is severe in cultivated areas. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface, contour stripcropping, winter cover crops, grassed waterways, and incorporation of crop residue into the plow layer help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Controlling erosion and maintaining stands of the key forage species are management concerns. Overgrazing or grazing when the soil is wet causes compaction and excessive runoff. Deep-rooted legumes are subject to frost heaving. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods keep the pasture in good condition and control erosion.

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

This soil is moderately well suited to building site development. The seasonal wetness, a moderate shrink-swell potential, and the slope are limitations on sites for dwellings. The soil is better suited to dwellings without basements than to dwellings with basements. Foundation drains and protective exterior wall coatings help to prevent wetness in basements. Backfilling along basement walls and foundations with material that has a low shrink-swell potential can minimize the structural damage caused by shrinking and swelling. Buildings should be designed so that they conform to the natural slope of the land.

This soil is poorly suited to septic tank absorption fields. The seasonal wetness and the slow permeability are severe limitations. Installing perimeter drains around the absorption fields lowers the seasonal high water table. Increasing the size of the absorption fields or installing alternating absorption fields helps to overcome the restricted permeability.

The damage to local roads and streets caused by low strength and frost action can be minimized by providing suitable base material.

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

OpD2—Opequon silty clay loam, 15 to 25 percent slopes, eroded. This shallow, moderately steep, well drained soil is on side slopes in the uplands. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are elongated and have slightly convex slopes. They range from 5 to 25 acres in size.

Typically, the surface layer is dark yellowish brown, friable silty clay loam about 5 inches thick. The subsoil is yellowish red and reddish brown, firm clay about 13 inches thick. Limestone bedrock is at a depth of about 18 inches. In some areas the soil is less than 12 inches deep over bedrock.

Included with this soil in mapping are small areas of the moderately deep Bratton soils. These soils are less sloping than the Opequon soil. Also included are small areas of soils that are severely eroded and are gullied. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate or moderately slow in the Opequon soil. The root zone is shallow. The available water capacity is very low. Runoff is rapid. The organic matter content is moderately low in the surface layer. The shrink-swell potential is high.

Most areas are used as hayland or pasture. Some areas are used as cropland. A few areas are wooded.

This soil is generally unsuited to corn, soybeans, small grain, and hay because of droughtiness, the shallow root zone, a severe hazard of erosion, and the slope.

This soil is poorly suited to grasses for pasture. Erosion is a severe hazard if the soil is cultivated during seedbed preparation or if the pastured areas are overgrazed. Controlling erosion and maintaining stands of the key forage species are the main management concerns. Overgrazing or grazing when the soil is too wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Maintaining stands of deep-rooted legumes is difficult because of the shallow root zone.

This soil is poorly suited to trees. North- and east-facing slopes are better sites for woodland than south- and west-facing slopes because of less transpiration and cooler temperatures, both of which result from less exposure to the drying effects of the prevailing wind. Constructing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion. Selecting seedlings that have been transplanted once reduces the seedling mortality rate. Frequent, light thinning and harvesting increase the vigor of the stand and reduce the windthrow hazard. The slope and the clayey texture of the subsoil limit the use of wheeled planting, mowing, spraying, and logging equipment. Tracked equipment can be used.

This soil is generally unsuited to building site development and septic tank absorption fields because of the slope, the shallowness to bedrock, low strength, and the high shrink-swell potential. Local roads should be constructed on the contour.

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

OpE2—Opequon silty clay loam, 25 to 40 percent slopes, eroded. This shallow, steep, well drained soil is on side slopes in the uplands. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are elongated and have convex slopes. They range from 10 to 50 acres in size.

Typically, the surface layer is dark brown, friable silty clay loam about 5 inches thick. The subsoil is about 9 inches of reddish brown and brown, firm silty clay and clay. The substratum is yellowish brown, friable sandy loam about 3 inches thick. Limestone bedrock is at a depth of about 17 inches. In some areas the soil is less than 12 inches deep over bedrock. A few areas are rocky.

Included with this soil in mapping are small areas of the moderately deep Bratton soils on the less sloping parts of the landscape. Also included are some areas of soils that are severely eroded and are gullied and small areas of the deep Brushcreek and Lawshe soils on colluvial foot slopes. Included soils make up about 20 percent of most mapped areas.

Permeability is moderate or moderately slow in the Opequon soil. The root zone is shallow. The available water capacity is very low. Runoff is rapid. The organic matter content is moderately low in the surface layer. The shrink-swell potential is high.

Most areas are wooded. A few areas are used as pasture. This soil is generally unsuited to corn, soybeans, small grain, and hay because of the slope, a severe hazard of erosion, the shallow root zone, and droughtiness.

This soil is poorly suited to grasses for pasture. Erosion is a severe hazard if the soil is cultivated during seedbed preparation or if the pastured areas are overgrazed. Controlling erosion and maintaining stands of the key forage species are the main management concerns. Overgrazing or grazing when the soil is too wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Maintaining stands of deep-rooted legumes is difficult to maintain because of the shallow root zone.

This soil is poorly suited to trees. North- and east-facing slopes are better sites for woodland than south- and west-facing slopes because of less transpiration and cooler temperatures, both of which result from less exposure to the drying effects of the prevailing wind. Constructing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion. Selecting seedlings that have been transplanted once and mulching around seedlings reduce the seedling mortality rate. Frequent, light thinning and harvesting increase the vigor of the stand and reduce the windthrow hazard. The slope and the clayey texture of the subsoil limit the use of wheeled planting, mowing, spraying, and logging equipment. Tracked equipment can be used.

This soil is generally unsuitable as a site for buildings and septic tank absorption fields because of the slope, the shallowness to bedrock, low strength, and the high shrink-swell potential. Local roads should be constructed on the contour.

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

OsF—Opequon silty clay loam, 40 to 60 percent slopes, very rocky. This shallow, very steep, well drained soil is on side slopes in the uplands. Most areas are elongated and have slightly convex slopes. They range from 20 to more than 500 acres in size. They have 2 to 10 percent rock outcrops, which occur as ledges (fig. 8).

Typically, the surface layer is dark brown, friable silty clay loam about 3 inches thick. The subsoil is about 11 inches thick. The upper part is reddish brown, firm silty clay loam. The lower part is reddish brown, firm channery silty clay. Limestone bedrock is at a depth of about 14 inches.

Included with this soil in mapping are small areas of the moderately deep Bratton soils on the less sloping parts of the landscape. Also included are some bedrock escarpments as much as 15 feet high and areas of the deep Brushcreek and Lawshe soils on colluvial foot slopes. Inclusions make up about 15 percent of most mapped areas.

Permeability is moderate or moderately slow in the Opequon soil. The root zone is shallow. The available water capacity is very low. Runoff is rapid. The organic matter content is moderately low in the surface layer. The shrink-swell potential is high.

Most areas are wooded. This soil is generally unsuited to corn, soybeans, small grain, hay, and pasture because of the slope, a severe hazard of erosion, the shallow root zone, and droughtiness.

This soil is poorly suited to trees. North- and east-facing slopes are better sites for woodland than south- and west-facing slopes because of less transpiration and cooler temperatures, both of which result from less exposure to the drying effects of the prevailing wind. Constructing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion. Selecting seedlings that have been transplanted once and mulching reduce the seedling mortality rate. Frequent, light thinning and harvesting increase the vigor of the stand and reduce the windthrow hazard. The slope and the clayey texture of the subsoil limit the use of wheeled planting, mowing, spraying, and logging equipment. Tracked equipment can be used.

This soil is generally unsuitable as a site for buildings and septic tank absorption fields because of the slope, the shallowness to bedrock, low strength, and the high shrink-swell potential. Local roads should be constructed on the contour.

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

OwB—Otwell silt loam, 1 to 6 percent slopes. This deep, nearly level and gently sloping, moderately well drained soil is in lake basins. Slopes are smooth and uniform. Most areas are irregularly shaped and have smooth, uniform slopes. They range from 3 to more than 100 acres in size.

Typically, the surface layer is brown, friable silt loam

Figure 8.—Rock ledges in an area of Opequon silty clay loam, 40 to 60 percent slopes, very rocky.

about 9 inches thick. The subsoil is about 59 inches thick. The upper part is yellowish brown, friable silt loam and firm silty clay loam; the next part is a fragipan of yellowish brown, mottled, very firm, brittle silty clay loam; and the lower part is yellowish brown, mottled, firm silty clay. The subsoil is mottled at a depth of about 24 inches. In some areas the soil is somewhat poorly drained.

Included with this soil in mapping are small areas of Licking soils. These soils are on the periphery of most areas. They have more clay than the Otwell soil. They make up about 15 percent of most mapped areas.

Permeability is moderately slow above the fragipan in the Otwell soil and very slow in the fragipan. The rooting depth is restricted mainly to the moderately deep zone above the fragipan. The available water capacity is moderate. Runoff is medium. The organic matter content is moderately low in the surface layer. A seasonal high water table is between depths of 24 and 42 inches during extended wet periods.

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

This soil is well suited to corn, soybeans, and small grain. It can be cropped frequently, but erosion is a moderate hazard. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface and include meadow crops, grassed waterways, contour farming, cover crops, and incorporation of crop residue into the plow layer help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Controlling erosion and maintaining stands of the key forage species are the major management concerns. Overgrazing or grazing when the soil is wet causes compaction and excessive runoff. Maintaining stands of deep-rooted legumes is difficult because of the limited depth to a fragipan and because of frost action. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

This soil is well suited to trees. Selecting seedlings that have been transplanted once or mulching around seedlings reduces the seedling mortality rate. Frequent, light thinning and harvesting increase the vigor of the stand and reduce the windthrow hazard.

This soil is moderately well suited to building site development. The seasonal wetness and a moderate shrink-swell potential are limitations on sites for dwellings. Because of the seasonal wetness, the soil is better suited to dwellings without basements than to dwellings with basements. Foundation drains and protective exterior wall coatings help to prevent wetness in basements. Backfilling along basement walls and foundations with material that has a low shrink-swell potential can minimize the structural damage caused by shrinking and swelling.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and the slow permeability. Installing perimeter drains reduces the wetness. Increasing the size of the absorption fields or installing alternating absorption fields helps to overcome the restricted permeability. Land grading helps to remove surface water away from the absorption fields.

Providing suitable base material minimizes the damage to local roads and streets caused by low strength and frost action.

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

OwC2—Otwell silt loam, 6 to 15 percent slopes, eroded. This deep, strongly sloping, moderately well drained soil is in lake basins. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are elongated or irregularly shaped and have smooth, uniform slopes. They range from 3 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 60 inches thick. The upper part is yellowish brown, firm silty clay loam. The lower part is a fragipan of strong brown and yellowish brown, mottled, firm, brittle silty clay loam. The subsoil is mottled at a depth of about 21 inches.

Included with this soil in mapping are small areas of Licking soils in the slightly higher landscape positions. These soils have more clay in the subsoil than the Otwell soil. They make up about 15 percent of most mapped areas.

Permeability is moderately slow above the fragipan in the Otwell soil and very slow in the fragipan. The rooting depth is restricted mainly to the moderately deep zone above the fragipan. The available water capacity is moderate. The organic matter content is moderately low in the surface layer. A seasonal high water table is between depths of 24 and 42 inches during extended wet periods.

Most areas are used as cropland. This soil is moderately well suited to corn, soybeans, and small grain. The hazard of erosion is severe in cultivated areas. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface, contour stripcropping, winter cover crops, grassed waterways, and incorporation of crop residue into the plow layer help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Controlling erosion and maintaining stands of the key forage species are management concerns. Overgrazing or grazing when the soil is wet causes compaction and excessive runoff. Deep-rooted legumes are subject to frost heaving. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

This soil is well suited to trees. Selecting seedlings that have been transplanted once and mulching around seedlings reduce the seedling mortality rate. Frequent, light thinning and harvesting increase the vigor of the stand and reduce the windthrow hazard.

This soil is moderately well suited to building site development. The wetness, a moderate shrink-swell potential, and the slope are limitations on sites for dwellings. The soil is better suited to dwellings without basements than to dwellings with basements. Foundation drains and protective exterior wall coatings help to prevent wetness in basements. Backfilling along basement walls and foundations with material that has a low shrink-swell potential can minimize the structural damage caused by shrinking and swelling. Buildings should be designed so that they conform to the natural slope of the land.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and the slow permeability. Installing perimeter drains reduces the wetness. Increasing the size of the absorption fields or installing alternating absorption fields helps to overcome the restricted permeability. Installing the distribution lines on the contour minimizes lateral seepage of the effluent.

Providing suitable base material minimizes the damage to local roads and streets caused by low strength and frost action.

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

Pe—Peoga silt loam. This deep, nearly level, poorly drained soil is on low terraces. Areas are commonly elongated and are 5 to 30 acres in size. Slopes are smooth and even. They range from 0 to 2 percent.

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

Included with this soil in mapping are small areas of the well drained Elkinsville and moderately well drained Sciotoville soils on the higher terraces. Sciotoville soils have a fragipan. Included soils make up about 15 percent of most mapped areas.

Permeability is slow in the Peoga soil. The root zone is deep in drained areas. The available water capacity is high. The organic matter content is moderate in the surface layer. A seasonal high water table is within a depth of 12 inches during extended wet periods.

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

If drained, this soil is moderately well suited to corn, soybeans, and small grain. It can be cropped intensively. The seasonal wetness is the main management concern. It delays spring planting in most years. Subsurface and surface drains are commonly used to remove excess water. The surface layer crusts after hard rains. Shallow cultivation of intertilled crops breaks up the crust. Incorporating crop residue into the plow layer helps to maintain tilth.

This soil is moderately well suited to grasses and legumes for hay and pasture. It is poorly suited to grazing early in spring. Grazing when the soil is wet causes compaction. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods minimize compaction and help to keep the pasture in good condition.

This soil is moderately well suited to trees. The species selected for planting should be those that are tolerant of wetness. The trees can be logged when the soil is frozen or during the drier parts of the year. Selecting seedlings that have been transplanted once reduces the seedling mortality rate. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced can reduce the windthrow hazard.

This soil is poorly suited to building site development. The seasonal wetness is a severe limitation on sites for dwellings. Installing drains at the base of footings, sealing exterior walls, draining roof water, and shaping the site so that surface water drains away from foundations help to prevent wetness in basements and crawl spaces. Because of poor drainage outlets, pumps are needed in many areas.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and the slow permeability. Installing perimeter drains, enlarging the absorption fields, and shaping the site so that surface water drains away from the absorption fields help to overcome these limitations.

The seasonal wetness, a high potential for frost action, and low strength severely limit the use of this soil as a site for local roads and streets. Installing a drainage system and providing suitable base material help to overcome these limitations.

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

Pq—Pits, quarry. This map unit consists of nearly level to very steep, surface-mined areas from which dense, hard, gray limestone has been or is being removed for use in construction. The pits are mainly in areas where limestone bedrock is close to the surface. Typically, they are adjacent to areas of Bratton, Faywood, Lowell, and Opequon soils. Actively mined pits are continually being enlarged. Most of the pits are rectangular or square and range from 5 to 50 acres in size.

Because the soils around the pits are commonly disturbed during mining, erosion is a severe hazard. Uncontrolled runoff results in gullying and siltation in the lower areas and nearby drainageways. The material remaining after mining is poorly suited to plants. Some areas that are no longer being mined support weeds and trees.

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

PtB—Plainfield sand, 3 to 8 percent slopes. This deep, gently sloping, excessively drained soil is on terraces. Areas are elongated and have uniform slopes. They range from 10 to 150 acres in size.

Typically, the surface layer is dark brown, very friable sand about 9 inches thick. The subsoil is brown and strong brown, very friable and loose sand about 39 inches thick. The substratum to a depth of about 80 inches is yellowish brown, loose sand.

Included with this soil in mapping are small areas of the well drained Elkinsville soils in the lower landscape positions. These soils make up about 15 percent of most mapped areas.

Permeability is rapid in the Plainfield soil. The root zone is deep. The available water capacity is low. Runoff is slow. The organic matter content is low in the surface layer.

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

Unless irrigated, this soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If irrigated, it is better suited to these crops. It is especially well suited to deep-rooted crops. No-till cropping systems or other kinds of conservation tillage can help to maintain the content of organic matter, reduce droughtiness, and control soil blowing and water erosion. Cropping systems that leave crop residue on the surface and cover crops help to maintain the organic matter content, conserve moisture, and control soil blowing and water erosion. Because applied nutrients are rapidly leached from this soil, smaller, more frequent applications of fertilizer and lime are better suited than one large application.

This soil is moderately well suited to trees. Seedling mortality is a hazard during dry periods. Selecting seedlings that have been transplanted once and mulching around seedlings reduce the seedling mortality rate. Drought-tolerant species should be selected for planting.

This soil is well suited to building site development and local roads and streets. It is only moderately well suited to septic tank absorption fields because of the hazard of ground-water contamination. It readily absorbs but does not adequately filter the effluent. The caving of cutbanks is a hazard in excavations. Lawns dry up during periods of low rainfall in summer. New seedlings should be mulched and watered. Soil blowing is a hazard during construction. It can be controlled by maintaining as much vegetation as possible on the construction site.

The land capability classification is IVs. The woodland ordination symbol is 4S. The pasture and hayland suitability group is B-1.

RoB—Rossmoyne silt loam, 1 to 6 percent slopes. This deep, nearly level and gently sloping, moderately well drained soil is on till plains. Most areas are irregularly shaped and have uniform slopes. They range from 20 to 500 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 63 inches thick. The upper part is yellowish brown, friable silt loam; the next part is a fragipan of yellowish brown, mottled, very firm, brittle silty clay loam; and the lower part is yellowish brown, mottled, firm clay. In some areas the soil is well drained.

Included with this soil in mapping are small areas of Avonburg and Loudon soils. The somewhat poorly drained Avonburg soils are in nearly level areas. Loudon soils do not have a fragipan and contain more clay than the Rossmoyne soil. They are in areas where interbedded limestone and shale bedrock is closer to the surface. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate above the fragipan in the Rossmoyne soil and moderately slow or slow in the fragipan. The rooting depth is restricted mainly to the moderately deep zone above the fragipan. The available water capacity is moderate. Runoff is medium. The organic matter content is moderate in the surface layer. A perched seasonal high water table is between depths of 18 and 36 inches during extended wet periods.

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

This soil is well suited to corn, soybeans, and small grain. It can be cropped frequently, but erosion is a moderate hazard. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface and include meadow crops, grassed waterways, contour farming, cover crops, and incorporation of crop residue into the plow layer help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for pasture and hay. Controlling erosion and maintaining stands of the key forage species are management concerns. Overgrazing or grazing when the soil is too wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

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

This soil is moderately well suited to building site development. The seasonal wetness and a moderate shrink-swell potential are limitations on sites for dwellings. Because of the seasonal wetness, the soil is better suited to dwellings without basements than to dwellings with basements. Foundation drains and protective exterior wall coatings help to prevent wetness in basements. The adverse effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete and by backfilling around foundations with material that has a low shrink-swell potential.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and the slow or moderately slow permeability. Installing perimeter drains around the absorption fields lowers the seasonal high water table. Increasing the size of the absorption fields helps to overcome the restricted permeability.

Providing suitable base material and installing a drainage system minimize the damage to local roads and streets resulting from low strength and frost action.

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

RoC2—Rossmoyne silt loam, 6 to 12 percent slopes, eroded. This deep, strongly sloping, moderately well drained soil is on side slopes on till plains. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are irregularly shaped and have uniform slopes. They range from 5 to 10 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 60 inches thick. The upper part is yellowish brown, friable silty clay loam. The lower part is a fragipan of yellowish brown, very firm, brittle clay loam. The subsoil is mottled at a depth of about 15 inches. The substratum to a depth of about 75 inches is yellowish brown, firm loamy glacial till. In some areas the soil does not have a fragipan. In a few areas it is well drained.

Included with this soil in mapping are small areas of the well drained Jessup and Loudon soils. These soils are in areas where interbedded limestone and shale bedrock is closer to the surface. They make up about 10 percent of most mapped areas.

Permeability is moderate above the fragipan in the Rossmoyne soil and slow or moderately slow in the fragipan. The rooting depth is restricted mainly to the moderately deep zone above the fragipan. The available water capacity is moderate. Runoff is rapid. The organic matter content is moderate in the surface layer. A perched seasonal high water table is between depths of 18 and 36 inches during extended wet periods.

This soil is used mainly as pasture or cropland. It is moderately well suited to corn, soybeans, and small grain. Erosion is a severe hazard in cultivated areas. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. The surface layer crusts after hard rains. Cropping systems that leave crop residue on the surface and include grasses and legumes, grassed waterways, and cover crops help to control erosion, minimize crusting, and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Controlling erosion and maintaining stands of the key forage species are management concerns. Overgrazing or grazing when the soil is wet causes compaction, increases the runoff rate, and reduces forage yields. Pasture rotation and restricted grazing when the soil is wet help to keep the pasture in good condition and control erosion.

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

This soil is moderately well suited to building site development. The seasonal wetness, a moderate shrink-swell potential, and the slope are limitations on sites for dwellings. The soil is better suited to dwellings without basements than to dwellings with basements. Building sites should be landscaped so that surface water drains away from foundations. Drains at the base of footings and exterior wall coatings help to prevent wetness in basements. Backfilling excavations along basement walls and foundations with material that has a low shrink-swell potential can minimize the structural damage caused by shrinking and swelling. Buildings should be designed so that they conform to the natural slope of the land.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and the slow or moderately slow permeability. Installing perimeter drains around the absorption fields reduces the wetness. Increasing the size of the fields helps to overcome the restricted permeability.

The damage to local roads and streets caused by low strength and frost action can be minimized by providing suitable base material and by installing a drainage system.

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

SaB—Sardinia silt loam, 1 to 6 percent slopes. This deep, nearly level and gently sloping, moderately well drained soil is on stream terraces. Most areas are elongated and have uniform slopes. They range from 5 to 15 acres in size.

Typically, the surface layer is dark yellowish brown, friable silt loam about 9 inches thick. The subsoil is about 56 inches thick. It is yellowish brown. The upper part is friable silt loam and firm silty clay loam; the next part is mottled, firm silty clay loam and clay loam; and the lower part is mottled, firm clay loam and sandy clay loam. The substratum to a depth of about 80 inches is yellowish brown, friable gravelly sandy clay loam and firm clay loam.

Included with this soil in mapping are small areas of the well drained Williamsburg soils in the slightly higher landscape positions. These soils make up about 15 percent of most mapped areas.

Permeability is moderate or moderately slow in the Sardinia soil. The root zone is deep. The available water capacity is high. Runoff is medium. The organic matter content is moderately low in the surface layer. A seasonal high water table is between depths of 18 and 36 inches during extended wet periods.

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

This soil is well suited to corn, soybeans, and small grain. It can be cropped frequently, but erosion is a hazard. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. The surface layer crusts after hard rains. Cropping systems that leave crop residue on the surface, contour farming, winter cover crops, grassed waterways, and incorporation of crop residue into the plow layer help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Controlling erosion and maintaining stands of the key forage species are management concerns. Overgrazing or grazing when the soil is wet causes compaction and excessive runoff. Deep-rooted legumes are subject to frost heaving. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

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

This soil is moderately well suited to building site development. The seasonal wetness and a moderate shrink-swell potential are limitations on sites for dwellings. Because of the seasonal wetness, the soil is better suited to dwellings without basements than to dwellings with basements. Building sites should be landscaped so that surface water drains away from foundations and septic tank absorption fields. Drains at the base of footings and exterior wall coatings help to prevent wetness in basements. Backfilling excavations along basement walls and foundations with material that has a low shrink-swell potential minimizes the structural damage caused by shrinking and swelling.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and the moderately slow permeability. Installing perimeter drains around the absorption fields reduces the wetness. Increasing the size of the fields or installing alternating absorption fields helps to overcome the restricted permeability.

The damage to local roads and streets caused by low strength and frost action can be minimized by providing suitable base material and installing a drainage system.

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

ScB—Sciotoville silt loam, 1 to 6 percent slopes. This deep, nearly level and gently sloping, moderately well drained soil is on stream terraces. Most areas are somewhat elongated and have uniform slopes. They range from 10 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 61 inches thick. The upper part is yellowish brown and brown, mottled, friable silt loam and firm silty clay loam; the next part is a fragipan of brown, mottled, very firm, brittle silty clay loam; and the lower part is brown, firm silt loam. The substratum to a depth of about 80 inches is brown, mottled, firm silt loam.

Included with this soil in mapping are small areas of the well drained Elkinsville soils in the slightly higher landscape positions. Also included are small areas of the poorly drained Peoga soils along drainageways. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate above the fragipan in the Sciotoville soil and moderately slow or slow in the fragipan. The rooting depth is restricted mainly to the moderately deep zone above the fragipan. The available water capacity is moderate. Runoff is medium. The organic matter content is moderately low in the surface layer. A seasonal high water table is between depths of 18 and 36 inches during extended wet periods.

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

This soil is well suited to corn, soybeans, and small grain. It can be cropped frequently, but the hazard of erosion is moderate in cultivated areas. The soil is subject to crusting. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface, contour farming, winter cover crops, and grassed waterways reduce the hazard of erosion. Returning crop residue to the soil helps to maintain tilth and the organic matter content and minimizes crusting.

This soil is well suited to grasses and legumes for hay and pasture. Controlling erosion and maintaining stands of the key forage species are management concerns. Overgrazing or grazing when the soil is wet causes compaction and excessive runoff. Deep-rooted legumes are subject to frost heaving. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

This soil is well suited to trees. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is moderately well suited to building site development. Because of the seasonal wetness, it is better suited to dwellings without basements than to dwellings with basements. Building sites should be landscaped so that surface water drains away from foundations. Drains at the base of footings and exterior wall coatings help to prevent wetness in basements.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and the moderately slow or slow permeability. Installing perimeter drains around the absorption fields reduces the wetness. Increasing the size of the fields or installing alternating absorption fields helps to overcome the restricted permeability.

The damage to local roads and streets caused by frost action can be minimized by providing suitable base material and by installing a drainage system.

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

ShE—Shelocta-Berks association, steep. These well drained soils are on side slopes in the uplands. The deep Shelocta soil is commonly on the lower side slopes. The moderately deep Berks soil is on the steeper shoulder slopes. Slopes are dominantly 25 to 40 percent. They are generally uniform. Areas are irregularly shaped and range from 50 to 250 acres in size. Most are about 55 percent Shelocta silt loam and 35 percent Berks silt loam. Because of present and anticipated land uses, mapping the two soils separately was not considered practical or necessary.

Typically, the Shelocta soil has a surface layer of dark yellowish brown, friable silt loam about 7 inches thick. The subsurface layer is yellowish brown, friable silt loam about 7 inches thick. The subsoil is about 34 inches thick. The upper part is dark yellowish brown and yellowish brown, friable silt loam and channery silt loam. The lower part is strong brown, firm channery and very channery silty clay loam. Siltstone bedrock is at a depth of about 48 inches.

Typically, the Berks soil has a surface layer of dark grayish brown, friable silt loam about 3 inches thick. The subsoil is about 27 inches thick. The upper part is light olive brown, friable channery silt loam. The lower part is yellowish brown, friable very channery silt loam. Fractured siltstone bedrock that is weathered in the upper 6 inches is at a depth of about 30 inches.

Included with these soils in mapping are small areas of the moderately well drained, moderately deep Latham and moderately deep Wernock soils on ridgetops. Wernock soils have a lower content of coarse fragments in the subsoil than the Shelocta and Berks soils. Included soils make up about 10 percent of most mapped areas.

Permeability is moderate in the Shelocta soil and moderate or moderately rapid in the Berks soil. The root zone is deep in the Shelocta soil and moderately deep in the Berks soil. The available water capacity is moderate in the Shelocta soil and very low in the Berks soil. Runoff is very rapid on both soils. The organic matter content is moderate in the surface layer of the Shelocta soil and moderately low in the surface layer of the Berks soil.

Most areas are wooded. These soils are generally unsuited to corn, soybeans, small grain, and hay and are poorly suited to pasture because of the slope and the hazard of erosion. This hazard is very severe if the soils are cultivated during seedbed preparation or if pastured areas are overgrazed. Controlling erosion and maintaining stands of the key forage species are management concerns. Overgrazing or grazing when the soils are too wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

These soils are moderately well suited to woodland. Constructing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion. Selecting seedlings that have been transplanted once and mulching around seedlings reduce the seedling mortality rate on the Berks soil. North- and east-facing slopes are better sites for woodland than south- and west-facing slopes because of less evaporation and cooler temperatures, both of which result from less exposure to the drying effects of the prevailing wind and the sun.

These soils are generally unsuited to building site development and septic tank absorption fields because of the slope of both soils and the bedrock at a depth of 20 to 40 inches in the Berks soil. Local roads should be constructed on the contour.

The land capability classification is VIe. The woodland ordination symbol is 4R in areas of the Shelocta soil. In areas of the Berks soil, it is 4R on north aspects and 3R on south aspects. The pasture and hayland suitability group is A-3 in areas of the Shelocta soil and F-2 in areas of the Berks soil.

ShF—Shelocta-Berks association, very steep. These well drained soils are on side slopes along deep drainageways in the uplands. The deep Shelocta soil is commonly in areas on foot slopes and benches where slopes range from 40 to 60 percent. The moderately deep Berks soil is on the steeper shoulder slopes. Slopes are dominantly 40 to 70 percent. They are generally uneven. Narrow benches are in some areas. Areas are irregularly shaped and range from 200 to 1,000 acres in size. Most are about 55 percent Shelocta silt loam and 35 percent Berks silt loam. Because of present and anticipated land uses, mapping the two soils separately was not considered practical or necessary.

Typically, the Shelocta soil has a surface layer of dark yellowish brown, friable silt loam about 7 inches thick. The subsurface layer is yellowish brown, friable silt loam about 7 inches thick. The subsoil is about 34 inches thick. The upper part is dark yellowish brown and yellowish brown, friable silt loam and channery silt loam. The lower part is strong brown, firm channery and very channery silty clay loam. Siltstone bedrock is at a depth of about 48 inches.

Typically, the Berks soil has a surface layer of dark grayish brown, friable silt loam about 3 inches thick. The subsoil is about 27 inches thick. The upper part is light olive brown, friable channery silt loam. The lower part is yellowish brown, friable very channery silt loam. Fractured siltstone bedrock that is weathered in the upper 6 inches is at a depth of about 30 inches.

Included with these soils in mapping are small areas of the moderately deep Wernock soils. These soils have a lower content of coarse fragments than the Berks soil. They make up about 10 percent of most mapped areas.

Permeability is moderate in the Shelocta soil and moderate or moderately rapid in the Berks soil. The root zone is deep in the Shelocta soil and moderately deep in the Berks soil. The available water capacity is moderate in the Shelocta soil and very low in the Berks soil. Runoff is very rapid on both soils. The organic matter content is moderate in the surface layer of the Shelocta soil and moderately low in the surface layer of the Berks soil.

Most areas are wooded. These soils are generally unsuited to corn, soybeans, small grain, hay, and pasture because of the slope and the hazard of erosion.

These soils are moderately well suited to woodland. Constructing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion. Selecting seedlings that have been transplanted once and mulching around seedlings reduce the seedling mortality rate. North- and east-facing slopes are better sites for woodland than south- and west-facing slopes because of less evaporation and cooler temperatures, both of which result from less exposure to the drying effects of the prevailing wind and the sun.

These soils are generally unsuited to building site development and septic tank absorption fields because of the slope of both soils and the bedrock at a depth of 20 to 40 inches in the Berks soil. Local roads should be constructed on the contour.

The land capability classification is VIIe. The woodland ordination symbol is 4R in areas of the Shelocta soil. In areas of the Berks soil, it is 4R on north aspects and 3R on south aspects. The pasture and hayland suitability group is H-1.

SmD—Shelocta-Muse association, hilly. These deep, well drained soils are on colluvial foot slopes in the uplands. The Shelocta soil is commonly on the upper two-thirds of the foot slopes, and Muse soil is on the lower one-third. Landslips are common in some areas. Slopes are dominantly 15 to 25 percent. They generally are irregularly shaped. Areas are elongated and range from 20 to 200 acres in size. Most are about 60 percent Shelocta silt loam and 30 percent Muse silt loam. Because of present and anticipated land uses, mapping the two soils separately was not considered practical or necessary.

Typically, the Shelocta soil has a surface layer of brown, friable silt loam about 7 inches thick. The subsurface layer is yellowish brown, friable silt loam about 7 inches thick. The subsoil is yellowish brown, firm channery silty clay loam about 38 inches thick. The substratum to a depth of about 60 inches is yellowish brown, firm channery silty clay loam.

Typically, the Muse soil has a surface layer of brown, friable silt loam about 2 inches thick. The subsurface layer is yellowish brown, friable silt loam about 4 inches thick. The subsoil is about 40 inches thick. The upper part is yellowish brown and yellowish red, firm silty clay loam and shaly silty clay loam. The lower part is yellowish red, mottled, firm shaly silty clay. The substratum is yellowish brown, yellowish red, and grayish brown, firm very shaly silty clay about 8 inches thick. Soft shale bedrock is at a depth of about 54 inches.

Included with these soils in mapping are small areas of the moderately deep Bratton and Trappist soils. Bratton soils are underlain by limestone bedrock. Trappist soils are in the less sloping areas. Also included are some areas of soils that are susceptible to slippage. Included soils make up about 10 percent of most mapped areas.

Permeability is moderate in the Shelocta soil and slow in the Muse soil. The root zone is deep in both soils. The available water capacity is moderate. Runoff is medium. The organic matter content is moderate in the surface layer.

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

These soils are poorly suited to corn, soybeans, and small grain but can be cropped occasionally. The hazard of erosion is severe in cultivated areas. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface and include meadow crops, grassed waterways, contour stripcropping, cover crops, and incorporation of crop residue into the plow layer help to control erosion and maintain tilth and the organic matter content.

These soils are moderately well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soils are too wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

These soils are well suited to trees. Hillside slippage in areas of the Muse soil causes curvature of some trees (fig. 9). Constructing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion. North- and east-facing slopes are better sites for woodland than south- and west-facing slopes because of less evaporation and cooler temperatures, both of which result from less exposure to the drying effects of the prevailing wind and the sun.

These soils are poorly suited to building site development and septic tank absorption fields because of the slope of both soils and the slow permeability and low strength in the Muse soil. Buildings should be designed so that they conform to the natural slope of the land. Installing septic tank absorption in suitable fill material or increasing the size of the fields helps to overcome the restricted permeability. Local roads and streets should be built on the contour. Providing suitable base material can minimize the road damage caused by low strength.

The included soils that are susceptible to slippage are generally unsuited to building site development and septic tank absorption fields.

The land capability classification is IVe. The woodland ordination symbol is 4R in areas of the Shelocta soil and 3R in areas of the Muse soil. The pasture and hayland suitability group is A-2.

SoE—Shelocta-Muse-Colyer association, steep. These well drained soils are on colluvial foot slopes and shoulder slopes in the uplands. The deep Shelocta soil is commonly on the upper two-thirds of the foot slopes, and the deep Muse soil is on the lower one-third. Landslips are common in areas of the Muse soil. The shallow Colyer soil occurs as narrow bands on the steepest part of the shoulder slopes in most areas. Slopes are irregular. They are dominantly 25 to 50 percent, but in some areas they are more than 50 percent. Most areas are elongated and range from 25 to 100 acres in size. They are about 55 percent Shelocta silt loam, 25 percent Muse silt loam, and 15 percent Colyer very shaly silty clay loam. Because of present and anticipated land uses, mapping the three soils separately was not considered practical or necessary.

Typically, the Shelocta soil has a surface layer of brown, friable silt loam about 7 inches thick. The subsurface layer is yellowish brown, friable silt loam about 7 inches thick. The subsoil is yellowish brown, firm channery silty clay loam about 38 inches thick. The substratum to a depth of about 60 inches is yellowish brown, firm very channery silty clay loam.

Typically, the Muse soil has a surface layer of brown, friable silt loam about 2 inches thick. The subsurface layer is yellowish brown, friable silt loam about 4 inches thick. The subsoil is about 40 inches thick. The upper part is yellowish brown and yellowish red, firm silty clay loam and shaly silty clay loam. The lower part is yellowish red, mottled, firm shaly silty clay. The substratum is yellowish brown, yellowish red, and

Figure 9.—A wooded area of the Shelocta-Muse association, hilly. Hillside movement causes curvature of trees on the Muse soil.

grayish brown, firm very shaly silty clay about 8 inches thick. Soft shale bedrock is at a depth of about 54 inches.

Typically, the Colyer soil has a surface layer of brown, friable very shaly silty clay loam about 4 inches thick. The subsoil is strong brown and yellowish red, firm very shaly clay about 11 inches thick. Gray shale bedrock is at a depth of about 15 inches.

Included with these soils in mapping are small areas of the moderately deep Berks and Trappist soils on ridgetops. Also included are some small areas of soils that are subject to slippage. Included soils make up about 5 percent of most mapped areas.

Permeability is moderate in the Shelocta soil and slow in the Muse and Colyer soils. The root zone is deep in Shelocta and Muse soils and shallow in the Colyer soil. The available water capacity is moderate in the Shelocta and Muse soils and very low in the Colyer soil. Runoff is rapid on Shelocta and Muse soils and very rapid on the Colyer soil. The organic matter content is moderate in the surface layer of the Shelocta and Muse soils and moderately low in the surface layer of the Colyer soil.

Most areas are wooded. These soils are generally unsuited to corn, soybeans, small grain, and hay and are poorly suited to pasture because of the steep, uneven slopes and the hazard of erosion. This hazard is very severe if the soils are cultivated during seedbed preparation or if pastured areas are overgrazed. Controlling erosion and maintaining stands of the key forage species are management concerns. Overgrazing or grazing when the soils are too wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

These soils are moderately well suited to trees. Constructing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion. Selecting seedlings that have been transplanted once and mulching around seedlings reduce the seedling mortality rate on the Colyer soil. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced can reduce the windthrow hazard on the Colyer soil. North- and east-facing slopes are better sites for woodland than south- and west-facing slopes because of less evaporation and cooler temperatures, both of which result from less exposure to the drying effects of the prevailing wind and the sun.

These soils are generally unsuited to building site development and septic tank absorption fields because of the slope, slow permeability, and low strength in areas of the Muse and Colyer soils; the depth to bedrock in the Colyer soil; and slippage on some of the included soils. Local roads should be constructed on the contour.

The land capability classification is VIIe. The woodland ordination symbol is 4R in areas of the Shelocta soil and 3R in areas of Muse and Colyer soils. The pasture and hayland suitability group is A-3 in areas of the Shelocta and Muse soils and E-2 in areas of the Colyer soil.

Sp—Skidmore gravelly loam, occasionally flooded. This deep, nearly level, well drained soil is in elongated areas on flood plains. Most areas range from 5 to 400 acres in size. Slopes range from 0 to 2 percent.

Typically, the surface layer is dark yellowish brown, friable gravelly loam about 9 inches thick. The subsoil is about 26 inches thick. The upper part is yellowish brown, friable gravelly and very gravelly loam. The lower part is yellowish brown, friable extremely gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, friable extremely gravelly sandy loam.

Included with this soil in mapping are small areas of Nolin soils in the lower positions on the flood plains. These soils have a lower content of coarse fragments than the Skidmore soil. Also included are areas on alluvial fans where slopes are more than 2 percent. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately rapid in the Skidmore soil. The root zone is deep. The available water capacity is low. Runoff is slow. The organic matter content is moderately low in the surface layer.

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

This soil is moderately well suited to corn and soybeans and can be cropped intensively. Winter wheat can be damaged by flooding. No-till cropping systems or other kinds of conservation tillage minimize crusting and improve tilth. The flooding occurs in late fall and early spring and thus does not interfere with most farming activities. Incorporating crop residue into the surface layer helps to maintain tilth and increases the content of organic matter. In dry years the soil may be somewhat droughty. It is well suited to irrigation.

This soil is moderately well suited to grasses and legumes for hay and pasture. Maintaining stands of the key forage species is the major management concern. Flooding sometimes deposits sediments on pasture and hayland. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition.

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

This soil is generally unsuited to building site development and septic tank absorption fields because of the occasional flooding. The included alluvial fans are less likely to be flooded. If suitable fill material is added, local roads and streets can be constructed above the expected high level of flooding.

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

TkA—Tilsit silt loam, 0 to 3 percent slopes. This nearly level, moderately well drained soil is on the tops of ridges in the uplands. Most slopes are slightly convex. They are steeper at the edges of the ridgetops than in other areas. Most areas are elongated and range from 3 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 42 inches thick. The upper part is dark yellowish brown and strong brown, friable silt loam. The lower part is a fragipan of yellowish brown, mottled, very firm, brittle silt loam and channery silt loam. Thinly bedded siltstone and sandstone bedrock is at a depth of about 49 inches. In places the soil does not have a fragipan and is shallower over bedrock. Water-filled depressions are in some areas.

Included with this soil in mapping are small areas of the moderately deep, well drained Wernock soils on the strongly sloping parts of the landscape. These soils do not have a fragipan. They make up about 15 percent of most mapped areas.

Permeability is moderate above the fragipan in the Tilsit soil and slow in the fragipan. The rooting depth is restricted mainly to the moderately deep zone above the fragipan. The available water capacity is moderate. Runoff is medium. The organic matter content is moderately low in the surface layer. A seasonal high water table is between depths of 18 and 30 inches during extended wet periods.

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

This soil is well suited to corn, soybeans, and small grain. The removal of excess water and maintenance of tilth and the organic matter content are the major management concerns. The soil dries slowly in the spring. As a result, planting is often delayed. Subsurface drains are used to lower the seasonal high water table in some of the wetter areas. No-till cropping systems and other kinds of conservation tillage leave crop residue on the surface and thus improve tilth and increase the organic matter content.

This soil is well suited to grasses and legumes for pasture and hay. Maintaining stands of the key forage species is a management concern. Overgrazing or grazing when the soil is wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition.

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

This soil is moderately well suited to building site development. Because of the seasonal wetness, it is better suited to dwellings without basements than to dwellings with basements. Building sites should be landscaped so that surface water drains away from foundations and septic tank absorption fields. Drains at the base of footings and exterior wall coatings help to prevent wetness in basements.

This soil is poorly suited to septic tank absorption fields because of the slow or moderately slow permeability and the seasonal wetness. Increasing the size of the absorption area or installing alternating absorption fields helps to overcome the restricted permeability. Installing perimeter drains around the absorption fields lowers the seasonal high water table.

The damage to local roads and streets caused by low strength and frost action can be minimized by installing a drainage system and by providing suitable base material.

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

TrB—Trappist silt loam, 3 to 8 percent slopes. This moderately deep, gently sloping, well drained soil is on the tops of ridges in the uplands. Most areas are elongated and have uniform slopes. They range from 5 to 50 acres in size.

Typically, the surface layer is dark yellowish brown, friable silt loam about 7 inches thick. The subsoil is about 17 inches of dark brown and strong brown, firm silty clay loam and silty clay. Shale bedrock is at a depth of about 24 inches. It is weathered in the upper part. In some areas the soil is moderately well drained.

Included with this soil in mapping are small areas of the shallow Colyer soils on shoulder slopes. These soils make up about 15 percent of most mapped areas.

Permeability is moderately slow in the Trappist soil. The root zone is moderately deep. The available water capacity is low. Runoff is medium. The organic matter content is moderate in the surface layer.

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

This soil is well suited to corn, soybeans, and small grain. Erosion is a moderate hazard in cultivated areas. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface, contour farming, and cover crops help to control erosion. Incorporating crop residue into the plow layer helps to maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Controlling erosion and maintaining stands of the key forage species are management concerns. Overgrazing or grazing when the soil is too wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

This soil is well suited to trees. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced can reduce the windthrow hazard.

This soil is moderately well suited to building site development. A moderate shrink-swell potential and the bedrock at a depth of 20 to 40 inches are limitations on sites for dwellings. The soil is better suited to dwellings without basements than to dwellings with basements. The adverse effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by extending foundations to the bedrock, and by backfilling around the foundations with material that has a low shrink-swell potential.

This soil is poorly suited to septic tank absorption fields because of the bedrock at a depth of 20 to 40 inches and the moderately slow permeability. Installing the absorption fields in suitable fill material can elevate the fields a sufficient distance above the bedrock. Increasing the size of the absorption fields helps to overcome the restricted permeability.

Providing suitable base material minimizes the damage to local roads and streets caused by low strength.

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

TrC—Trappist silt loam, 8 to 15 percent slopes. This moderately deep, strongly sloping, well drained soil is on the tops and sides of ridges in the uplands. Most areas are elongated and have uniform slopes. They range from 5 to 50 acres in size.

Typically, the surface layer is dark yellowish brown, friable silt loam about 7 inches thick. The subsoil is about 17 inches of dark brown and strong brown, firm silty clay and silty clay loam. Shale bedrock is at a depth of about 24 inches. It is weathered in the upper part. In some areas the soil is moderately well drained.

Included with this soil in mapping are small areas of the deep Muse soils on colluvial foot slopes. These soils make up about 20 percent of most mapped areas.

Permeability is moderately slow in the Trappist soil. The root zone is moderately deep. The available water capacity is low. Runoff is medium. The organic matter content is moderate in the surface layer.

Most areas are used as pasture or woodland.

This soil is moderately well suited to corn, soybeans, and small grain. It can be cropped occasionally, but erosion is a severe hazard. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Contour stripcropping, winter cover crops, grassed waterways, and cropping systems that leave crop residue on the surface help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for pasture and hay. Controlling erosion and maintaining tilth and stands of the key forage species are management concerns. Overgrazing or grazing when the soil is too wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

This soil is well suited to trees. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced can reduce the windthrow hazard.

This soil is moderately well suited to building site development. The bedrock at a depth of 20 to 40 inches, a moderate shrink-swell potential, and the slope are limitations on sites for dwellings. The soil is better suited to dwellings without basements than to dwellings with basements. The adverse effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by extending foundations to the bedrock, and by backfilling around the foundations with material that has a low shrink-swell potential. Buildings should be designed so that they conform to the natural slope of the land.

This soil is poorly suited to septic tank absorption fields because of the bedrock at a depth of 20 to 40 inches and the moderately slow permeability. Installing the absorption fields in suitable fill material can elevate the fields a sufficient distance above the bedrock. Increasing the size of the absorption fields helps to overcome the restricted permeability.

Providing suitable base material minimizes the damage to local roads and streets caused by low strength.

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

TrD2—Trappist silt loam, 15 to 25 percent slopes, eroded. This moderately deep, moderately steep, well drained soil is on side slopes in the uplands. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are elongated and have irregular slopes. They range from 5 to 30 acres in size.

Typically, the surface layer is dark yellowish brown, friable silt loam about 7 inches thick. The subsoil is about 17 inches of dark brown and strong brown, firm silty clay and silty clay loam. Shale bedrock is at a depth of about 24 inches. It is weathered in the upper part. In some areas the soil is moderately well drained.

Included with this soil in mapping are small areas of the deep Shelocta and Muse soils on colluvial foot slopes. These soils make up about 20 percent of most mapped areas.

Permeability is moderately slow in the Trappist soil. The root zone is moderately deep. The available water capacity is low. Runoff is rapid. The organic matter content is moderate in the surface layer.

Most areas are wooded. Some areas have been cleared and are used as cropland.

This soil is generally unsuited to corn, soybeans, small grain, and hay because of the slope and the hazard of erosion. It is poorly suited to pasture. If the pasture is overgrazed or is plowed during seedbed preparation, the hazard of erosion is very severe. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

This soil is well suited to trees. Constructing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a plant cover also help to control erosion. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced can reduce the windthrow hazard.

This soil is poorly suited to building site development. The slope and the bedrock at a depth of 20 to 40 inches are severe limitations on sites for dwellings. Buildings should be designed so that they conform to the natural slope of the land. The soil is better suited to dwellings without basements than to dwellings with basements because of the depth to bedrock.

This soil is poorly suited to septic tank absorption fields because of the bedrock at a depth of 20 to 40 inches, the moderately slow permeability, and the slope. Installing the absorption fields in suitable fill material can elevate the fields a sufficient distance above the bedrock. Increasing the size of the absorption fields helps to overcome the restricted permeability. Installing the leach lines on the contour minimizes lateral seepage of the effluent.

Providing suitable base material minimizes the damage to local roads and streets caused by low strength. Because of the slope, the roads and streets should be built on the contour.

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

Ud—Udorthents, silty. These soils occur as areas of cut and fill. They are mainly in areas of construction. In areas that have been cut, the remaining soil material is similar to the subsoil and substratum of the adjacent soils. In fill or disposal areas, the characteristics of the soil material are more varied. They generally are the same as those in the subsoil and substratum of nearby soils. Most areas are irregularly shaped and are 50 to 75 acres in size. Slopes range from 0 to 5 percent.

Typically, the upper 80 inches is silt loam and silty clay loam. In a few areas the texture is loam. The available water capacity is dominantly low or very low in the root zone. Internal water movement and runoff vary. Tilth is poor. Hard rains tend to seal the surface in poorly vegetated areas. As a result, the rate of water infiltration is reduced and the emergence and growth of plants are restricted.

Most areas are used as construction sites. The suitability of the soils as sites for buildings and sanitary facilities varies. Onsite investigation is needed to determine the potential for any proposed use and the limitations affecting that use.

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

WgC—Wernock silt loam, 8 to 15 percent slopes. This moderately deep, strongly sloping, well drained soil is on the tops of ridges in the uplands. Most areas are elongated and have slightly convex slopes. They range from 10 to more than 200 acres in size.

Typically, the surface layer is brown, friable silt loam about 2 inches thick. The subsurface layer is yellowish brown, friable silt loam about 3 inches thick. The subsoil is strong brown and yellowish brown, friable silty clay loam about 19 inches thick. The substratum is yellowish brown, friable channery silt loam about 6 inches thick. Thinly bedded siltstone bedrock is at a depth of about 30 inches. In some areas the subsoil has a higher content of coarse fragments.

Included with this soil in mapping are small areas of Berks soils on the more sloping ridgetops. These soils make up about 15 percent of most mapped areas.

Permeability is moderate in the Wernock soil. The root zone is moderately deep. The available water capacity is low. Runoff is medium. The organic matter content is moderate in the surface layer.

Most areas are wooded. Some have been cleared and are used as cropland.

This soil is moderately well suited to corn, soybeans, and small grain. It can be row cropped occasionally, but erosion is a severe hazard in cultivated areas. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface and include meadow crops, grassed waterways, contour stripcropping, cover crops, and incorporation of crop residue into the plow layer help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for pasture and hay. Controlling erosion and maintaining stands of the key forage species are management concerns. Overgrazing or grazing when the soil is wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

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

This soil is moderately well suited to building site development. The bedrock at a depth of 30 to 40 inches and the slope are limitations on sites for dwellings. The soil is better suited to dwellings without basements than to dwellings with basements. Buildings should be designed so that they conform to the natural slope of the land.

This soil is poorly suited to septic tank absorption fields because of the bedrock at a depth of 30 to 40 inches. Installing the absorption fields in suitable fill material can elevate the fields a sufficient distance above the bedrock and can improve the filtration of effluent.

Providing suitable base material minimizes the damage to local roads and streets caused by low strength and frost action.

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

WmB—Williamsburg silt loam, 1 to 6 percent slopes. This deep, nearly level and gently sloping, well drained soil is on stream terraces. Most areas are elongated and have uniform slopes. They range from 5 to 20 acres in size.

Typically, the surface layer is dark yellowish brown, friable silt loam about 10 inches thick. The subsoil is about 70 inches thick. The upper part is strong brown, friable silt loam and firm loam and clay loam. The lower part is strong brown, yellowish red, and yellowish brown, firm gravelly clay loam. In some areas the surface layer is loam.

Included with this soil in mapping are small areas of the moderately well drained Sardinia soils. These soils are in positions on the landscape similar to those of the Williamsburg soil. They make up about 15 percent of most mapped areas.

Permeability is moderate or moderately rapid in the Williamsburg soil. The root zone is deep. The available water capacity is moderate. Runoff is medium. The organic matter content is moderately low in the surface layer.

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

This soil is well suited to corn, soybeans, and small grain. It can be cropped frequently, but erosion is a moderate hazard in cultivated areas. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Grassed waterways and contour farming also help to control erosion. Cropping systems that incorporate crop residue into the soil help to maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Controlling erosion and maintaining stands of the key forage species are management concerns. Proper stocking rates, pasture rotation, timely deferment of grazing, and mowing for weed control help to keep the pasture in good condition and control erosion.

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

This soil is moderately well suited to building site development. A moderate shrink-swell potential is a limitation on sites for dwellings. The adverse effects of shrinking and swelling can be reduced by backfilling around foundations with material that has a low shrink-swell potential.

This soil is only moderately well suited to septic tank absorption fields because of the moderate permeability. Increasing the size of the absorption fields minimizes this limitation.

Providing suitable base material minimizes the damage to local roads and streets caused by low strength.

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

WmC2—Williamsburg silt loam, 6 to 15 percent slopes, eroded. This deep, strongly sloping, well drained soil is on stream terraces. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are elongated and have uniform slopes. They range from 5 to 30 acres in size.

Typically, the surface layer is yellowish brown, friable silt loam about 6 inches thick. The subsoil is about 57 inches thick. The upper part is yellowish brown, friable silt loam and firm loam. The lower part is strong brown and yellowish brown, firm clay loam and gravelly clay loam. The substratum to a depth of about 80 inches is yellowish brown and strong brown, firm gravelly sandy clay loam and sandy clay loam. In some areas the soil is moderately well drained. In other areas it has a surface layer and subsurface layer of loam.

Included with this soil in mapping are small areas of the moderately well drained Licking soils. These soils contain more clay than the Williamsburg soil. Also included, in the higher landscape positions, are the moderately well drained Otwell soils, which have a fragipan. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate or moderately rapid in the Williamsburg soil. The root zone is deep. The available water capacity is moderate. Runoff is medium. The organic matter content is moderately low in the surface layer.

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

This soil is moderately well suited to corn, soybeans, and small grain. The hazard of erosion is severe in cultivated areas. No-till cropping systems or other kinds of conservation tillage reduce the hazard of erosion and improve tilth. Cropping systems that leave crop residue on the surface and include grasses and legumes, grassed waterways, contour stripcropping, cover crops, and incorporation of crop residue into the plow layer help to control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Controlling erosion and maintaining stands of the key forage species are management concerns. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion.

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

This soil is moderately well suited to building site development. A moderate shrink-swell potential and the slope are limitations on sites for dwellings. The adverse effects of shrinking and swelling can be reduced by backfilling around foundations with material that has a low shrink-swell potential. Buildings should be designed so that they conform to the natural slope of the land.

This soil is only moderately well suited to septic tank absorption fields because of the moderate permeability and the slope. Increasing the size of the fields helps to overcome the restricted permeability. Installing the distribution lines on the contour helps to overcome the slope.

Providing suitable base material minimizes the damage to local roads and streets caused by low strength.

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

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 Soil Conservation Service.

About 101,400 acres in the survey area, or nearly 27 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county, but most are in the western half, mainly in general map units 5 through 11, which are described under the heading "General Soil Map Units."

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table 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. Most of the prime farmland in Adams County consists of well drained or moderately well drained soils. About 3,800 acres of the prime farmland consists of poorly drained or somewhat poorly drained soils, and about 3,400 acres consists of soils that are frequently flooded.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The soils in the survey area are assigned to various interpretive groups at the end of each map unit description and in some of the tables. The groups for each map unit also are shown in the section "Interpretive Groups," which follows the tables at the back of this survey.

Crops and Pasture

Steven Z. Willson, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under the heading "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

More than 151,000 acres in Adams County was used for crops and pasture in 1984 *(14)*. Of this total, about 86,000 acres was cropland and 65,000 acres was pasture. About 47,000 acres of the cropland was used mainly for corn or soybeans; 8,000 acres for close-growing crops, mainly wheat; 3,250 acres for tobacco; and 26,000 acres for hay *(5)*. The acreage used for crops and pasture in the county has not been significantly reduced by urban development. Only about 9,000 acres in the county is urban or built-up land *(14)*.

The potential of the soils in Adams County for grain crops and pasture is good. Production can be increased by using the information in this survey and by applying the latest production techniques.

The paragraphs that follow describe the management needed on the cropland and pasture in the survey area. The main management needs are measures that control erosion, reduce wetness, and maintain fertility and tilth.

Erosion is a major problem in Adams County *(14)*. It is a hazard on about 81 percent of the cropland and 92 percent of the pasture in the county. Even in nearly level areas, erosion can reduce productivity or interfere with fieldwork. In areas where slopes are more than 2 percent, special conservation practices are needed to keep erosion from significantly reducing productivity or increasing the cost of production. Productivity is reduced if the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer results in poor tilth in soils that have a clayey subsoil, such as Bratton, Faywood, Loudon, and Lowell soils. Erosion also reduces the productivity of soils that tend to be droughty, such as Faywood and Opequon soils, because it reduces the water-holding capacity of the soils.

Erosion increases the cost of production. Many of the plant nutrients added to the soil in commercial fertilizer or in organic material are held by the soil particles in the surface layer. Erosion removes these plant nutrients along with the soil particles.

Erosion on farmland results in the pollution of streams by sediments and nutrients. Reducing the hazard of erosion helps to prevent this pollution and improves the quality of water for municipal uses, for recreation, and for fish and wildlife.

In the more eroded spots in many gently sloping and strongly sloping fields, tilling and preparing a good seedbed are difficult because most of the original surface layer has been lost. In these spots the reduced seed-soil contact and reduced water-holding capacity in the soil result in poor stands. These spots are common in areas of the eroded Cincinnati, Jessup, Loudon, Lowell, and Rossmoyne soils.

Erosion-control practices commonly provide a protective cover, help to control runoff, and increase the rate of water infiltration. Contour farming and contour stripcropping are effective erosion-control measures, but slopes are typically too short and irregular in Adams County for these practices to be practical in most areas. The practices could be used on Lowell, Loudon, Cincinnati, Jessup, and Rossmoyne soils.

A cropping system that keeps a plant cover on the soil for extended periods can hold soil losses to amounts that do not reduce the productive capacity of the soils. On livestock farms where pasture and hay are grown in rotation with grain crops, including grasses and legumes in the cropping system helps to control erosion, provides nitrogen, and improves tilth.

Conservation tillage leaves crop residue on the surface, increases the rate of water infiltration, and reduces the hazards of runoff and erosion. It is suited to most of the soils in Adams County. Unless they are systematically drained, the somewhat poorly drained and poorly drained soils are not so well suited to no-till farming as the well drained and moderately well drained soils.

Grassed waterways help to control erosion by holding the surface soil in place and by slowing runoff. Natural drainageways are the best sites for grassed waterways. They generally require a minimum of shaping when a good channel is established. Channels that are wide and flat can be easily crossed by farm machinery. Many areas where surface runoff is concentrated into a narrow channel or where it crosses steeper slopes can be protected by a grassed waterway.

Information about the design of erosion-control measures for each kind of soil is available at the local office of the Soil Conservation Service. Current information about tillage practices is available at local offices of the Soil Conservation Service and the Cooperative Extension Service.

Wetness is a limitation on about 12,000 acres of cropland in the county *(14)*. The somewhat poorly drained Avonburg, McGary Variant, and Newark soils and the poorly drained Peoga soils dry out and warm up slowly in spring unless a drainage system is installed. Wetness delays planting, germination, and harvesting and reduces yields. In many years excess moisture in the root zone damages crops.

Small areas of wetter soils are commonly included in areas of Faywood, Loudon, Lowell, and Rossmoyne soils along drainageways and in swales. A drainage system is needed in some of these wetter areas.

The design of both surface and subsurface drainage systems varies with the kind of soil and the availability of outlets. Drains should be spaced closer together in the slowly permeable soils than in the more rapidly permeable soils. Finding adequate drainage outlets is difficult in many areas.

Information about the design of drainage systems for each kind of soil is available at the local office of the Soil Conservation Service.

Fertility is naturally low in most of the soils on uplands in the county. These soils are naturally acid and require applications of lime to raise the pH level enough for legumes and other crops to grow well. The supply of available phosphorus and potassium is naturally low in many of these soils. Newark soils have a strongly acid surface layer, and Gessie soils have a mildly alkaline surface layer. Additions of lime and fertilizer on all soils should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kind and amount of fertilizer and lime needed.

Tilth is an important factor affecting the germination of seeds and the infiltration of water. Soils with good tilth are friable and porous. Deterioration of tilth is a problem in many of the soils in Adams County.

The surface layer of most soils in the county is light colored and has a moderately low or moderate organic matter content. After periods of intensive rainfall, it tends to crust as it dries. When dry, the crust is hard and nearly impervious to water. It reduces the rate of water infiltration and increases the runoff rate and the hazard of erosion. If a moldboard plow is used on the soils in the fall, the surface tends to crust in winter and early spring. Consequently, the plow layer is nearly as dense and hard in the spring as it was before it was plowed in the fall. Regular additions of crop residue, manure, and other organic material are needed to maintain good soil structure and minimize crusting.

The field crops that are suited to the soils and climate of Adams County include many that are not commonly grown. Corn and soybeans are the main row crops. Grain sorghum, sunflowers, navy beans, and similar crops could be grown if economic conditions were favorable. Wheat is the most common small grain crop. Oats, rye, barley, and flax could be grown. Seed could be produced from fescue, timothy, and bluegrass and from red clover, alsike clover, and alfalfa.

The specialty crops grown commercially in Adams County are vegetables, small fruits, tree fruits, and nursery plants. A few scattered areas throughout the county are used for grapes, tomatoes, melons, peppers, cucumbers, and many other vegetables and small fruits. Also, there are several vineyards, orchards, and areas used for Christmas trees.

Deep soils that are characterized by good natural drainage and a high content of organic matter in the topsoil and that warm up early in the spring are especially well suited to many vegetables and fruits. The Elkinsville, Lowell, Rossmoyne, Sciotoville, and Williamsburg soils that have slopes of 2 percent or less and the Nolin and Gessie soils in areas where the hazard of flooding has been reduced are better suited to intensively grown horticultural crops than other soils in the county. Crops generally can be planted and harvested earlier on these soils than on the other soils. If organic material, such as green manure, mulch, or animal manure is added, the soils can be very productive under high levels of management. Because of possible frost damage, care is needed if orchard, vineyard, and small fruit crops are planted in low areas. Ridges and bottom land along the Ohio River are good sites for orchards, vineyards, vegetables, and small fruits because the river has a moderating effect on local climatic conditions.

Tobacco is the chief specialty crop grown in the county. It can be grown on a wide variety of soils. It is affected by soil type, tilth, and climate to a greater extent than any other crop. It grows best on deep, friable, well drained soils, such as Crider, Elkinsville, Gessie, Nolin, and Williamsburg soils. Because of a low available water capacity and a moderately low organic matter content, Faywood soils tend to produce a leaf that is relatively large, light in color and body, fine in texture, and weak in aroma.

Tobacco is grown on soils that have a fragipan, such as Cincinnati, Rossmoyne, and Sciotoville soils. The fragipan limits the growth and yields of tobacco. The yield reduction, however, is proportionately less for tobacco than it is for corn and alfalfa. Because of slow or moderately slow permeability, the fragipan also limits the amount of available water in dry years, restricts root growth, and increases the likelihood of disease in very wet years. Jessup, Loudon, and Lowell soils have a high content of clay. They tend to produce a leaf that is small, dark, heavy in body, and strong in aroma.

Good drainage is needed in the fields selected for tobacco production. Tobacco cannot withstand waterlogging. Its roots are very sensitive to low concentrations of oxygen in the soil. The amount of oxygen is limited in Avonburg, Newark, McGary Variant, and other soils that have a seasonal high water table. Plant disease is more likely in these soils than in other soils. Crop rotations, surface and subsurface drainage systems, deferment of plowing during wet periods, incorporation of crop residue into the soil, cover crops, and ridge tillage are needed because of the wetness of these soils.

Tobacco is a transplanted crop. Seedlings are started from tiny seeds broadcast on soil beds. They are subsequently transplanted to the fields. The seedlings require protection against harsh weather. The bed sites generally have some type of wind barrier, such as buildings, fence rows, hedges, or trees. The seedlings grow best in beds prepared on deep, well drained, moderately permeable soils that have a slight slope and a southern or southeastern exposure. Cincinnati, Crider, Elkinsville, Lowell, and Williamsburg soils and the Loudon and Rossmoyne soils in the higher landscape positions are good sites for beds. In many areas the beds are prepared in the fields that are to be planted to tobacco. Crowning the beds in the center during tillage helps to drain off surface water.

Growing tobacco year after year tends to deplete natural fertility and breaks down soil structure. Crop rotations reduce the likelihood of disease and the hazard of erosion. Those that include grasses and legumes improve tilth. Deep disking or plowing immediately after cutting and planting a cover crop reduce the likelihood of disease, insect, and weed problems during the following years and help to control soil erosion.

The latest information about growing tobacco and other specialty crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Pasture and hayland make up approximately 24 percent of the acreage in Adams County. Most of the pasture and hayland is on hillsides adjacent to cultivated areas of less sloping soils. The soils that are used for pasture and hay formed in loess, glacial till, or shale or limestone residuum. They are subject to erosion. The pasture and hayland dominantly support bluegrass and tall grasses. The tall grasses are tall fescue, orchardgrass, and timothy. Many pastures are unimproved and require renovation and brush control.

Some pastures and meadows are overgrazed. Overgrazing has resulted in low forage production and weedy pastures. The soils are subject to increased erosion because of the sparse, short vegetative cover. In many areas the soils are acid and have low levels of phosphorus and potassium. In time, good management can restore the soils to a much higher level of productivity.

The successful establishment of forage crops requires the selection of quality seed of species and varieties adapted to the climate and the soils. Reseeding requires proper seedbed preparation, proper seeding methods and seeding times, and applications of recommended kinds and amounts of lime and fertilizer. The existing grasses and weeds should be killed or suppressed before the desirable species are reseeded. The object is to kill the existing sod and leave it on or near the surface as a dead mulch, which can help to control erosion. Nearly level pastures can be plowed. The vegetation on gently sloping and strongly sloping soils should be killed or suppressed. The pasture should be tilled and seeded on the contour.

No-till seeding can be effective on most of the soils in Adams County. Before this method of seeding is used, the vegetation should be suppressed or killed by grazing and herbicides.

April or August is usually the best time for seeding. The forage species can be seeded with small grain, but in many areas forage production is reduced because of plant competition for light, moisture, and nutrients.

Seeding mixtures should be based on the soil type and the desired pasture management system. Mixtures of legumes and grasses have a higher nutrient value than grasses alone. The legumes provide nitrogen, which improve the growth of grasses. Alfalfa and red clover should be seeded on soils that are characterized by good drainage. Ladino clover and alsike clover are better adapted to the wetter soils. Birdsfoot trefoil, bromegrass, lespedeza, warm-season grasses, and vetches are generally not grown for forage in Adams County, but they are adapted to the county and could be used in a forage management system. Applying lime and fertilizer according to the results of soil tests ensures good productivity and lengthens the life of the stand. Controlling weeds by mowing, clipping, and spraying is important for continued high production. The weeds should be mowed before they go to seed.

Control of insects, such as alfalfa weevil and potato leafhopper, may be necessary. If herbicides are used, all label restrictions should be observed.

Harvesting hay, silage, or pasture plants at the proper stage of maturity helps to obtain the maximum quality feed. The current "Ohio Agronomy Guide" can provide information about the proper management of the forage species in specific areas.

The soils in Adams County are assigned to pasture and hayland suitability groups. Soils that are assigned the same pasture and hayland suitability group symbol require the same general management and have about the same potential productivity. The suitability groups are based on soil characteristics and limitations.

Group A soils have few limitations affecting the management and growth of climatically adapted plants. Group A-1 consists of deep, well drained soils. The surface layer is silt loam. The available water capacity is moderate. Plants on these soils respond well to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH level in the subsoil shortens the life of some deep-rooted legumes. Slopes range from 1 to 15 percent.

Group A-2 consists of deep, well drained and moderately well drained soils. The surface layer is silt loam. The available water capacity is moderate. Plants on these soils respond well to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH level in the subsoil shortens the life of some deep-rooted legumes. Slopes range from 15 to 25 percent. They may interfere with mechanical applications of lime and fertilizer and with clipping, mowing, and spraying for weed control. The slopes increase the risk of erosion if the pasture is overgrazed or cultivated for reseeding. These soils are suited to no-till reseeding and interseeding.

Group A-3 consists of deep, well drained soils. The surface layer is silt loam. The available water capacity is moderate. Slopes range from 25 to 50 percent. This group generally is not suited to pasture and hay because of the slope.

Group A-5 consists of deep, well drained soils on flood plains. These soils are frequently flooded or occasionally flooded. Grazing is limited during periods of stream overflow. The floodwater deposits sediments that lower the quality of the forage. The surface layer is silt loam. The available water capacity is high. Slopes range from 0 to 3 percent.

Group A-6 consists of deep, well drained and moderately well drained soils that are subject to frost action, which can damage legumes. Mixing fibrous-rooted grasses with the legumes and applying good grazing management minimize the damage caused by frost action. The surface layer is silt loam. The available water capacity is very high or high. Slopes range from 0 to 15 percent.

Group B soils are limited because of droughtiness. Group B-1 consists of deep, excessively drained soils. The surface layer is sand. The subsoil is sandy. Forage growth and production are limited because of a low available water capacity. Slopes range from 3 to 8 percent.

Group B-3 consists of deep, well drained soils that are occasionally flooded. The surface layer is gravelly loam. The subsoil is gravelly to extremely gravelly. The available water capacity is low. Slopes range from 0 to 2 percent.

Group C soils are wet because of a seasonal high water table. Group C-2 consists of deep, somewhat poorly drained and poorly drained soils. The surface layer is silty clay loam or silt loam. The available water capacity is moderate or high. The seasonal high water table limits the rooting depth of deep-rooted forage plants. Some of the soils have a fragipan, which also restricts the rooting depth. Shallow-rooted species grow best on these soils. Subsurface drains are used to lower the seasonal high water table. The effectiveness of the drains generally is limited by restricted permeability in the subsoil or by the position of the soils on the landscape. Because of the limited root zone, these soils are better suited to forage species that do not have a taproot than to other species. Slopes range from 0 to 3 percent.

Group C-3 consists of deep, somewhat poorly drained soils on flood plains. These soils are frequently flooded. Grazing is limited during periods of stream overflow. The floodwater deposits sediments that lower the quality of the forage. The surface layer is silt loam. The available water capacity is high. Slopes range from 0 to 2 percent. Frost action in these soils may damage legumes. Including grasses in the seeding mixture and applying good grazing management minimize the damage caused by frost action. The seasonal high water table limits the rooting depth of forage plants. Shallow-rooted species grow best on these soils. Subsurface drains are used to lower the seasonal high water table. The effectiveness of the drains is limited by the position of the soils on the landscape.

Group E consists of shallow soils in which the root zone is less than 20 inches deep. Group E-1 consists of shallow, well drained soils that have a surface layer of silty clay loam. The available water capacity is very low. It restricts forage production. These soils are well suited to native warm-season grasses. Slopes range from 8 to 25 percent.

Group E-2 consists of shallow, well drained soils that have a surface layer of silty clay loam or very shaly silty clay loam. The available water capacity is very low. Slopes range from 25 to 50 percent. Shallow-rooted species should be selected for planting.

Group F soils have a moderately deep root zone. The root growth of climatically adapted plants is restricted to the upper 20 to 40 inches. As a result, these soils are better suited to forage species that do not have a taproot than to other species. Group F-1 consists of moderately deep, well drained and moderately well drained soils. The surface layer is silt loam or silty clay loam. The available water capacity is low or very low. These soils are droughty. They are suited to warm-season grasses, such as switchgrass, big bluestem, indiangrass, and Caucasian bluestem. Plants on these soils respond well to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH level in the subsoil of some of the soils shortens the life of some deep-rooted legumes. Slopes range from 3 to 25 percent.

Group F-2 consists of moderately deep, steep, well drained soils. The surface layer is silt loam or flaggy silty clay loam. The available water capacity is low or very low. Slopes range from 25 to 40 percent. This group generally is not suited to pasture and hay.

Group F-3 consists of deep, well drained and moderately well drained soils that have a fragipan. Because of a limited root zone, these soils are better suited to forage species that do not have a taproot than to other forage species. Plants on these soils respond well to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH level in the subsoil shortens the life of some deep-rooted legumes. The surface layer is silt loam. The available water capacity is moderate in the root zone. Slopes range from 0 to 15 percent.

Group F-5 consists of deep, moderately well drained soils that have a high content of clay in the subsoil. The high content of clay restricts the rooting depth. The surface layer is silt loam or silty clay loam. The available water capacity is moderate. Slopes range from 12 to 25 percent. Plants on these soils respond well to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH level in the subsoil shortens the life of some deep-rooted legumes.

Group H soils are too steep for forage production. Group H-1 consists of shallow to deep, well drained soils. Slopes range from 40 to 70 percent. These soils are generally unsuited to pasture and hay.

Yields per Acre

Bennie L. White, county agricultural extension agent, and Edward McDowell, Agricultural Stabilization and Conservation Service, helped prepare this section.

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

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

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

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

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit *(11)*. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

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

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

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

Woodland Management and Productivity

Woodland makes up approximately 187,100 acres in Adams County, or nearly 50 percent of the total land area *(13)*. Most of the woodland is under private ownership. The state, however, owns approximately 18,500 acres of the woodland. The most extensive wooded areas are in the eastern half of the county.

The woodland in Adams County is largely a mixed forest dominated by oak. Other major species of trees include hickory, beech, yellow-poplar, walnut, and maple. Maple tends to be an early successional species, and oak is the climax species. Thus, oak is characteristic of a mature forest.

In places the woodland shows the results of abuse and neglect. Heavy cutting without plans for future timber crops has resulted in understocked stands of mature trees. High grading has continually removed the best trees and left diseased or damaged trees in the stands. Culls and low-value trees occupy valuable growing space on many excellent woodland sites. Low-value American elm and cull beech and poorly formed black cherry and maple now occupy thousands of acres in areas where yellow-poplar, oak, and sugar maple once grew. Grazing by livestock has destroyed the leaf litter, killed young trees, damaged roots, and compacted the soil. In time, good management can restore the woodland to a higher level of production.

Eastern redcedar, a very common species that can be easily established, has not been developed to its fullest potential. Periodically thinning stands to maintain optimum spacing can yield wood chips and fenceposts.

Soils vary in their productivity as woodland. The available water capacity of a soil, an important factor affecting tree growth, is influenced by soil depth, texture, permeability, and internal drainage. Slope, degree of past erosion, reaction, natural fertility, aspect, and position of the soil on the landscape also are important factors affecting tree growth.

Aspect is the compass direction in which a slope faces. North aspects have an azimuth of 355 degrees to 95 degrees. South aspects have an azimuth of 96 to 354 degrees *(4)*. Trees grow better on north aspects than on south aspects. Some of the factors that make south aspects less productive are a higher soil temperature, which is a result of more direct sunrays; a higher evaporation rate; earlier snowmelt; and more freezing and thawing.

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

The slope is another important factor affecting woodland management. Very steep slopes seriously limit the use of equipment. As the gradient increases, the rate of water infiltration decreases and the runoff rate and hazard of erosion increase.

Erosion reduces the amount of soil available for water storage. Severe erosion removes the more porous surface layer and exposes the less porous subsoil, thus increasing the runoff rate and lowering the rate of water infiltration. Under these conditions, tree growth and natural reseeding are restricted.

Soil reaction and natural fertility influence the growth and suitability of different kinds of trees. Trees grow more slowly in the less fertile soils, but fertility is a major factor only in areas where critical nutrients are deficient.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil; and *N*, snowpack. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, and N.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, and fire lanes and in log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment and season of use are not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

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

The *volume,* a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It generally is the most common species on the soil and is the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

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

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from a commercial nursery or from local offices of the Soil Conservation Service; the Cooperative Extension Service; or the Ohio Department of Natural Resources, Division of Forestry.

Recreation

Recreation is an important enterprise in Adams County. Serpent Mound State Memorial, Adams Lake, Mineral Springs, and Shawnee and Brush Creek State Forests provide opportunities for fishing, swimming, camping, hiking, picnicking, and hunting. The Ohio River and Ohio Brush Creek provide opportunities for many kinds of water sports. Prairie vegetation can be observed in five prairie areas—Lynx, Adams Lake, Buzzard Roost Rock Preserve, and the Wilderness and Red Rock Preserve.

Hunting attracts many people from other parts of the state and from out of state. The major game animals are deer, rabbit, and squirrel. Other game animals are turkey, beaver, and grouse.

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

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

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

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

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

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor *(1)*. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

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

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, soybeans, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are goldenrod and foxtail.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, beech, maple, hawthorn, dogwood, hickory, and black walnut. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are shrub honeysuckle, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, duckweed, reed canarygrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and shallow ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, and mink.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils *may be included within the mapped areas of a specific soil.*

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

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

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered. Some of the moderately steep to very steep soils in the county are subject to hillside slippage, which can damage buildings.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 13 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

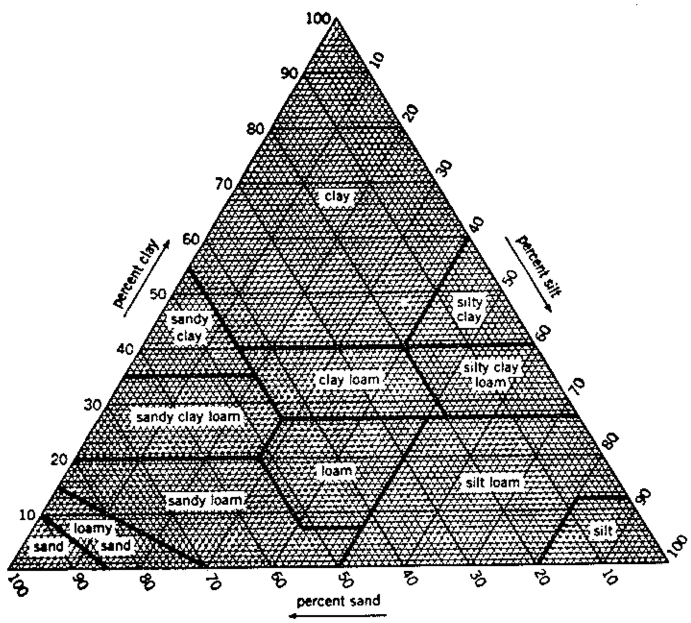

Figure 10.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 10). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

Classification of the soils is determined according to the Unified soil classification system *(3)* and the system adopted by the American Association of State Highway and Transportation Officials *(2)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

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

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

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

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

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18. Only saturated zones within a depth of about 6 feet are indicated.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate*, or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high.* It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Physical and Chemical Analyses of Selected Soils

Several of the soils in Adams County were sampled and analyzed by the Soil Characterization Laboratory, Department of Agronomy, Ohio State University, Columbus, Ohio. The physical and chemical data obtained from most of the samples include particle-size distribution, reaction, organic matter content, calcium carbonate equivalent, and extractable cations. These data were used in classifying the soils and in evaluating their behavior under various land uses.

Eight pedons selected as representative for their respective series were sampled for analysis. They are described in the section "Soil Series and Their Morphology." These series and their laboratory identification numbers are Brushcreek series (AD-29), Shelocta series (AD-27), Bratton series (AD-35), Colyer series (AD-31), Otwell series (AD-26), Jessup series (AD-30), Opequon series (AD-33), and Wernock series (AD-28).

In addition to the data from Adams County, laboratory data also are available from nearby counties in southwestern Ohio. These data and the data from Adams County are on file at the Department of Agronomy, Ohio State University, Columbus, Ohio; the Ohio Department of Natural Resources, Division of Soil and Water Conservation, Columbus, Ohio; and the Soil Conservation Service, State Office, Columbus, Ohio.

Engineering Index Test Data

Several of the soils in Adams County were analyzed for engineering properties by the Ohio Department of Transportation, Division of Highways, Bureau of Testing, Soils and Foundation Section, Columbus, Ohio. Engineering test data also are available from nearby counties that have many of the same soils. All the data are on file at the Department of Agronomy, Ohio State University, Columbus, Ohio; the Ohio Department of Natural Resources, Division of Soil and Water Conservation, Columbus, Ohio; and the Soil Conservation Service, State Office, Columbus, Ohio.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(12)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalf (*Ud*, meaning humid, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalf*, the suborder of the Alfisols that has a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, mixed, mesic Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(10)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(12)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Aaron Series

The Aaron series consists of deep, moderately well drained, slowly permeable soils in the uplands. These soils formed in material weathered from interbedded limestone, siltstone, and calcareous shale. Slopes range from 0 to 6 percent.

Aaron soils are similar to Loudon soils and are commonly adjacent to Lowell soils. Loudon soils formed in glacial till and the underlying residuum. Lowell soils are well drained and are in the higher landscape positions. They do not have 2-chroma mottles in the upper part of the subsoil.

Typical pedon of Aaron silt loam, 0 to 2 percent slopes, about 2 miles west of West Union, in Liberty Township; 5,710 feet southeast of the intersection of State Route 136 and County Road 21, along County Road 21, then 710 feet south:

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; moderate fine granular structure; friable; many roots; medium acid; abrupt smooth boundary.

BE—7 to 13 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium subangular blocky structure; firm; common roots; common faint brown (10YR 5/3) silt coatings on faces of peds; strongly acid; clear wavy boundary.

Bt1—13 to 21 inches; yellowish brown (10YR 5/6) silty clay; moderate medium subangular blocky structure; firm; common roots; common faint yellowish brown (10YR 5/6) clay films on faces of peds; strongly acid; clear wavy boundary.

Bt2—21 to 27 inches; yellowish brown (10YR 5/6) silty clay; common medium distinct pale brown (10YR 6/3) and grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; common faint yellowish brown (10YR 5/6) and common distinct pale brown (10YR 6/3) clay films on faces of peds; common fine black (N 2/0) concretions of iron and manganese oxide; strongly acid; clear wavy boundary.

Bt3—27 to 42 inches; yellowish brown (10YR 5/6) clay; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; common faint yellowish brown (10YR 5/6 and 5/4) clay films on faces of peds; many fine black (N 2/0) concretions of iron and manganese oxide; strongly acid; clear wavy boundary.

BC—42 to 48 inches; yellowish brown (10YR 5/6) clay; common medium distinct grayish brown (10YR 5/2) and few medium faint yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; firm; common fine and medium black (N 2/0) concretions of iron and manganese oxide; neutral; clear wavy boundary.

C—48 to 58 inches; yellowish brown (10YR 5/8) silty clay; common medium distinct yellowish brown (10YR 5/4) mottles; massive; firm; common fine and medium black (N 2/0) concretions of iron and manganese oxide; slight effervescence; mildly alkaline; abrupt smooth boundary.

R—58 to 60 inches; hard limestone bedrock.

The thickness of the solum ranges from 30 to 50 inches. The depth to bedrock ranges from 40 to 60 inches. The Bt horizon has value of 4 or 5 and chroma of 4 to 6. It is silty clay or clay.

Avonburg Series

The Avonburg series consists of deep, somewhat poorly drained soils on till plains. These soils formed in loess and Illinoian glacial till. They have a fragipan. Permeability is moderate above the fragipan and very slow in the fragipan. Slopes range from 0 to 2 percent.

Avonburg soils are commonly adjacent to Loudon and Rossmoyne soils. Loudon and Rossmoyne soils are moderately well drained and are in the higher landscape positions. They have fewer gray mottles in the subsoil than the Avonburg soils.

Typical pedon of Avonburg silt loam, 0 to 2 percent slopes, about 1.25 miles northwest of Seaman, in Scott Township; 1,300 feet southwest of the junction of Township Roads 188 and 189, along Township Road 189, then 925 feet west:

Ap—0 to 11 inches; brown (10YR 4/3) silt loam, light gray (10YR 7/2) dry; weak medium granular structure; friable; many roots; common prominent black (N 2/0) stains of iron and manganese oxide on faces of peds; medium acid; abrupt smooth boundary.

E—11 to 16 inches; yellowish brown (10YR 5/4) silt loam; few medium distinct grayish brown (10YR 5/2) mottles; weak thin platy structure; friable; common roots; many distinct grayish brown (10YR 5/2) silt coatings on faces of peds; common prominent black (N 2/0) stains of iron and manganese oxide on faces of peds; strongly acid; clear wavy boundary.

Btx1—16 to 21 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct grayish brown (10YR 5/2) and few medium distinct gray (10YR 5/1) mottles; weak coarse and very coarse prismatic structure; firm and very firm; brittle in about 45 percent of the material; common roots; many distinct grayish brown (10YR 5/2) silt coatings on faces of prisms; common faint yellowish brown (10YR 5/4) clay films on faces of peds; few coarse fragments; few prominent black (N 2/0) stains of iron and manganese oxide on faces of peds; strongly acid; clear wavy boundary.

Btx2—21 to 36 inches; yellowish brown (10YR 5/6) silty clay loam; many medium distinct grayish brown

(10YR 5/2) mottles; weak very coarse prismatic structure; very firm; brittle; common distinct grayish brown (10YR 5/2) clay films on faces of peds; few coarse fragments; few fine black (N 2/0) concretions of iron and manganese oxide; few prominent red (2.5YR 4/6) iron stains on faces of peds; strongly acid; clear wavy boundary.

2Bt1—36 to 57 inches; light olive brown (2.5Y 5/6) clay loam; common medium distinct gray (10YR 6/1) and many medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; firm; common prominent grayish brown (10YR 5/2) clay films on faces of peds; few coarse fragments; many black (N 2/0) concretions and stains of iron and manganese oxide; slightly acid; clear wavy boundary.

2Bt2—57 to 74 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; common distinct yellowish brown (10YR 5/4) clay films and silt coatings on faces of peds; few coarse fragments; common prominent black (N 2/0) stains of iron and manganese oxide on faces of peds; slightly acid.

The thickness of the solum ranges from 5 to 8 feet. Depth to the fragipan ranges from 16 to 36 inches.

The Ap horizon has chroma of 2 to 4. The E horizon has value of 5 or 6 and chroma of 2 to 4. It is silt loam or silty clay loam. The Btx horizon has value of 5 or 6 and chroma of 2 to 6. The 2Bt has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 to 6.

Berks Series

The Berks series consists of moderately deep, well drained, moderately permeable or moderately rapidly permeable soils on the tops and sides of ridges in the uplands. These soils formed in material weathered from siltstone and fine grained sandstone. Slopes range from 15 to 70 percent.

Berks soils are commonly adjacent to Shelocta soils. Shelocta soils have a lower content of clay and coarse fragments in the subsoil than the Berks soils and are deep over bedrock. They are on the slightly less sloping foot slopes, side slopes, and benches.

Typical pedon of Berks silt loam, in an area of Shelocta-Berks association, very steep, about 15.5 miles southeast of West Union, in Green Township; 975 feet south of the junction of Township Road 202B and Forest Trail Road, along Forest Trail Road, then 260 feet west:

A—0 to 3 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; many roots; about 10 percent coarse fragments; very strongly acid; abrupt smooth boundary.

Bw1—3 to 15 inches; light olive brown (2.5Y 5/4) channery silt loam; weak medium subangular blocky structure; friable; many roots; about 25 percent coarse fragments; very strongly acid; clear wavy boundary.

Bw2—15 to 36 inches; yellowish brown (10YR 5/6) very channery silt loam; weak medium subangular blocky structure; friable; common roots; about 40 percent coarse fragments; very strongly acid; clear wavy boundary.

R—36 to 38 inches; fractured siltstone bedrock that is weathered in the upper 6 inches.

The depth to bedrock ranges from 20 to 40 inches. The content of siltstone and fine grained sandstone fragments ranges from 10 to 20 percent in the A horizon and from 15 to 60 percent in individual subhorizons of the Bw horizon.

The A horizon has chroma of 2 or 3. It is commonly silt loam but is loam in some pedons. The B horizon has hue of 2.5Y or 10YR and chroma of 4 to 6.

Bratton Series

The Bratton series consists of moderately deep, well drained soils on ridgetops and shoulder slopes in the uplands. These soils formed in loess and in the underlying material weathered from limestone. Permeability is moderately slow in the solum and rapid in the substratum. Slopes range from 2 to 15 percent.

Bratton soils are similar to Faywood, Jessup, and Lowell soils and are commonly adjacent to Opequon soils. Jessup, Lowell, and Faywood soils have yellower hue than the Bratton soils. Jessup and Lowell soils are deep over bedrock. Opequon soils are along drainageways. They are shallow over bedrock.

Typical pedon of Bratton silt loam, 2 to 8 percent slopes, about 5.2 miles east of West Union, in Tiffin Township; 3,035 feet east of the intersection of County Roads 5 and 26, along County Road 5, then 250 feet north:

Ap—0 to 8 inches; yellowish brown (10YR 5/4) silt loam, very pale brown (10YR 7/4) dry; weak medium and fine granular structure; friable; common fine roots; strongly acid; abrupt smooth boundary.

Bt1—8 to 13 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; few fine roots; few faint dark brown (7.5YR 4/4) clay films on faces of peds; medium acid; clear wavy boundary.

2Bt2—13 to 21 inches; yellowish red (5YR 5/6) silty clay; moderate medium angular blocky structure; firm; common faint yellowish red (5YR 4/6) clay films on faces of peds; few soft dark accumulations of iron and manganese oxide; medium acid; clear wavy boundary.

2Bt3—21 to 28 inches; yellowish red (5YR 5/6) clay; moderate medium angular blocky structure; firm; many faint yellowish red (5YR 5/6) clay films on faces of peds; common soft dark accumulations of iron and manganese oxide; strongly acid; clear wavy boundary.

2Bt4—28 to 33 inches; strong brown (7.5YR 5/6) clay; moderate medium angular blocky structure; firm; common faint strong brown (7.5YR 5/6) clay films on faces of peds; common soft dark accumulations of iron and manganese oxide; strongly acid; abrupt irregular boundary.

2C—33 to 35 inches; brownish yellow (10YR 6/8) and pale yellow (2.5Y 7/4) sandy loam; massive; friable; strong effervescence; mildly alkaline; clear irregular boundary.

2R—35 to 37 inches; hard limestone bedrock.

The thickness of the solum ranges from 20 to 38 inches. The depth to bedrock ranges from 20 to 40 inches.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. The 2Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay or clay. The 2C horizon has hue of 2.5Y or 10YR, value of 5 or 6, and chroma of 4 to 8. It is loamy sand or sandy loam.

Brushcreek Series

The Brushcreek series consists of deep, moderately well drained, slowly permeable soils on foot slopes in the uplands. These soils formed in residuum and colluvium derived from interbedded calcareous shale and limestone. Slopes range from 6 to 25 percent.

Brushcreek soils are similar to Muse soils and are commonly adjacent to Lawshe and Opequon soils. Muse soils have redder hue in the lower part of the subsoil than the Brushcreek soils. Lawshe soils have a surface layer that is darker than that of the Brushcreek soils. They are in the lower positions on foot slopes. Opequon soils are shallow over bedrock. They are in the steeper areas.

Typical pedon of Brushcreek silt loam, in an area of Brushcreek-Lawshe complex, 12 to 25 percent slopes, eroded, about 0.5 mile north of West Union, in Tiffin Township; 790 feet south of the intersection of State Route 247 and County Road 22, along State Route 247, then 660 feet east:

Ap—0 to 6 inches; brown (10YR 5/3) silt loam, light yellowish brown (10YR 6/4) dry; moderate fine and medium granular structure; friable; many roots; about 10 percent limestone fragments; slightly acid; abrupt smooth boundary.

Bt1—6 to 10 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium subangular blocky structure; common roots; firm; common faint yellowish brown (10YR 5/4) clay films and common distinct brown (10YR 4/3) silt coatings on faces of peds; about 5 percent limestone fragments; strongly acid; clear wavy boundary.

Bt2—10 to 19 inches; yellowish brown (10YR 5/6) silty clay; strong medium angular blocky structure; firm; few roots; many faint yellowish brown (10YR 5/4) clay films on faces of peds; about 10 percent limestone fragments; medium acid in the upper part and mildly alkaline in the lower part; clear wavy boundary.

Bt3—19 to 24 inches; yellowish brown (10YR 5/6) silty clay; common fine prominent grayish brown (2.5Y 5/2) mottles; moderate medium subangular blocky structure; firm; many distinct brown (10YR 5/3) clay films on faces of peds; about 10 percent limestone fragments; slight effervescence; moderately alkaline; clear wavy boundary.

BC—24 to 33 inches; yellowish brown (10YR 5/6) channery silty clay loam; common medium prominent gray (N 6/0 and 5Y 6/1) mottles; weak coarse subangular blocky structure; firm; few distinct brown (10YR 5/3) clay films on vertical faces of peds; about 25 percent limestone fragments; strong effervescence; moderately alkaline; clear wavy boundary.

C—33 to 56 inches; light olive gray (5Y 6/2) channery silty clay loam grading to channery silty clay in the lower 6 inches; common medium prominent light olive brown (2.5Y 5/4) mottles; massive; firm; about 15 percent limestone fragments; strong effervescence; moderately alkaline; clear wavy boundary.

Cr—56 to 60 inches; gray (5Y 6/1), calcareous, soft shale bedrock that has some thin strata of limestone.

The thickness of the solum ranges from 20 to 40 inches. The depth to soft bedrock ranges from 40 to 60 inches. The content of coarse fragments, mainly limestone and shale, ranges from 0 to 15 percent in the Ap horizon, from 2 to 15 percent in the Bt horizon, and from 10 to 35 percent in the BC and C horizons.

The Ap horizon has value of 3 to 5 and chroma of 2 to 4. It is commonly silt loam but is silty clay loam in some pedons. The Bt horizon has hue of 10YR or

7.5YR, value of 4 or 5, and chroma of 3 to 6. It is silty clay or clay in the fine-earth fraction. The C horizon has hue of 5Y to 2.5Y, value of 5 or 6, and chroma of 1 to 6. It is clay or silty clay in the fine-earth fraction.

Cincinnati Series

The Cincinnati series consists of deep, well drained soils on side slopes and in other areas on till plains. These soils formed in loess and in the underlying glacial till. They have a fragipan. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. Slopes range from 2 to 12 percent.

Cincinnati soils are similar to Rossmoyne soils and are commonly adjacent to Rossmoyne and Jessup soils. Rossmoyne soils are moderately well drained and have low-chroma mottles in the upper 10 inches of the subsoil. They are in the less sloping areas. Jessup soils have more clay in the upper part of the subsoil than the Cincinnati soils and do not have a fragipan. They are in the steeper areas.

Typical pedon of Cincinnati silt loam, 2 to 6 percent slopes, about 1.75 miles northeast of Winchester, in Winchester Township; 1,320 feet east of the intersection of County Road 400 and Township Road 49B, along County Road 400, then 265 feet north:

Ap—0 to 9 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; moderate medium granular structure; friable; many roots; about 25 percent yellowish brown (10YR 5/6) subsoil material; strongly acid; abrupt smooth boundary.

BE—9 to 13 inches; yellowish brown (10YR 5/6) silt loam; moderate fine subangular blocky structure; friable; common roots; strongly acid; clear wavy boundary.

Bt—13 to 18 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few roots; common faint yellowish brown (10YR 5/6) clay films in pores; common distinct yellowish brown (10YR 5/4) silt coatings on faces of peds; few coarse fragments; strongly acid; clear wavy boundary.

2Btx—18 to 28 inches; yellowish brown (10YR 5/6) silty clay loam; weak very coarse prismatic structure; very firm; brittle; common distinct grayish brown (10YR 5/2) clay films on faces of peds in the lower part; common distinct pale brown (10YR 6/3) silt coatings on faces of peds; about 5 percent coarse fragments; strongly acid; clear wavy boundary.

2Bt1—28 to 45 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct grayish brown (10YR 5/2) and few medium faint strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; common distinct grayish brown (10YR 5/2) clay films on faces of peds; few fine black (N 2/0) concretions of iron and manganese oxide; few coarse fragments; strongly acid; clear wavy boundary.

2Bt2—45 to 57 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; common distinct grayish brown (10YR 5/2) clay films on faces of peds; few coarse fragments; slightly acid; clear wavy boundary.

2Bt3—57 to 60 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; firm; few distinct brown (10YR 5/3) clay films on faces of peds; few coarse fragments; slightly acid.

The thickness of the solum and the depth to carbonates range from 48 to 120 inches. The thickness of the loess mantle ranges from 18 to 25 inches. Depth to the fragipan ranges from 18 to 34 inches.

The Ap horizon has value of 4 or 5 and chroma of 3 or 4. The BE and Bt horizons have value of 4 or 5 and chroma of 4 to 6. They are typically not mottled, but in some pedons they have mottles with chroma of 3 or more. They are silt loam or silty clay loam. The 2Btx and 2Bt horizon have colors similar to those of the Bt horizon. They have mottles of both high and low chroma.

Colyer Series

The Colyer series consists of shallow, well drained, slowly permeable soils on shoulder slopes in the uplands. These soils formed in material weathered from shale. Slopes range from 25 to 50 percent.

Colyer soils are commonly adjacent to Muse and Shelocta soils. Muse and Shelocta soils are on the less sloping foot slopes and shoulder slopes. They are deep over bedrock and have a lower content of coarse fragments in the subsoil than the Colyer soils. Also, Shelocta soils have yellower hue in the subsoil.

Typical pedon of Colyer very shaly silty clay loam, in an area of the Shelocta-Muse-Colyer association, steep, about 5.7 miles east-northeast of Peebles, in Franklin Township; in Brushcreek State Forest; 8,900 feet north of the intersection of State Route 73 and Township Road 250A, along Township Road 250A, then 250 feet north:

A—0 to 4 inches; brown (10YR 4/3) very shaly silty clay loam; moderate fine granular structure; friable; many medium roots; about 40 percent coarse fragments; extremely acid; clear wavy boundary.

Bw1—4 to 7 inches; strong brown (7.5YR 5/6) very shaly clay; moderate medium subangular blocky structure; firm; many medium roots; common distinct dark brown coatings on faces of peds; about 45 percent coarse fragments; extremely acid; clear wavy boundary.

Bw2—7 to 15 inches; yellowish red (5YR 5/6) very shaly clay; moderate medium subangular blocky structure; firm; common fine roots; about 55 percent coarse fragments; extremely acid; clear wavy boundary.

R—15 to 18 inches; gray (10YR 5/1) shale bedrock.

The thickness of the solum and the depth to bedrock range from 8 to 20 inches. The content of shale fragments ranges from 35 to 55 percent in individual subhorizons of the Bw horizon.

The A horizon has value and chroma of 2 to 4. The B horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 4 to 6. It is the very shaly analogs of silty clay or clay.

Crider Series

The Crider series consists of deep, well drained, moderately permeable soils in the uplands. These soils formed in loess and in the underlying limestone residuum. Slopes range from 1 to 6 percent.

Crider soils are commonly adjacent to Bratton soils. Bratton soils are moderately deep over bedrock and have more clay in the subsoil than the Crider soils. They are along drainageways.

Typical pedon of Crider silt loam, 1 to 6 percent slopes, about 4.4 miles northwest of Peebles, in Bratton Township; 725 feet east of the intersection of County Road 100 and Township Road 124B, along County Road 100, then 130 feet north:

Ap—0 to 12 inches; brown (10YR 4/3) silt loam, yellowish brown (10YR 5/4) dry; weak fine granular structure; friable; common roots; neutral; abrupt smooth boundary.

Bt1—12 to 23 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few roots; common distinct strong brown (7.5YR 5/6) clay films on faces of peds; common distinct dark yellowish brown (10YR 4/4) silt coatings on faces of peds; few fine black (N 2/0) concretions of iron and manganese oxide; neutral; clear wavy boundary.

Bt2—23 to 29 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common distinct strong brown (7.5YR 5/6) and few faint yellowish brown (10YR 5/6) clay films on faces of peds; neutral; clear wavy boundary.

Bt3—29 to 33 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common faint yellowish brown (10YR 5/6) clay films on faces of peds, few distinct dark yellowish brown (10YR 4/4) silt coatings on faces of peds; few coarse fragments; slightly acid; clear wavy boundary.

Bt4—33 to 38 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; common faint strong brown (7.5YR 5/6) clay films on faces of peds; slightly acid; clear wavy boundary.

2Bt5—38 to 45 inches; strong brown (7.5YR 5/6) silty clay; common fine prominent red (2.5YR 4/6) mottles; strong medium subangular blocky structure; firm; common faint strong brown (7.5YR 5/6) clay films on faces of peds; slightly acid; clear wavy boundary.

2Bt6—45 to 80 inches; strong brown (7.5YR 5/6) silty clay; few medium prominent grayish brown (10YR 5/2) mottles; strong medium subangular blocky structure; firm; common faint strong brown (7.5YR 5/6) and common distinct yellowish brown (10YR 5/4) clay films on faces of peds; about 10 percent coarse fragments; strongly acid.

The thickness of the solum and the depth to bedrock range from 60 to more than 100 inches. The Ap horizon has chroma of 3 or 4. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. The 2Bt horizon has hue of 5YR, 7.5YR, or 10YR and chroma of 4 to 6. It is silty clay or silty clay loam.

Eden Series

The Eden series consists of moderately deep, well drained, slowly permeable soils on side slopes in the uplands. These soils formed in material weathered from interbedded calcareous shale and limestone. Slopes range from 25 to 70 percent.

Eden soils are commonly adjacent to Faywood and Jessup soils. Faywood and Jessup soils have a lower content of coarse fragments throughout than the Eden soils. They are in the less sloping areas. Jessup soils are deep over bedrock.

Typical pedon of Eden flaggy silty clay loam, 25 to 40 percent slopes, eroded, about 9.4 miles southwest of West Union, in Sprigg Township; 330 feet west of the intersection of State Route 41 and County Road 20A:

A—0 to 5 inches; brown (10YR 4/3) flaggy silty clay loam, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure; firm; many roots; about 20 percent coarse fragments; strong effervescence; mildly alkaline; abrupt smooth boundary.

Bt1—5 to 7 inches; light olive brown (2.5Y 5/6) flaggy clay; moderate medium subangular blocky structure; firm; common roots; common distinct light olive brown (2.5Y 5/4) clay films on faces of peds; common fine dark brown (10YR 3/3) organic stains on faces of peds; about 20 percent coarse fragments; strong effervescence; moderately alkaline; clear wavy boundary.

Bt2—7 to 11 inches; yellowish brown (10YR 5/6) flaggy silty clay; moderate medium subangular blocky structure; firm; few roots; many distinct yellowish brown (10YR 5/4) and few faint yellowish brown (10YR 5/6) clay films on faces of peds; few fine distinct dark brown (10YR 3/3) organic stains on faces of peds; about 20 percent coarse fragments; strong effervescence; moderately alkaline; clear irregular boundary.

Bt3—11 to 16 inches; light olive brown (2.5Y 5/6) flaggy clay; common medium distinct light olive brown (2.5Y 5/4) mottles; moderate medium subangular blocky structure; firm; common distinct yellowish brown (10YR 5/4) clay films on faces of peds; about 35 percent coarse fragments; strong effervescence; moderately alkaline; clear wavy boundary.

C—16 to 29 inches; light olive brown (2.5Y 5/4) very flaggy clay; few medium distinct olive (5Y 5/3) mottles; massive; firm; about 55 percent coarse fragments; strong effervescence; moderately alkaline; clear wavy boundary.

Cr—29 to 31 inches; fractured limestone bedrock interbedded with calcareous shale.

The thickness of the solum ranges from 16 to 34 inches. The depth to bedrock ranges from 20 to 40 inches. The content of limestone and calcareous shale flagstones ranges from 0 to 25 percent in the A horizon, from 10 to 35 percent in the B horizon, and from 25 to 75 percent in the C horizon.

The A horizon has value of 4 or 5 and chroma of 2 to 4. It is commonly flaggy silty clay loam but is flaggy silt loam in some pedons. The Bt horizon has hue of 10YR, 2.5Y, or 5Y and chroma of 4 to 6. It is flaggy silty clay or flaggy clay. The C horizon has hue of 5Y or 2.5Y or is neutral in hue. It has value of 4 to 6 and chroma of 0 to 4. It is flaggy to extremely flaggy clay or silty clay.

Elkinsville Series

The Elkinsville series consists of deep, well drained, moderately permeable soils on low terraces along streams. These soils formed in alluvium. Slopes range from 1 to 6 percent.

Elkinsville soils are commonly adjacent to Peoga, Plainfield, and Sciotoville soils. Peoga soils are poorly drained and are in drainageways. Plainfield soils have more sand in the subsoil than the Elkinsville soils. They are in the higher landscape positions. Sciotoville soils are moderately well drained and are in the lower landscape positions. They have a fragipan.

Typical pedon of Elkinsville silt loam, 1 to 6 percent slopes, about 0.5 mile southeast of Sandy Springs, in Green Township; 1,980 feet southeast of the intersection of Federal Route 52 and Township Road 218, along Federal Route 52, then 330 feet south:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; weak fine granular structure; friable; many roots; medium acid; abrupt smooth boundary.

Bt1—8 to 12 inches; yellowish brown (10YR 5/6) silt loam; moderate coarse subangular blocky structure; friable; common roots; few faint yellowish brown (10YR 5/6) clay films on faces of peds; few soft dark accumulations of iron and manganese oxide; strongly acid; clear wavy boundary.

Bt2—12 to 24 inches; yellowish brown (10YR 5/6) silt loam; moderate medium prismatic structure parting to weak coarse subangular blocky; friable; common distinct strong brown (7.5YR 5/6) clay films on faces of peds; few soft dark accumulations of iron and manganese oxide; strongly acid; clear wavy boundary.

2Bt3—24 to 47 inches; yellowish brown (10YR 5/6) very fine sandy loam; moderate coarse prismatic structure parting to weak coarse subangular blocky; friable; common faint yellowish brown and common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common soft dark accumulations of iron and manganese oxide; strongly acid; clear wavy boundary.

2C—47 to 80 inches; yellowish brown (10YR 5/6) very fine sandy loam; massive with some platiness; friable; strongly acid.

The thickness of the solum ranges from 40 to 70 inches. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The 2Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is loam, clay loam, very fine sandy loam, or sandy clay loam. The 2C horizon has hue of 7.5YR or 10YR and chroma of 3 to 6. It is loam, very fine sandy loam, silty clay loam, or silt loam.

Faywood Series

The Faywood series consists of moderately deep, well drained, moderately slowly permeable or slowly permeable soils on the tops and sides of ridges in the uplands. These soils formed in material weathered from interbedded limestone and calcareous shale. Slopes range from 8 to 25 percent.

Faywood soils are similar to Bratton, Jessup, and Lowell soils and are commonly adjacent to Aaron, Eden, Jessup, and Rossmoyne soils. Bratton soils have redder hue in the subsoil than the Faywood soils. Lowell, Jessup, Aaron, and Rossmoyne soils are deep over bedrock. Aaron and Rossmoyne soils are in the less sloping areas. They have gray mottles in the upper 10 inches of the argillic horizon. Rossmoyne soils have a fragipan. Eden soils have a higher content of coarse fragments throughout than the Faywood soils. They are in the steeper areas. Jessup soils are in landscape positions similar to those of Faywood soils.

Typical pedon of Faywood silty clay loam, 15 to 25 percent slopes, eroded, about 3.5 miles northwest of Manchester, in Sprigg Township; 1,650 feet southeast of the junction of Township Roads 4B and 329, along Township Road 329, then 530 feet south:

Ap—0 to 6 inches; yellowish brown (10YR 5/4) silty clay loam, very pale brown (10YR 7/4) dry; about 30 percent yellowish brown (10YR 5/6) material from the B horizon; moderate medium subangular blocky structure; friable; many roots; many faint dark yellowish brown (10YR 4/4) coatings on faces of peds; few coarse fragments; slightly acid; abrupt smooth boundary.

Bt—6 to 14 inches; yellowish brown (10YR 5/6) clay; moderate medium angular blocky structure; firm; common roots; common faint yellowish brown (10YR 5/4) clay films on faces of peds; few coarse fragments; slight effervescence; mildly alkaline; clear wavy boundary.

BC—14 to 28 inches; light yellowish brown (2.5Y 6/4) clay; common medium distinct olive (5Y 5/3) mottles; moderate medium subangular blocky structure; firm; common faint light olive brown (2.5Y 5/4) and few distinct olive (5Y 5/4) clay films on faces of peds; about 10 percent coarse fragments; strong effervescence; moderately alkaline; clear wavy boundary.

C—28 to 34 inches; light olive brown (2.5Y 5/6) and brown (7.5YR 5/4) channery clay; massive with some platiness; firm; about 25 percent limestone fragments; strong effervescence; moderately alkaline; abrupt smooth boundary.

R—34 to 36 inches; hard limestone bedrock interbedded with calcareous shale.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The content of flagstones and channery fragments of limestone and shale ranges from 0 to 15 percent in the B horizon and is as much as 25 percent in the C horizon.

The Ap horizon has value of 4 or 5 and chroma of 3 or 4. It is silty clay loam or silt loam. The Bt horizon has hue of 7.5YR to 2.5Y and value and chroma of 4 to 6. It is silty clay loam, silty clay, or clay. The C horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is silty clay, clay, or the channery analogs of those textures.

Gessie Series

The Gessie series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in recent alluvium. Slopes range from 0 to 2 percent.

Gessie soils are similar to Nolin soils. Nolin soils contain less sand in the subsoil than the Gessie soils.

Typical pedon of Gessie loam, frequently flooded, about 1.5 miles north of Seaman, in Scott Township; 2,180 feet northeast of the junction of State Highway 247 and Township Road 188, along State Highway 247, then 2,245 feet east:

Ap—0 to 11 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many roots; few faint dark brown (10YR 4/3) organic stains on faces of peds; slight effervescence; mildly alkaline; abrupt smooth boundary.

C1—11 to 19 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure; friable; common roots; slight effervescence; mildly alkaline; clear wavy boundary.

C2—19 to 60 inches; brown (10YR 4/3), stratified silt loam and loam; massive; friable; slight effervescence; mildly alkaline.

The A horizon has value of 4 or 5 and chroma of 2 or 3. It is commonly loam but is silt loam in some pedons. The C horizon has value of 4 or 5 and chroma of 3 or 4. It is dominantly silt loam or loam, but in some pedons it has thin strata of silty clay loam, sandy loam, or loamy sand.

Jessup Series

The Jessup series consists of deep, well drained, slowly permeable soils on side slopes in the glaciated uplands. These soils formed in loess, glacial till, and clayey material weathered from limestone and calcareous shale. Slopes range from 1 to 35 percent.

Jessup soils are similar to Bratton, Faywood, and Lowell soils and are commonly adjacent to Faywood and Rossmoyne soils. Rossmoyne soils are moderately well drained and are in the less sloping areas. They have a fragipan. Bratton and Faywood soils are moderately deep over bedrock. Faywood soils are along drainageways and are in the steeper areas. Bratton and Lowell soils do not have fragments of glacial till in the subsoil.

Typical pedon of Jessup silt loam, 1 to 8 percent slopes, about 5.1 miles west-northwest of Pebbles, in Bratton Township; 1,320 feet southeast of the intersection of Township Road 124 and County Road 14, along Township Road 124, then 250 feet south-southwest:

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; weak coarse granular structure; friable; many roots; very strongly acid; abrupt wavy boundary.

E—7 to 12 inches; yellowish brown (10YR 5/4) and light yellowish brown (10YR 6/4) silt loam; weak thick platy structure parting to weak fine subangular blocky; very friable; many roots; many vesicular pores; very strongly acid; clear wavy boundary.

Bt1—12 to 18 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium subangular blocky structure; friable; common roots; common vesicular pores; common distinct strong brown (7.5YR 5/8) clay films on faces of peds; common distinct light yellowish brown (10YR 6/4) silt coatings on vertical faces of peds; few coarse fragments; very strongly acid; clear wavy boundary.

2Bt2—18 to 24 inches; yellowish brown (10YR 5/4) silty clay loam; moderate fine and medium subangular blocky structure; firm; few fine roots; common faint dark yellowish brown (10YR 4/4) clay films and many distinct light yellowish brown (10YR 6/4) silt coatings on faces of peds; few coarse fragments; very strongly acid; clear wavy boundary.

2Bt3—24 to 33 inches; yellowish brown (10YR 5/6) silty clay; common medium distinct yellowish red (5YR 5/6) mottles; moderate coarse and medium subangular blocky structure parting to moderate very fine angular blocky; firm; common faint yellowish brown (10YR 5/4) clay films on faces of peds; few coarse fragments; very strongly acid; clear wavy boundary.

2Bt4—33 to 41 inches; yellowish brown (10YR 5/6) clay; few fine distinct pale yellow (2.5Y 7/4) mottles; weak coarse prismatic structure parting to moderate very fine angular blocky; firm; common faint yellowish brown (10YR 5/4) clay films on faces of peds; common fine and medium dark stains and concretions of iron and manganese oxide; about 5 percent coarse fragments; medium acid in the upper part and neutral in the lower part; clear wavy boundary.

3Bt5—41 to 54 inches; light olive brown (2.5Y 5/6) clay; few fine distinct pale yellow (2.5Y 7/4) mottles; weak coarse prismatic structure parting to moderate fine angular blocky; firm; few distinct yellowish brown (10YR 5/4) clay films on faces of peds; common fine and medium dark stains and concretions of iron and manganese oxide; few coarse fragments; mildly alkaline; abrupt smooth boundary.

3BC—54 to 64 inches; olive (5Y 5/4) and light olive gray (5Y 6/2) silty clay; weak coarse subangular blocky structure; firm; few fragments of hard shale and chert; slight effervescence; moderately alkaline; gradual wavy boundary.

3Cr—64 to 66 inches; light gray (5Y 6/1), soft shale bedrock that has thin strata of limestone; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 60 inches. The depth to free carbonates ranges from 36 to 60 inches. The depth to paralithic contact ranges from 40 to 84 inches. The silty mantle is 10 to 24 inches thick.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. It is commonly silt loam but is silty clay loam in some eroded areas. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 8. It is silt loam or silty clay loam. The 2Bt horizon generally has hue of 10YR or 7.5YR, but in some pedons it has hue of 2.5Y in the lower part. This horizon has value of 4 or 5 and chroma of 4 to 6. It is silty clay loam, silty clay, or clay. The 3Bt horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6, and chroma of 3 to 6. It is silty clay, clay, or silty clay loam.

Latham Series

The Latham series consists of moderately deep, moderately well drained, slowly permeable soils on ridgetops and benches in the uplands. These soils formed in material weathered from acid shale. Slopes range from 8 to 25 percent.

Latham soils are adjacent to Tilsit and Wernock soils. Tilsit soils contain less clay in the subsoil than the Latham soils and have a fragipan. Wernock soils are well drained and have less clay in the subsoil than the Latham soils. Tilsit and Wernock soils are on the less sloping ridgetops.

Typical pedon of Latham silt loam, 8 to 15 percent slopes, about 7 miles east-southeast of Peebles, in Franklin Township; 2,200 feet northwest of the junction of Township Road 140 and County Road 49, along County Road 49, then 3,000 feet north:

Ap—0 to 6 inches; brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; weak very fine granular structure; friable; many roots; medium acid; abrupt smooth boundary.

Bt1—6 to 11 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; common roots; few coarse fragments; common faint brown (7.5YR 5/4) clay films and common distinct dark yellowish brown (10YR 4/4) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

Bt2—11 to 17 inches; strong brown (7.5YR 5/6) silty clay; moderate medium subangular blocky structure; firm; common roots; common faint brown (7.5YR 5/4) clay films on faces of peds; few coarse fragments; very strongly acid; clear wavy boundary.

Bt3—17 to 25 inches; strong brown (7.5YR 5/6) and light olive brown (2.5Y 5/4) silty clay; few medium distinct light brownish gray (10YR 6/2) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few roots; common distinct yellowish brown (10YR 5/4) clay films and light olive brown (2.5Y 5/4) silt coatings on faces of peds; few coarse fragments; very strongly acid; clear wavy boundary.

Bt4—25 to 35 inches; strong brown (7.5YR 5/4) shaly silty clay; common medium prominent gray (5Y 5/1) mottles; moderate medium angular blocky structure; firm; few roots; common distinct gray (5YR 5/1) clay films on faces of peds; about 25 percent soft shale fragments; very strongly acid; clear wavy boundary.

Cr—35 to 40 inches; gray (10YR 5/1), thinly bedded shale bedrock.

The thickness of the solum and the depth to paralithic contact range from 20 to 40 inches. The content of coarse fragments ranges from 0 to 25 percent in individual subhorizons of the Bt horizon.

The Ap horizon has value of 4 or 5. It is silt loam or silty clay loam. The Bt horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 4 to 6. It is silty clay loam or silty clay.

Lawshe Series

The Lawshe series consists of deep, moderately well drained, very slowly permeable soils on foot slopes in the uplands. These soils formed in colluvium and material weathered from calcareous shale. Slopes range from 12 to 25 percent.

Lawshe soils are commonly adjacent to Brushcreek and Faywood soils. Both of the adjacent soils have a surface layer that is lighter in color than that of the Lawshe soils. Brushcreek soils are in landscape positions similar to those of the Lawshe soils. The well drained Faywood soils are on side slopes. They are moderately deep over bedrock.

Typical pedon of Lawshe silty clay loam, in an area of Brushcreek-Lawshe complex, 12 to 25 percent slopes, eroded, about 2.7 miles east-northeast of Tranquility, in Bratton Township; 450 feet east of the intersection of Township Road 124B and County Road 100, along County Road 100, then 1,250 feet north:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; friable; many roots; few strong brown (7.5YR 5/6) limestone fragments; neutral; clear smooth boundary.

AB—6 to 12 inches; very dark grayish brown (10YR 3/2) silty clay, grayish brown (10YR 5/2) dry; moderate very fine and fine granular structure; common distinct very dark gray (10YR 3/1) organic coatings on faces of peds; common roots; few strong brown (7.5YR 5/6) limestone fragments; mildly alkaline; clear smooth boundary.

Bw1—12 to 16 inches; brown (10YR 4/3) silty clay; common medium faint dark grayish brown (10YR 4/2) mottles; moderate fine angular blocky structure; common distinct dark gray (10YR 4/1) organic coatings on faces of peds; few roots; few strong brown (7.5YR 5/6) limestone fragments; mildly alkaline; clear smooth boundary.

Bw2—16 to 22 inches; yellowish brown (10YR 5/4) silty clay; common medium distinct dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; common distinct dark grayish brown (2.5Y 4/2) coatings on vertical faces of peds; very few roots; few strong brown (7.5YR 5/6) limestone fragments; slight effervescence; mildly alkaline; clear smooth boundary.

Bw3—22 to 25 inches; light olive brown (2.5Y 5/4) silty clay; common fine distinct yellowish brown (10YR 5/6) and gray (N 6/0) mottles; weak coarse subangular blocky structure; common distinct dark grayish brown (2.5Y 4/2) coatings on vertical faces of peds; very few roots; about 10 percent strong brown (7.5YR 5/6) limestone fragments; slight effervescence; moderately alkaline; clear wavy boundary.

BC—25 to 37 inches; light olive brown (2.5Y 5/4) silty clay; many fine distinct light olive gray (5Y 6/2) and common fine distinct yellowish brown (10YR 5/4) mottles; weak coarse prismatic structure; very firm;

many distinct light yellowish brown (2.5Y 6/4) coatings on vertical faces of peds; few medium very pale brown (10YR 7/3) soft accumulations of calcium carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

C—37 to 50 inches; gray (5Y 6/1) silty clay; common medium prominent light olive brown (2.5Y 5/4) mottles; massive; firm, plastic; few medium prominent black (10YR 2/1) concretions of iron and manganese oxide; few platy shale fragments; strong effervescence; moderately alkaline; gradual smooth boundary.

Cr—50 to 60 inches; olive (5Y 5/3) and light yellowish brown (2.5Y 6/4), calcareous, soft shale bedrock that has thin strata of limestone.

The thickness of the solum ranges from 20 to 40 inches. The depth to bedrock ranges from 40 to 60 inches.

The Ap horizon is silt loam, silty clay loam, silty clay, or the flaggy analogs of those textures. The upper part of the Bw horizon has value of 4 or 5 and chroma of 3 to 6. It is silty clay or clay. The lower part has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 4 to 6. It is silty clay, clay, or the flaggy analogs of those textures. The C horizon has hue of 10YR, 5Y, 2.5Y, or 5G, value of 5 or 6, and chroma of 1 to 4. It is silty clay or clay.

Licking Series

The Licking series consists of deep, moderately well drained, slowly permeable soils on high terraces. These soils formed in clayey lacustrine sediments and in a thin mantle of silty material. Slopes range from 1 to 25 percent.

Licking soils are commonly adjacent to McGary Variant and Otwell soils. The somewhat poorly drained McGary Variant soils are in drainageways. Otwell soils have less clay in the subsoil than the Licking soils and have a fragipan. They are in the slightly higher landscape positions.

Typical pedon of Licking silt loam, 1 to 6 percent slopes, about 1.6 miles northeast of Peebles, in Franklin Township; 130 feet southwest along County Road 198 from the intersection of County Road 198 and Township Road 125C, then 3,100 feet west:

Ap—0 to 8 inches; yellowish brown (10YR 5/4) silt loam, light yellowish brown (10YR 6/4) dry; moderate fine subangular blocky structure; friable; many roots; very strongly acid; abrupt smooth boundary.

BE—8 to 13 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; many roots; many distinct yellowish brown (10YR 5/4) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

Bt1—13 to 19 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct brown (10YR 5/3) mottles; moderate medium subangular blocky structure; firm; common roots; common distinct brown (10YR 5/3) clay films on faces of peds; very strongly acid; clear wavy boundary.

2Bt2—19 to 31 inches; yellowish brown (10YR 5/6) silty clay; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; few roots; firm; common faint yellowish brown (10YR 5/4) clay films on faces of peds; strongly acid; clear wavy boundary.

2Bt3—31 to 41 inches; strong brown (7.5YR 5/6) clay; common medium distinct gray (N 6/0) mottles; moderate coarse prismatic structure parting to moderate medium and coarse angular blocky; firm; many distinct dark brown (7.5YR 4/4) clay films on faces of peds; slightly acid; clear wavy boundary.

2Bt4—41 to 48 inches; brown (7.5YR 5/4) clay; common medium distinct gray (N 6/0) mottles; moderate very coarse prismatic structure parting to weak coarse angular blocky; firm; few light gray (10YR 7/1) concretions of calcium carbonate in which effervescence is violent; many faint dark brown (7.5YR 4/4) clay films on faces of peds; neutral; clear wavy boundary.

2C—48 to 70 inches; dark brown (7.5YR 4/4) clay; few medium distinct gray (N 6/0) mottles; massive; firm; brown (7.5YR 5/2) bedding planes; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 36 to 60 inches. The silty mantle ranges from 12 to 30 inches in thickness.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 4 to 6. The 2Bt horizon has hue of 10YR or 7.5YR and chroma of 4 to 6. It is dominantly silty clay or clay, but in some pedons it has thin subhorizons of silty clay loam. The 2C horizon has hue of 10YR, 7.5YR, or 2.5Y, value of 3 to 5, and chroma of 3 or 4. It typically is silty clay or clay but has thin strata of silty clay loam or silt loam in some pedons.

Loudon Series

The Loudon series consists of deep, moderately well drained, slowly permeable soils on glaciated uplands. These soils formed in loess and Illinoian glacial till and in the underlying clayey material weathered from calcareous shale and thin strata of limestone. Slopes range from 0 to 15 percent.

Loudon soils are similar to Aaron soils and are commonly adjacent to Rossmoyne soils. Aaron soils do not have a subsoil that formed partly in glacial till. Rossmoyne soils have a fragipan and contain more silt than the Loudon soils. They are in the lower areas on broad interfluves where the deposits of glacial till are thicker.

Typical pedon of Loudon silt loam, 2 to 6 percent slopes, about 4.5 miles northeast of Seaman, in Scott Township; 6,340 feet south of the intersection of State Route 770 and Township Road 100, along Township Road 100, then 200 feet east:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many roots; few fine black (N 2/0) concretions of iron and manganese oxide; neutral; abrupt smooth boundary.

BE—8 to 12 inches; yellowish brown (10YR 5/4) silt loam; few medium faint brown (10YR 5/3) and common medium faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; common roots; common distinct pale brown (10YR 6/3) silt coatings on faces of peds; few fine black (N 2/0) concretions of iron and manganese oxide; slightly acid; clear wavy boundary.

Bt1—12 to 21 inches; yellowish brown (10YR 5/6) silty clay loam; few medium distinct strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; friable; few roots; common distinct yellowish brown (10YR 5/4) clay films and many distinct pale brown (10YR 6/3) silt coatings on faces of peds; common black (N 2/0) stains and concretions of iron and manganese oxide; strongly acid; clear wavy boundary.

2Bt2—21 to 35 inches; yellowish brown (10YR 5/6) silty clay; common medium prominent grayish brown (10YR 5/2) and few medium distinct strong brown (7.5YR 5/6) mottles; moderate medium angular and subangular blocky structure; firm; common faint yellowish brown (10YR 5/4) clay films on faces of peds; common distinct pale brown (10YR 6/3) silt coatings on faces of peds in the upper part; common prominent black (N 2/0) stains of iron and manganese oxide on faces of peds; few angular coarse fragments; very strongly acid; clear wavy boundary.

2Bt3—35 to 51 inches; yellowish brown (10YR 5/6) silty clay; common medium prominent light brownish gray (10YR 6/2) and few medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; common faint yellowish brown (10YR 5/6) and few faint yellowish brown (10YR 5/4) clay films on faces of peds; many medium black (N 2/0) concretions of iron and manganese oxide; few angular coarse fragments; very strongly acid; clear wavy boundary.

3Bt4—51 to 64 inches; yellowish brown (10YR 5/4) silty clay; common medium faint yellowish brown (10YR 5/6) and few medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; common faint yellowish brown (10YR 5/6) clay films on faces of peds; firm; many medium black (N 2/0) stains and concretions of iron and manganese oxide; about 8 percent angular coarse fragments; slightly acid; clear wavy boundary.

3Cr—64 to 66 inches; light olive brown (2.5Y 5/6), soft, weathered shale bedrock; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to bedrock range from 40 to 84 inches. The thickness of the silty mantle ranges from 10 to 24 inches.

The Ap horizon has value of 4 or 5. The 2Bt horizon has hue of 7.5YR to 2.5Y and chroma of 4 to 6. It is silty clay loam or silty clay.

Lowell Series

The Lowell series consists of deep, well drained, moderately slowly permeable soils on the tops of ridges in the uplands. These soils formed in material weathered from interbedded limestone and calcareous shale. Slopes range from 2 to 15 percent.

Lowell soils are similar to Bratton, Faywood, and Jessup soils and are commonly adjacent to Faywood and Bratton soils. Bratton and Faywood soils are moderately deep over bedrock. They are along drainageways. Jessup soils formed in loess and in the underlying glacial till and residuum. They have glacial pebbles and stones in the upper part of the subsoil.

Typical pedon of Lowell silt loam, 2 to 8 percent slopes, about 9 miles southwest of West Union, in Sprigg Township; 1 mile north of the junction of State Route 41 and Township Road 185, along Township Road 185, then 0.75 mile east:

Ap—0 to 6 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; weak fine granular structure; friable; many fine roots; many distinct dark brown (10YR 3/3) silt coatings on faces of peds; medium acid; abrupt smooth boundary.

BE—6 to 9 inches; strong brown (7.5YR 5/6) silty clay loam; moderate fine subangular blocky structure; friable; common fine roots; many distinct brown (10YR 4/3) silt coatings on faces of peds; strongly acid; clear wavy boundary.

Bt1—9 to 16 inches; strong brown (7.5YR 5/6) silty clay;

moderate medium subangular blocky structure; firm; common fine roots; common faint brown (7.5YR 5/4) clay films on faces of peds; medium acid; clear wavy boundary.

Bt2—16 to 23 inches; strong brown (7.5YR 5/6) silty clay; moderate medium subangular blocky structure; firm; few fine roots; common distinct brown (10YR 5/3) and yellowish brown (10YR 5/4) clay films on faces of peds; few soft dark accumulations of iron and manganese oxide; medium acid; clear wavy boundary.

Bt3—23 to 28 inches; yellowish brown (10YR 5/6) silty clay; few fine distinct light brownish gray (2.5Y 6/2) and few medium distinct grayish brown (2.5YR 5/2) mottles; moderate medium subangular blocky structure; firm; common distinct olive (5Y 5/3) clay films on faces of peds; common stains of iron and manganese oxide; few coarse fragments; slightly acid; clear wavy boundary.

Bt4—28 to 39 inches; olive yellow (2.5Y 6/6) silty clay; common medium distinct greenish gray (5GY 6/1) mottles; moderate medium subangular blocky structure; firm; common distinct light olive brown (2.5Y 5/4) clay films on faces of peds; common prominent black (N 2/0) stains of iron and manganese oxide; about 10 percent coarse fragments; neutral; clear wavy boundary.

BC—39 to 43 inches; light olive brown (2.5Y 5/6) silty clay; common medium distinct light brownish gray (2.5Y 6/1) mottles; massive with some platiness; firm; common prominent black (N 2/0) stains of iron and manganese oxide; about 5 percent coarse fragments; strong effervescence in a few spots; mildly alkaline; abrupt smooth boundary.

R—43 to 45 inches; light gray (10YR 7/2), hard limestone bedrock.

The thickness of the solum and the depth to limestone bedrock are more than 40 inches. The Ap horizon has value of 4 or 5 and chroma of 3 or 4. The BE horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The Bt horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 5 or 6, and chroma of 4 to 6. It is silty clay or clay in the lower part.

McGary Variant

The McGary Variant consists of deep, somewhat poorly drained soils in old glacial lake basins. These soils formed in thin deposits of lacustrine material and a thin layer of sandy loam over limestone bedrock. Permeability is slow or very slow in the subsoil and moderately rapid in the substratum. Slopes range from 0 to 3 percent.

McGary Variant soils are commonly adjacent to Licking and Otwell soils. Licking and Otwell soils are moderately well drained and are in the higher landscape positions. Otwell soils have more silt than the McGary Variant soils and have a fragipan.

Typical pedon of McGary Variant silty clay loam, 0 to 3 percent slopes, rarely flooded, about 2.6 miles southeast of Peebles, in Meigs Township; 2,245 feet east along County Road 8 from the intersection of County Roads 8 and 27, then 164 feet south:

Ap—0 to 10 inches; grayish brown (10YR 5/2) silty clay loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; many fine roots; common distinct dark grayish brown (10YR 4/2) silt coatings on faces of peds; neutral; abrupt smooth boundary.

Bg—10 to 15 inches; grayish brown (10YR 5/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; many fine roots; common distinct brown (10YR 5/3) and grayish brown (10YR 5/2) silt coatings on faces of peds; neutral; clear wavy boundary.

Bw1—15 to 20 inches; yellowish brown (10YR 5/6) silty clay; common medium distinct grayish brown (10YR 5/2) and few medium distinct gray (10YR 5/1) mottles; moderate medium subangular blocky structure; firm; common fine roots; common distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) silt coatings on faces of peds; neutral; clear wavy boundary.

Bw2—20 to 33 inches; yellowish brown (10YR 5/6) silty clay; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; many medium grayish brown (10YR 5/2) and common distinct yellowish brown (10YR 5/4) silt coatings on faces of peds; common prominent black (N 2/0) stains of iron and manganese oxide; neutral; clear wavy boundary.

B′g1—33 to 46 inches; gray (10YR 6/1) silty clay; common medium prominent olive yellow (2.5Y 6/6) mottles; moderate medium subangular blocky structure; firm; common prominent black (N 2/0) stains and concretions of iron and manganese oxide; neutral; clear wavy boundary.

B′g2—46 to 55 inches; gray (10YR 5/1) silty clay; moderate medium prominent yellowish brown (10YR 5/6) and common medium faint gray (10YR 6/1) mottles; moderate medium subangular blocky structure; firm; common prominent black (N 2/0) stains and concretions of iron and manganese oxide; few coarse fragments; mildly alkaline; clear wavy boundary.

2C—55 to 57 inches; yellowish brown (10YR 5/4) sandy loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; very friable; few coarse fragments; strong effervescence; moderately alkaline; clear wavy boundary.

2R—57 to 60 inches; limestone bedrock.

The thickness of the solum and the depth to limestone bedrock range from 40 to 60 inches. The Ap horizon has value of 4 to 6. The Bg horizon has value of 4 to 6 and chroma of 1 or 2. It is silty clay loam, silty clay, or clay. The Bw horizon has chroma of 3 to 6. It is silty clay or clay. The 2C horizon has value of 5 or 6 and chroma of 3 to 6.

Muse Series

The Muse series consists of deep, well drained, slowly permeable soils on foot slopes in the uplands. These soils formed in colluvium derived from acid shale and siltstone. Slopes range from 15 to 50 percent.

Muse soils are similar to Brushcreek soils and are commonly adjacent to Colyer and Shelocta soils. Brushcreek soils have a higher content of lime in the lower part than the Muse soils. Colyer soils have a higher content of coarse fragments in the subsoil than the Muse soil. They are on the upper shoulder slopes. Shelocta soils have less clay in the subsoil than the Muse soils. They are on the upper foot slopes.

Typical pedon of Muse silt loam, in an area of Shelocta-Muse-Colyer association, steep, about 7.5 miles southeast of West Union, in Brushcreek Township; 660 feet northeast along Township Road 150 from the intersection of County Road 9 and Township Road 150, then 2,410 feet north:

A—0 to 2 inches; brown (10YR 4/3) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many roots; very strongly acid; clear wavy boundary.

E—2 to 6 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; many roots; very strongly acid; clear wavy boundary.

BE—6 to 10 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; many roots; few faint yellowish brown (10YR 5/6) clay films on faces of peds; many faint yellowish brown (10YR 5/4) silt coatings on faces of peds; about 5 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt1—10 to 28 inches; yellowish red (5YR 5/6) shaly silty clay loam; moderate medium subangular blocky structure; firm; common roots; common distinct strong brown (7.5YR 5/6) clay films on faces of peds; about 15 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt2—28 to 46 inches; yellowish red (5YR 5/6) shaly silty clay; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common distinct strong brown (7.5YR 5/6) clay films on faces of peds; common roots; about 25 percent coarse fragments; very strongly acid; clear wavy boundary.

C—46 to 54 inches; variegated yellowish red (5YR 5/6), yellowish brown (10YR 5/4), and grayish brown (10YR 5/2) very shaly silty clay; massive; firm; about 50 percent coarse fragments; very strongly acid; clear wavy boundary.

Cr—54 to 56 inches; yellowish brown (10YR 5/4), soft shale bedrock.

The thickness of the solum and the depth to bedrock are more than 40 inches. The content of shale fragments ranges from 0 to 25 percent in the B horizon and from 40 to 60 percent in the C horizon.

The A horizon has value of 4 or 5 and chroma of 3 or 4. It is commonly silt loam but is silty clay loam in some pedons. The Bt horizon has hue of 7.5YR or 5YR and chroma of 4 to 6. It is silty clay loam, silty clay, clay, or the shaly analogs of those textures. The C horizon has hue of 10YR to 2.5YR, value of 5 or 6, and chroma of 4 to 8. It is very shaly silty clay or very shaly clay.

Newark Series

The Newark series consists of deep, somewhat poorly drained, moderately permeable soils on flood plains. These soils formed in recent alluvium. Slopes range from 0 to 2 percent.

Newark soils are commonly adjacent to Nolin soils, which are well drained.

Typical pedon of Newark silt loam, frequently flooded, about 7.4 miles northeast of West Union, in Brushcreek Township; 1.2 miles west of the intersection of County Road 6 and Township Road 232, along Township Road 232, then 925 feet north:

Ap—0 to 9 inches; yellowish brown (10YR 5/4) silt loam, light yellowish brown (10YR 6/4) dry; weak medium granular structure; friable; many roots; common black (N 2/0) concretions of iron and manganese oxide; strongly acid; abrupt smooth boundary.

Bg—9 to 17 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium distinct yellowish brown (10YR 5/4) and common medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; common roots; common black (N 2/0) concretions of iron and manganese oxide; medium acid; clear wavy boundary.

Bw—17 to 28 inches; yellowish brown (10YR 5/4) silty clay loam; many coarse distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; firm; few roots; common black (N 2/0) concretions of iron and manganese oxide; few coarse fragments; medium acid; clear wavy boundary.

B′g—28 to 34 inches; light brownish gray (10YR 6/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; common black (N 2/0) concretions of iron and manganese oxide; medium acid; clear wavy boundary.

C—34 to 67 inches; yellowish brown (10YR 5/4) silty clay loam; common medium prominent gray (5Y 5/1) and common medium faint yellowish brown (10YR 5/4) mottles; massive; firm; few black (N 2/0) concretions of iron and manganese oxide; medium acid.

The thickness of the solum ranges from 24 to 40 inches. The content of coarse fragments, mostly pebbles, ranges from 0 to 5 percent in the solum and is as much as 15 percent in the substratum.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. The B horizon has hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 2 to 4. It is silt loam or silty clay loam. The C horizon has value of 4 or 5 and chroma of 4 to 6. It is loam, silt loam, or silty clay loam.

Nicholson Series

The Nicholson series consists of deep, moderately well drained soils on the tops of ridges in the uplands. These soils formed in loess and in the underlying clayey residuum. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. Slopes range from 1 to 6 percent.

Nicholson soils are similar to Tilsit soils and are adjacent to Crider and Lowell soils. Tilsit soils do not have a subsoil layer below the fragipan. Crider soils are well drained and are in the higher landscape positions. They do not have a fragipan. Lowell soils are well drained and are in the slightly higher landscape positions.

Typical pedon of Nicholson silt loam, 1 to 6 percent slopes, about 3.7 miles northwest of Peebles, in Bratton Township; 4,000 feet south of the intersection of County Road 13 and Township Road 121B, along Township Road 121B, then 400 feet east:

Ap—0 to 10 inches; brown (10YR 5/3) silt loam, light yellowish brown (10YR 6/4) dry; weak fine granular structure; friable; common roots; common fine black (N 2/0) stains of iron and manganese oxide on faces of peds; neutral; abrupt smooth boundary.

Bt1—10 to 21 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common roots; few faint yellowish brown (10YR 5/4) silt coatings and few faint yellowish brown (10YR 5/6) clay films on faces of peds; neutral; clear wavy boundary.

Bt2—21 to 24 inches; yellowish brown (10YR 5/6) silty clay loam; few fine distinct pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; common roots; many faint yellowish brown (10YR 5/4) silt coatings and common faint yellowish brown (10YR 5/6) clay films on faces of peds; common medium black (N 2/0) concretions of iron and manganese oxide; strongly acid; clear wavy boundary.

Btx—24 to 44 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; weak very coarse prismatic structure parting to moderate thick platy; very firm; brittle; few roots on faces of prisms; common faint yellowish brown (10YR 5/4) clay films on faces of prisms; light brownish gray (10YR 6/2) and pale brown (10YR 6/3) seams of clay; common medium black (N 2/0) concretions of iron and manganese oxide; strongly acid; clear wavy boundary.

2Bt—44 to 51 inches; strong brown (7.5YR 5/6) silty clay; common medium prominent pale brown (10YR 6/3) and common medium prominent brown (7.5YR 5/2) mottles; moderate medium angular blocky structure; firm; common distinct brown (7.5YR 5/4) clay films on faces of peds; about 10 percent coarse fragments; strongly acid; clear wavy boundary.

2BC—51 to 60 inches; strong brown (7.5YR 5/6) gravelly clay; many medium prominent red (2.5YR 4/6), common medium distinct brown (7.5YR 5/2), and common medium distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; firm; common faint strong brown (7.5YR 5/6) clay films on faces of peds; about 30 percent coarse fragments; slightly acid; abrupt smooth boundary.

2R—60 to 62 inches; hard limestone bedrock.

The solum is more than 40 inches thick. Depth to the fragipan ranges from 20 to 30 inches.

The Ap horizon has value of 4 or 5 and chroma of 3 or 4. The Bt and Btx horizons are silt loam or silty clay loam. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The Btx horizon has hue of 7.5YR to 2.5Y, value of 3 to 5, and chroma of 4 to 8. The 2Bt horizon has hue of 2.5YR to 2.5Y, value of 4 or 5, and chroma of 4 to 6. It is silty clay or clay.

Nolin Series

The Nolin series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in recent alluvium. Slopes range from 0 to 3 percent.

Nolin soils are similar to Gessie soils and are commonly adjacent to Newark soils. Gessie soils have more sand in the subsoil than the Nolin soils. Newark soils are somewhat poorly drained and are in the lower positions on the flood plains.

Typical pedon of Nolin silt loam, occasionally flooded, about 10.2 miles southeast of Peebles, in Jefferson Township; 1,075 feet southeast of the intersection of State Routes 348 and 781, along State Route 348, then 595 feet east:

Ap—0 to 10 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

Bw—10 to 45 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure; friable; few fine roots; common faint brown (10YR 4/3) organic coatings on faces of peds; slightly acid; clear wavy boundary.

C—45 to 80 inches; dark yellowish brown (10YR 4/4) silt loam; few medium faint brown (10YR 5/3) mottles; massive; friable; slightly acid.

The solum is more than 40 inches thick. The Bw horizon has value of 4 or 5. The C horizon has hue of 10YR or 7.5YR and value of 4 or 5. It is silt loam or loam and can be stratified.

Omulga Series

The Omulga series consists of deep, moderately well drained soils in preglacial valleys. These soils formed in loess, colluvium, or old alluvium. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. Slopes range from 1 to 15 percent.

Omulga soils are similar to Otwell and Sciotoville soils. Otwell soils are less acid in the subsoil than the Omulga soils. Sciotoville soils have low-chroma mottles in the upper 10 inches of the subsoil.

Typical pedon of Omulga silt loam, 1 to 6 percent slopes, about 1.7 miles west of Blue Creek, in Brushcreek Township; 660 feet west of the intersection of State Route 125 and County Road 6, along State Route 125, then 365 feet north:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; few roots; few coarse fragments; strongly acid; abrupt smooth boundary.

Bt1—8 to 17 inches; yellowish brown (10YR 5/4) silt loam; few medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few roots; common faint yellowish brown (10YR 5/4) clay films on faces of peds; few coarse fragments; strongly acid; clear wavy boundary.

Bt2—17 to 27 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common faint yellowish brown (10YR 5/4) clay films on faces of peds; common dark accumulations of iron and manganese oxide; about 5 percent coarse fragments; very strongly acid; clear wavy boundary.

Btx1—27 to 44 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; weak very coarse prismatic structure parting to moderate thick platy; very firm; brittle; common faint yellowish brown (10YR 5/4) clay films on faces of peds; common fine concretions of iron and manganese oxide; about 5 percent coarse fragments; very strongly acid; clear wavy boundary.

Btx2—44 to 50 inches; strong brown (7.5YR 5/6) silty clay loam; many medium prominent light brownish gray (10YR 6/2) mottles; weak very coarse prismatic structure parting to moderate thick platy; very firm; brittle; common faint strong brown (7.5YR 5/8) clay films on faces of peds; about 5 percent coarse fragments; very strongly acid; clear wavy boundary.

B′t—50 to 60 inches; yellowish brown (10YR 5/6) silty clay loam; common medium prominent light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; firm; about 5 percent coarse fragments; very strongly acid.

The thickness of the solum ranges from 40 to more than 60 inches. Depth to the fragipan ranges from 18 to 36 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The Btx horizon has hue of 10YR or 7.5YR and chroma of 4 to 6. The B′t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6.

Opequon Series

The Opequon series consists of shallow, well drained, moderately permeable or moderately slowly permeable soils on side slopes and shoulder slopes in the uplands. These soils formed in material weathered from limestone. Slopes range from 8 to 60 percent.

Opequon soils are commonly adjacent to Brushcreek, Bratton, and Lawshe soils. Brushcreek and Lawshe soils have yellower hue in the subsoil than the Opequon soils. They are deep over bedrock and are on colluvial foot slopes. Bratton soils are moderately deep over bedrock and are on ridgetops.

Typical pedon of Opequon silty clay loam, in an area of Bratton-Opequon complex, 8 to 15 percent slopes, eroded, about 2 miles northeast of Peebles, in Franklin Township; 5,015 feet east along Township Road 125C from the intersection of State Route 41 and Township Road 125C, then 530 feet south:

Ap—0 to 7 inches; dark yellowish brown (10YR 4/4) silty clay loam, yellowish brown (10YR 5/4) dry; weak fine granular structure; friable; many roots; many faint brown (10YR 4/3) silt coatings on faces of peds; few fine black (N 2/0) concretions of iron and manganese oxide; medium acid; clear wavy boundary.

Bt1—7 to 13 inches; yellowish red (5YR 4/6) clay; moderate medium subangular blocky structure; firm; common roots; common faint yellowish red (5YR 4/6) clay films on faces of peds; few fine black (N 2/0) concretions of iron and manganese oxide; medium acid; clear wavy boundary.

Bt2—13 to 19 inches; reddish brown (5YR 4/4) clay; moderate medium subangular blocky structure; firm; common roots; common faint reddish brown (5YR 4/4) clay films on faces of peds; neutral; clear wavy boundary.

R—19 to 20 inches; limestone bedrock.

The thickness of the solum and the depth to bedrock range from 12 to 20 inches. The content of coarse fragments ranges from 0 to 25 percent in the solum.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. It is commonly silty clay loam but is silt loam in some pedons. The Bt horizon has hue of 7.5YR to 5YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay, channery silty clay, or clay. The C horizon, if it occurs, has value of 5 or 6 and chroma of 4 to 8. It is sandy loam or loamy sand.

Otwell Series

The Otwell series consists of deep, moderately well drained soils in lake basins. These soils formed in loess, old alluvium, and lacustrine sediments. They have a fragipan. Permeability is moderately slow above the fragipan and very slow in the fragipan. Slopes range from 1 to 15 percent.

Otwell soils are similar to Omulga and Sciotoville soils and are commonly adjacent to Licking soils. Sciotoville soils have low-chroma mottles in the upper 10 inches of the subsoil. Omulga soils are more acid in the subsoil than the Otwell soils. Licking soils have more clay in the subsoil than the Otwell soils and do not have a fragipan. They are in the higher landscape positions.

Typical pedon of Otwell silt loam, 1 to 6 percent slopes, about 1.5 miles north-northeast of Peebles, in Franklin Township; 3,300 feet east along Township Road 125C from the intersection of State Route 41 and Township Road 125C, then 395 feet south:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many roots; many faint brown (10YR 5/3) silt coatings on faces of peds; many fine dark accumulations of iron and manganese oxide; neutral; abrupt smooth boundary.

BE—9 to 14 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common roots; common distinct yellowish brown (10YR 5/4) silt coatings on faces of peds; few fine dark accumulations of iron and manganese oxide; neutral; clear wavy boundary.

Bt1—14 to 24 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few roots; common faint yellowish brown (10YR 5/4) clay films on faces of peds; few dark accumulations of iron and manganese oxide; very strongly acid; clear wavy boundary.

Bt2—24 to 28 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct grayish brown (10YR 5/2) and few medium prominent strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; firm; common faint yellowish brown (10YR 5/4) clay films on faces of peds; few dark accumulations of iron and manganese oxide; very strongly acid; clear wavy boundary.

2Btx1—28 to 46 inches; yellowish brown (10YR 5/6) silty clay loam; about 30 percent clay; common medium distinct grayish brown (10YR 5/2) and common medium prominent strong brown (7.5YR 5/8) mottles; weak coarse prismatic structure parting to weak thick platy; very firm; brittle; common faint yellowish brown (10YR 5/6) clay films on faces of peds; common dark accumulations of iron and manganese oxide; very strongly acid; clear wavy boundary.

2Btx2—46 to 60 inches; yellowish brown (10YR 5/6) silty clay loam; few medium distinct brown (10YR 5/3) and few medium prominent strong brown (7.5YR 5/8) mottles; weak very coarse prismatic structure parting to weak thick platy; very firm; brittle; common faint yellowish brown (10YR 5/6) clay films on faces of peds; common fine concretions of iron and manganese oxide; strongly acid; clear wavy boundary.

2Bt—60 to 68 inches; yellowish brown (10YR 5/6) silty clay; common medium distinct strong brown (7.5YR 5/8) mottles; weak coarse prismatic structure; firm; common faint yellowish brown (10YR 5/6) clay films on faces of peds; medium acid.

The thickness of the solum ranges from 50 to 70 inches. Depth to the fragipan ranges from 20 to 30 inches.

The Ap horizon has value of 4 or 5 and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The 2Btx horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. The 2Bt horizon has hue of 10YR or 7.5YR and chroma of 2 to 6.

Peoga Series

The Peoga series consists of deep, poorly drained, slowly permeable soils on low terraces. These soils formed in silty material. Slopes range from 0 to 2 percent.

Peoga soils are commonly adjacent to Elkinsville and Sciotoville soils. Both of the adjacent soils are in the higher positions on terraces. Elkinsville soils are well drained. Sciotoville soils are moderately well drained and have a fragipan.

Typical pedon of Peoga silt loam, 0.8 mile southeast of Sandy Springs, in Green Township; about 925 feet east-southeast of the intersection of Federal Route 52 and Township Road 218, along Federal Route 52, then 2,180 feet south:

Ap—0 to 9 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 6/1) dry; common medium distinct dark brown (10YR 4/3) mottles; weak fine and medium subangular blocky structure; friable; many roots; common distinct yellowish brown (10YR 5/6) stains on faces of peds; strongly acid; abrupt smooth boundary.

BEg—9 to 15 inches; gray (10YR 5/1) silt loam; common medium distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; friable; common roots; common distinct yellowish brown (10YR 5/6) stains on faces of peds; strongly acid; clear wavy boundary.

Btg1—15 to 36 inches; grayish brown (10YR 5/2) silty clay loam; moderate medium subangular blocky structure; firm; few roots; common faint gray (10YR 6/1) and grayish brown (10YR 5/2) clay films on faces of peds; common strong brown (7.5YR 5/6) concretions and stains of iron and manganese oxide; strongly acid; clear wavy boundary.

Btg2—36 to 57 inches; grayish brown (10YR 5/2) silty clay loam; many medium prominent yellowish brown (10YR 5/6) and common medium distinct gray (N 6/0) mottles; weak medium subangular blocky structure; firm; common faint brown (7.5YR 5/4) clay films on faces of peds; common strong brown (7.5YR 5/6) stains of iron and manganese oxide on faces of peds; common fine black (N 2/0) concretions of iron and manganese oxide; strongly acid; clear wavy boundary.

C—57 to 80 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) and few medium prominent light gray (10YR 6/1) mottles; massive; firm; few fine black (N 2/0) concretions of iron and manganese oxide; strongly acid.

The thickness of the solum ranges from 48 to 72 inches. The Ap horizon has value of 4 or 5 and chroma of 1 or 2. The BEg and Btg horizons have hue of 10YR to 5Y, value of 5 or 6, and chroma of 1 or 2. They are silt loam or silty clay loam. The C horizon has chroma of 4 to 6. It is silty clay loam or silt loam and can be stratified.

Plainfield Series

The Plainfield series consists of deep, excessively drained, rapidly permeable soils on terraces. These soils formed in sandy drift. Slopes range from 3 to 8 percent.

Plainfield soils are commonly adjacent to Elkinsville soils. Elkinsville soils have more silt in the subsoil than the Plainfield soils. They are in the slightly lower positions on terraces.

Typical pedon of Plainfield sand, 3 to 8 percent slopes, in Sandy Springs, in Green Township; about 500 feet north of the junction of Federal Route 52 and County Road 31:

Ap—0 to 9 inches; dark brown (10YR 3/3) sand, brown (10YR 4/3) dry; weak fine granular structure; very friable; common roots; strongly acid; abrupt smooth boundary.

Bw1—9 to 26 inches; brown (7.5YR 4/4) sand; weak fine subangular blocky structure; very friable; very strongly acid; clear wavy boundary.

Bw2—26 to 48 inches; strong brown (7.5YR 5/6) sand; single grained; loose; few prominent dark brown (10YR 3/3) organic stains; very strongly acid; clear wavy boundary.

C—48 to 80 inches; yellowish brown (10YR 5/4) sand; single grained; loose; very strongly acid.

The thickness of the solum ranges from 42 to 48 inches. The Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6.

Rossmoyne Series

The Rossmoyne series consists of deep, moderately well drained soils on side slopes and in other areas on till plains. These soils formed in loess and Illinoian glacial till. They have a fragipan. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. Slopes range from 1 to 12 percent.

Rossmoyne soils are similar to Cincinnati soils and are commonly adjacent to Jessup and Loudon soils. Cincinnati soils are well drained. Jessup and Loudon soils do not have a fragipan and have more clay in the upper part of the solum than the Rossmoyne soils. They are in the slightly higher landscape positions.

Typical pedon of Rossmoyne silt loam, 1 to 6 percent slopes, about 6 miles northwest of Seaman, in Winchester Township; 3,300 feet south of the intersection of County Road 10 and Township Road 55B, along Township Road 55B, then 460 feet east:

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine and medium granular structure; friable; many roots; few coarse fragments; medium acid; abrupt smooth boundary.

BE—7 to 10 inches; yellowish brown (10YR 5/4) silt loam; moderate fine subangular blocky structure; friable; common roots; common distinct brown (10YR 4/3) silt coatings on vertical faces of peds; medium acid; clear wavy boundary.

Bt1—10 to 19 inches; yellowish brown (10YR 5/6) silt loam; few fine distinct light yellowish brown (10YR 6/4) mottles; moderate medium subangular blocky structure; friable; few faint yellowish brown (10YR 5/6) clay films on faces of peds; few coarse fragments; medium acid; clear wavy boundary.

Bt2—19 to 27 inches; yellowish brown (10YR 5/6) silt loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; common faint yellowish brown (10YR 5/6) clay films on faces of peds; common distinct pale brown (10YR 6/3) silt coatings on faces of peds; few coarse fragments; strongly acid; clear wavy boundary.

2Btx1—27 to 44 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate very coarse prismatic structure parting to moderate medium and thick platy; very firm; brittle; common distinct light brownish gray (10YR 6/2) clay films on faces of peds; common distinct pale brown (10YR 6/3) silt coatings on faces of prisms; many fine black (N 2/0) concretions of iron and manganese oxide; few coarse fragments; strongly acid; clear wavy boundary.

2Btx2—44 to 58 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate very coarse prismatic structure parting to moderate thick platy; very firm; brittle; many distinct light brownish gray (10YR 6/2) clay films on faces of peds; pale brown (10YR 6/3) silt coatings on faces of prisms; many fine black (N 2/0) concretions of iron and manganese oxide; few coarse fragments; strongly acid; clear wavy boundary.

2Bt—58 to 70 inches; yellowish brown (10YR 5/6) clay; common medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; common faint yellowish brown (10YR 5/4) and grayish brown (10YR 5/2) clay films on faces of peds; few coarse fragments; medium acid.

The thickness of the loess mantle ranges from 18 to 27 inches. Depth to the fragipan ranges from 18 to 30 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The Bt, 2Btx, and 2Bt horizons have chroma of 4 to 6. The Bt horizon is silt loam or silty clay loam. The 2Btx is silty clay loam or clay loam. The 2Bt horizon is clay loam, silty clay loam, or clay.

Sardinia Series

The Sardinia series consists of deep, moderately well drained, moderately permeable or moderately slowly permeable soils on stream terraces. These soils formed in water-deposited material. Slopes range from 1 to 6 percent.

Sardinia soils are similar to Elkinsville soils and are commonly adjacent to Williamsburg soils. Elkinsville and Williamsburg soils are well drained. Williamsburg soils have more sand in the subsoil than the Sardinia soils. They are in the slightly higher positions on the terraces.

Typical pedon of Sardinia silt loam, 1 to 6 percent slopes, about 3.1 miles north of Seaman, in Scott Township; 595 feet north of the junction of State Route 247 and County Road 10, along State Route 247, then 130 feet west:

Ap—0 to 9 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; moderate medium and fine granular structure; friable; common roots; medium acid; abrupt smooth boundary.

BE—9 to 14 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few roots; few faint yellowish brown (10YR 5/6) clay films; few distinct dark yellowish brown (10YR 4/4) silt coatings on faces of peds; few fine black (N 2/0) concretions of iron and manganese oxide; strongly acid; clear wavy boundary.

Bt1—14 to 20 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few roots; common distinct dark yellowish brown (10YR 4/4) clay films; many faint yellowish brown (10YR 5/4) silt coatings on faces of peds; strongly acid; clear wavy boundary.

Bt2—20 to 32 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; many faint yellowish brown (10YR 5/6) clay films and common faint yellowish brown (10YR 5/4) silt coatings on faces of peds; many fine black (N 2/0) concretions of iron and manganese oxide; strongly acid; clear wavy boundary.

2Bt3—32 to 44 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; common faint yellowish brown (10YR 5/6 and 5/8) clay films on faces of peds; common fine black (N 2/0) concretions of iron and manganese oxide; strongly acid; clear wavy boundary.

2Bt4—44 to 54 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; firm; common faint yellowish brown (10YR 5/6) clay films on faces of peds; common prominent black (N 2/0) concretions of iron and manganese oxide; slightly acid; clear wavy boundary.

2BC—54 to 65 inches; yellowish brown (10YR 5/6) sandy clay loam; common medium prominent light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; firm; common faint yellowish brown (10YR 5/6) clay films on faces of peds; few coarse fragments; slightly acid; clear wavy boundary.

2C1—65 to 71 inches; yellowish brown (10YR 5/4 and 5/8) gravelly sandy clay loam; massive; friable; about 25 percent coarse fragments; neutral; clear wavy boundary.

2C2—71 to 80 inches; yellowish brown (10YR 5/4 and 5/8) clay loam; massive; firm; about 10 percent coarse fragments; neutral.

The thickness of the solum ranges from 60 to 90 inches. The content of coarse fragments, dominantly of water-rounded pebbles, ranges from 0 to 10 percent in the Ap, BE, Bt, and 2Bt horizons and from 2 to 35 percent in the 2BC and 2C horizons.

The Ap horizon has chroma of 3 or 4. The Bt and 2Bt horizons have value of 4 or 5 and chroma of 4 to 6. The 2C horizon has value of 4 or 5 and chroma of 4 to 8. It is stratified loam, silty clay loam, sandy clay loam, or the gravelly analogs of those textures.

Sciotoville Series

The Sciotoville series consists of deep, moderately well drained soils on stream terraces. These soils formed mainly in acid, silty old alluvium. They have a fragipan. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. Slopes range from 1 to 6 percent.

Sciotoville soils are similar to Omulga and Otwell soils and are commonly adjacent to Elkinsville and Peoga soils. Omulga and Otwell soils do not have low-chroma mottles in the upper 10 inches of the subsoil. Elkinsville and Peoga soils do not have a fragipan. Elkinsville soils are well drained and are in the higher positions on the terraces. Peoga soils are poorly drained and are on low terraces.

Typical pedon of Sciotoville silt loam, 1 to 6 percent slopes, about 0.7 mile southeast of Sandy Springs, in Green Township; 1,910 feet east of the intersection of Federal Route 52 and Township Road 218, along Federal Route 52, then 1,320 feet south:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; moderate medium granular structure; friable; many roots; many faint brown (10YR 4/3) silt coatings on faces of peds; medium acid; abrupt smooth boundary.

Bt1—9 to 14 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; common roots; common distinct brown (7.5YR 5/4) clay films on faces of peds; common black (N 2/0) stains of iron and manganese oxide; few fine mica flakes; strongly acid; clear wavy boundary.

Bt2—14 to 22 inches; brown (7.5YR 5/4) silty clay loam; few fine distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; few roots; common distinct yellowish brown (10YR 5/4) and few faint brown (7.5YR 5/4) clay films and common distinct brown (10YR 5/3) silt coatings on faces of peds; few fine black (N 2/0) concretions and stains of iron and manganese oxide; few fine mica flakes; strongly acid; clear wavy boundary.

Btx1—22 to 37 inches; brown (7.5YR 5/4) silty clay loam; common medium distinct brown (7.5YR 5/2) mottles; moderate medium and coarse prismatic structure parting to weak thick platy; very firm and brittle in about 50 percent of the matrix; common faint brown (7.5YR 5/4) clay films on faces of peds; many distinct brown (10YR 5/3) silt coatings on faces of prisms; many black (N 2/0) stains on faces of peds; few fine black (N 2/0) concretions of iron and manganese oxide; many fine mica flakes; strongly acid; clear wavy boundary.

Btx2—37 to 49 inches; brown (7.5YR 5/4) silty clay loam; many medium distinct brown (7.5YR 5/2) mottles; moderate very coarse prismatic structure parting to weak thick platy; very firm and brittle in about 60 percent of the matrix; common faint brown (7.5YR 5/4) and common distinct brown (7.5YR 5/2) clay films on faces of prisms; many fine mica flakes; strongly acid; clear wavy boundary.

B't—49 to 70 inches; brown (7.5YR 5/4) silt loam; moderate medium subangular blocky structure; firm; common faint brown (7.5YR 5/4) clay films on faces of peds; many fine mica flakes; strongly acid; clear wavy boundary.

C—70 to 80 inches; brown (7.5YR 4/4) silt loam; common medium distinct brown (7.5YR 5/2) mottles; massive; firm; strongly acid.

The thickness of the solum ranges from 45 to 80 inches. Depth to the fragipan ranges from 18 to 38 inches.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 or 3. The Bt and Btx horizons are silt loam or silty clay loam. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The Btx horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is dominantly silt loam or silty clay loam but has thin lenses of loamy sand in some pedons.

Shelocta Series

The Shelocta series consists of deep, well drained, moderately permeable soils on foot slopes and benches in the uplands. These soils formed in loamy colluvium derived from sandstone, siltstone, and shale. Slopes range from 15 to 60 percent.

Shelocta soils are commonly adjacent to Berks, Colyer, and Muse soils. Berks and Colyer soils are moderately deep and have a higher content of coarse fragments in the subsoil than the Shelocta soils. Also, they are on slightly more sloping and more sloping foot slopes and shoulder slopes, respectively. Muse soils have more clay in the subsoil than the Shelocta soils. They are on the lower foot slopes.

Typical pedon of Shelocta silt loam, in an area of Shelocta-Muse-Colyer association, steep, about 8.2 miles southeast of West Union, in Brushcreek Township; 5,150 feet southwest along County Road 9 from the intersection of County Roads 9 and 59, then 330 feet east:

Ap—0 to 7 inches; brown (10YR 5/3) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many roots; about 5 percent coarse fragments; slightly acid; abrupt smooth boundary.

E—7 to 14 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; few roots; about 10 percent coarse fragments; medium acid; clear wavy boundary.

Bt1—14 to 33 inches; yellowish brown (10YR 5/8) channery silty clay loam; moderate medium subangular blocky structure; firm; common faint yellowish brown (10YR 5/8) clay films on faces of peds; about 15 percent coarse fragments; strongly acid; clear wavy boundary.

Bt2—33 to 52 inches; yellowish brown (10YR 5/6) channery silty clay loam; moderate medium subangular blocky structure; firm; common faint yellowish brown (10YR 5/6) clay films on faces of peds; about 25 percent coarse fragments; very strongly acid; clear wavy boundary.

C—52 to 60 inches; yellowish brown (10YR 5/6) very channery silty clay loam; massive; firm; about 35 percent coarse fragments; very strongly acid.

The thickness of the solum ranges from 40 to more than 60 inches. The depth to hard bedrock is more than 48 inches. The Ap horizon has value of 4 or 5 and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR and chroma of 4 to 8.

Skidmore Series

The Skidmore series consists of deep, well drained, moderately rapidly permeable soils on flood plains. These soils formed in mixed recent alluvium. Slopes range from 0 to 2 percent.

Skidmore soils are adjacent to Nolin soils. Nolin soils have a lower content of coarse fragments in the subsoil than the Skidmore soils.

Typical pedon of Skidmore gravelly loam, occasionally flooded, about 13.3 miles southeast of West Union, in Jefferson Township; 130 feet southwest of the junction of County Roads 7 and 180, along County Road 180, then 300 feet south:

Ap—0 to 9 inches; dark yellowish brown (10YR 4/4) gravelly loam, brown (10YR 5/3) dry; moderate medium granular structure; friable; many roots; many faint dark brown (10YR 4/3) silt coatings on faces of peds; about 15 percent gravel; slightly acid; abrupt smooth boundary.

Bw1—9 to 16 inches; yellowish brown (10YR 5/4) gravelly loam; weak fine subangular blocky structure; friable; common roots; common distinct dark yellowish brown (10YR 4/4) silt coatings on faces of peds; about 30 percent gravel; slightly acid; clear wavy boundary.

Bw2—16 to 22 inches; yellowish brown (10YR 5/4) very gravelly loam; weak fine subangular blocky structure; friable; few roots; about 50 percent gravel; slightly acid; clear wavy boundary.

BC—22 to 35 inches; yellowish brown (10YR 5/4) extremely gravelly sandy loam; weak coarse subangular blocky structure; friable; about 80 percent gravel; medium acid; clear wavy boundary.

C—35 to 60 inches; yellowish brown (10YR 5/6) extremely gravelly sandy loam; massive; friable; about 80 percent gravel; medium acid.

The thickness of the solum ranges from 26 to 35 inches. The depth to bedrock is more than 40 inches. The content of sandstone and siltstone fragments ranges from 10 to 40 percent in the A horizon and the upper part of the B horizon and from 35 to 80 percent in the lower part of the B horizon and in the C horizon.

The Ap horizon has chroma of 3 or 4. It generally is gravelly loam but is silt loam in some pedons. The Bw, BC, and C horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. They are loam or sandy loam in the fine-earth fraction.

Tilsit Series

The Tilsit series consists of deep, moderately well drained soils on the tops of ridges in the uplands. These soils formed in material weathered from siltstone. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. Slopes range from 0 to 3 percent.

Tilsit soils are similar to Nicholson soils and are commonly adjacent to Berks and Wernock soils. Nicholson soils have a subsoil layer below the fragipan. Berks and Wernock soils are moderately deep. They are well drained and are on the more sloping ridgetops and shoulder slopes.

Typical pedon of Tilsit silt loam, 0 to 3 percent slopes, about 8.2 miles southeast of Peebles, in Meigs Township; 1.5 miles northwest of the junction of State Routes 781 and 348, along State Route 781, then 5,000 feet north:

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many roots; medium acid; abrupt smooth boundary.

BE—7 to 12 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable; many roots; many faint dark brown (10YR 4/3) silt coatings on faces of peds; strongly acid; clear wavy boundary.

Bt1—12 to 20 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common roots; common faint strong brown (7.5YR 5/6) clay films on faces of peds; few coarse fragments; strongly acid; clear wavy boundary.

Bt2—20 to 25 inches; strong brown (7.5YR 6/6) silt loam; moderate medium subangular blocky structure; friable; common roots; common distinct yellowish brown (10YR 5/6) clay films on faces of peds; few coarse fragments; very strongly acid; clear wavy boundary.

Btx1—25 to 37 inches; yellowish brown (10YR 5/6) silt loam; common medium distinct grayish brown (10YR 5/2), few medium distinct brown (10YR 5/3), and few medium faint yellowish brown (10YR 5/8) mottles; weak very coarse prismatic structure parting to moderate thick platy; very firm; brittle; few roots on faces of prisms; common faint yellowish brown (10YR 5/6) clay films on faces of peds; many prominent light brownish gray (2.5Y 6/2) silt coatings on faces of prisms; about 10 percent coarse fragments; very strongly acid; abrupt wavy boundary.

Btx2—37 to 49 inches; yellowish brown (10YR 5/4) channery silt loam; common medium distinct light brownish gray (2.5Y 6/2) mottles; weak very coarse prismatic structure parting to moderate thick platy; very firm; brittle; common distinct grayish brown (10YR 5/2) clay films on faces of peds; about 25 percent coarse fragments; very strongly acid; abrupt wavy boundary.

R—49 to 51 inches; thinly bedded siltstone and fine grained sandstone bedrock.

The thickness of the solum and the depth to bedrock are more than 40 inches. Depth to the fragipan ranges from 20 to 28 inches. The content of coarse fragments ranges from 0 to 10 percent in the upper part of the solum and is as much as 25 percent in the lower part.

The Ap horizon has value of 4 or 5 and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. The Btx horizon has value of 4 or 5 and chroma of 4 to 6. The lower part of this horizon is silt loam, silty clay loam, or the channery analogs of those textures.

Trappist Series

The Trappist series consists of moderately deep, well drained, moderately slowly permeable soils on the tops and sides of ridges in the uplands. These soils formed in material weathered from black shale. Slopes range from 3 to 25 percent.

Trappist soils are commonly adjacent to Muse soils. Muse soils have a higher content of coarse fragments in the subsoil than the Trappist soils. They are on colluvial foot slopes.

Typical pedon of Trappist silt loam, 3 to 8 percent slopes, about 1.5 miles southeast of Peebles, in Meigs Township; 2,510 feet east along Township Road 129 from the intersection of County Road 27 and Township Road 129, then 400 feet south:

Ap—0 to 7 inches; dark yellowish brown (10YR 4/4) silt loam, pale brown (10YR 6/3) dry; weak coarse granular structure; friable; many fine roots; many faint brown (10YR 4/3) silt coatings on faces of peds; medium acid; abrupt smooth boundary.

Bt1—7 to 12 inches; dark brown (7.5YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; common roots; common faint dark brown (7.5YR 4/4) clay films on faces of peds; common distinct dark yellowish brown (10YR 4/4) silt coatings in root channels; strongly acid; clear wavy boundary.

Bt2—12 to 18 inches; strong brown (7.5YR 5/6) silty clay; moderate medium angular blocky structure; firm; few roots; common faint strong brown (7.5YR 5/6) clay films on faces of peds; strongly acid; clear wavy boundary.

Bt3—18 to 24 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium angular blocky structure; firm; common faint strong brown (7.5YR 5/6) clay films on faces of peds; few coarse fragments; strongly acid; clear wavy boundary.

R—24 to 26 inches; black (N 2/0) shale bedrock that is weathered in the upper few inches.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The content of coarse fragments ranges from 0 to 20 percent in the solum.

The Ap horizon has value of 4 or 5 and chroma of 3 or 4. Some pedons have an A horizon, which has value of 3. The Bt horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 4 to 8. It is silty clay loam, silty clay, clay, or the shaly analogs of those textures.

Wernock Series

The Wernock series consists of moderately deep, well drained, moderately permeable soils on the tops of ridges in the uplands. These soils formed in siltstone residuum. Slopes range from 8 to 15 percent.

Wernock soils are commonly adjacent to Berks and Tilsit soils. Berks soils have a higher content of coarse fragments throughout than the Wernock soils. They are on the steeper ridgetops. Tilsit soils are moderately well drained and are on the less sloping ridgetops. They have a fragipan.

Typical pedon of Wernock silt loam, 8 to 15 percent slopes, about 14.2 miles east-southeast of West Union, in Green Township; 2,770 feet southeast of the intersection of Township Roads 173 and 202B, along Township Road 202B, then 40 feet south:

A—0 to 2 inches; brown (10YR 4/3) silt loam, very pale brown (10YR 7/4) dry; weak fine granular structure; friable; many roots; very strongly acid; abrupt smooth boundary.

E—2 to 5 inches; yellowish brown (10YR 5/4) silt loam; weak fine granular structure; friable; many roots; very strongly acid; clear wavy boundary.

Bt1—5 to 15 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; many roots; common distinct brown (7.5YR 5/4) silt coatings and few faint strong brown (7.5YR 5/6) clay films on faces of peds; about 5 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt2—15 to 21 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; many roots; few faint strong brown (7.5YR 5/6) clay films and silt coatings on faces of peds; about 10 percent coarse fragments; strongly acid; clear wavy boundary.

BC—21 to 24 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct light yellowish brown (10YR 6/4) mottles; moderate medium subangular blocky structure; friable; common roots; few faint yellowish brown (10YR 5/6) clay films and silt coatings on faces of peds; about 10 percent coarse fragments; strongly acid; clear wavy boundary.

C—24 to 30 inches; yellowish brown (10YR 5/6) channery silt loam; massive; friable; few roots; few prominent light gray (10YR 7/2) silt coatings on vertical partings; about 25 percent coarse fragments; very strongly acid; clear wavy boundary.

R—30 to 32 inches; thinly bedded siltstone bedrock.

The thickness of the solum and the depth to bedrock range from 30 to 40 inches. The content of coarse fragments ranges from 0 to 10 percent to a depth of 24 inches and from 20 to 50 percent below that depth.

The A horizon has value of 3 to 5. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam.

Williamsburg Series

The Williamsburg series consists of deep, well drained, moderately permeable or moderately rapidly permeable soils on terraces. These soils formed in a thin layer of loess and in water-deposited material. Slopes range from 1 to 15 percent.

Williamsburg soils are commonly adjacent to Sardinia soils. Sardinia soils are moderately well drained and are in the slightly lower positions on the terraces. They have less sand in the subsoil than the Williamsburg soils.

Typical pedon of Williamsburg silt loam, 1 to 6 percent slopes, about 6.8 miles northeast of West Union, in Tiffin Township; 3,450 feet north of the intersection of County Road 5 and Township Road 84, along County Road 5, then 400 feet west:

Ap—0 to 10 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; weak fine and medium subangular blocky structure; friable; common roots; strongly acid; abrupt smooth boundary.

Bt1—10 to 20 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common roots; few faint clay films on faces of peds; common distinct dark yellowish brown (10YR 4/4) silt coatings on faces of peds; common prominent black (N 2/0) stains of iron and manganese oxide; very strongly acid; clear wavy boundary.

2Bt2—20 to 29 inches; strong brown (7.5YR 5/6) loam; moderate medium and coarse subangular blocky structure; firm; few roots; common distinct brown (7.5YR 4/4) clay films on faces of peds; common soft black (N 2/0) accumulations of iron and manganese oxide; very strongly acid; clear wavy boundary.

2Bt3—29 to 36 inches; strong brown (7.5YR 5/6) clay loam; moderate fine subangular blocky structure; firm; common distinct brown (7.5YR 4/4) clay films on faces of peds; few soft black (N 2/0) accumulations of iron and manganese oxide; few small rounded pebbles; very strongly acid; clear wavy boundary.

2Bt4—36 to 47 inches; strong brown (7.5YR 5/6) gravelly clay loam; moderate coarse subangular blocky structure; firm; common distinct strong brown (7.5YR 5/6) clay films on faces of peds; few fine brown (10YR 5/3) sand coatings on faces of peds; about 25 percent small rounded pebbles; very strongly acid; clear wavy boundary.

2Bt5—47 to 63 inches; yellowish red (5YR 5/6) gravelly clay loam; moderate medium subangular blocky structure; firm; common distinct strong brown (7.5YR 5/6) and yellowish red (5YR 5/6) clay films on faces of peds; common soft black (N 2/0) accumulations of iron and manganese oxide; about 20 percent small rounded pebbles; very strongly acid; clear wavy boundary.

2Bt6—63 to 80 inches; yellowish brown (10YR 5/6) gravelly clay loam; moderate medium subangular blocky structure; firm; common distinct strong brown (7.5YR 5/6) clay films on faces of peds; about 20 percent small rounded pebbles; very strongly acid.

The thickness of the solum ranges from 60 to 90 inches. The content of water-rounded fine gravel is 0 to 2 percent in the Ap and Bt horizons, is 2 to 10 percent in the upper part of the 2Bt horizon, and is as much as 35 percent in the lower part of the 2Bt horizon.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The 2Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is clay loam, sandy clay loam, loam, or the gravelly analogs of those textures.

Formation of the Soils

This section relates the major factors of soil formation to the soils in Adams County and explains some of the processes of soil formation.

Factors of Soil Formation

The five major factors of soil formation are parent material, climate, relief, living organisms, and time. Climate and living organisms, particularly vegetation, are active forces of soil formation. Their effect on the parent material is modified by relief and by the length of time that the parent material has been acted upon. The relative importance of each factor differs from place to place. In some areas one factor dominates and determines most of the soil properties, but the interaction of all five factors generally determines what kind of soil forms in any given place.

Parent Material

The soils in Adams County formed in several kinds of parent material, including glacial till, glacial outwash, residuum and colluvium derived from bedrock, loess, lacustrine deposits, and alluvium. Several soils formed in a combination of these kinds of parent material.

The northwestern part of the county was covered by glaciers of the Illinoian glacial age. The eastern part of the county has no glacial deposits.

The county has many different kinds of sedimentary rocks. These include limestone and calcareous shale of the Ordovician System in the western part of the county; limestone, calcareous shale, and dolomitic limestone of the Silurian System in the central and southwestern parts; and extremely acid shale and sandstone of the Devonian and Mississippian Systems in the eastern part.

Opequon soils formed entirely in material weathered from limestone bedrock. Aaron, Faywood, Lowell, and Eden soils formed in material weathered from interbedded limestone, siltstone, and calcareous shale. Bratton, Crider, and Nicholson soils formed in loess and material weathered from limestone. Loudon and Jessup soils formed in loess, Illinoian glacial till, and material weathered from calcareous shale and limestone. Brushcreek and Lawshe soils formed in colluvium and material weathered from calcareous shale and limestone. Shelocta and Muse soils formed in colluvium derived from sandstone, siltstone, and shale. Colyer, Trappist, and Latham soils formed in acid material weathered from shale. Berks, Tilsit, and Wernock soils formed in material weathered from siltstone and sandstone.

Cincinnati, Rossmoyne, and Avonburg soils formed in Illinoian glacial till overlain by 20 to 30 inches of loess. Glacial outwash is material deposited by the floodwater of melting glaciers. This material is generally along the present stream valleys, which commonly are high above the present stream channels. Williamsburg and Sardinia soils formed dominantly in glacial outwash.

Some soils formed in loess, colluvium, or old alluvium. They have stratified lacustrine sediments in the substratum. They are in areas of valley fill in abandoned preglacial drainage systems. Examples are Omulga, McGary Variant, and Licking soils. Some soils formed in silty or sandy material on terraces along the Ohio River or in backwater areas along the river. Examples are Elkinsville, Plainfield, Peoga, and Sciotoville soils.

Recent alluvium is the youngest parent material in the county. It accumulates where fresh sediments are deposited by floodwater. These sediments were derived mainly from the surface layer of soils that are higher on the landscape. Gessie, Nolin, Skidmore, and Newark soils formed in recent alluvium. They are characterized by little or no horizon development.

Climate

The climate throughout Adams County is so uniform that it has not resulted in significant differences among the soils in the county. As the soils formed, it favored physical and chemical weathering of the parent material and biological activity.

Because of a sufficient amount of rainfall, percolating water has leached carbonates in the soils. Carbonates have been leached to a depth of 6 to 10 feet in Cincinnati and Rossmoyne soils. The frequency of rainfall has caused wetting and drying cycles that have favored the translocation of clay minerals and the development of soil structure in Bratton, Jessup, Williamsburg, and other soils.

The range in temperature has favored both physical change and chemical weathering of the parent material. Freezing and thawing have aided in the development of soil structure. Warm summer temperatures have favored chemical reactions in the weathering of primary minerals.

Both rainfall and temperature have favored plant growth and the subsequent accumulation of organic matter in all of the soils.

Relief

Because of the effect of relief, different soils can form in the same kind of parent material. Cincinnati, Rossmoyne, and Avonburg soils formed under similar conditions, except for natural drainage, which depends largely on relief. The gently sloping and strongly sloping Cincinnati soils are well drained and are characterized by good surface drainage. The nearly level to strongly sloping Rossmoyne soils are moderately well drained and are in convex areas where the water table is high for relatively short but significant periods. The nearly level Avonburg soils are somewhat poorly drained and generally are on slight rises. Surface runoff generally is slow on these rises, and the water table is high for extended periods.

Living Organisms

The dominant native vegetation at the time of settlement in Adams County was hardwood forest. Oak, hickory, yellow-poplar, and ash were the most numerous tree species. There were grassy clearings on the well drained sites.

Cincinnati, Jessup, Wernock, and other soils that formed in the forested areas are acid and medium in natural fertility. Opequon soils formed in the grassy clearings. They are less acid than the soils that formed in the forested areas and are shallow over limestone bedrock.

Small burrowing animals, insects, and earthworms increase the permeability rate in the soils by leaving channels. Animals also mix the soil material and add organic matter to the soils. Worm channels or casts are common in the surface layer of the moderately well drained Lawshe soils. Crawfish channels are numerous in the somewhat poorly drained Avonburg soils.

Human activities, such as planting, cultivating, seeding, installing drainage systems, and cutting and filling, also affect soil formation. Applications of lime and fertilizer affect soil chemistry.

Time

Time is needed for the other soil-forming factors to produce their effects. The age of a soil is indicated, to some extent, by the degree of horizon development. If the parent material weathers slowly, the soil profile forms slowly. In many areas, however, factors other than time have been responsible for most of the differences in the kind and distinctness of horizons in the different soils.

The age of the parent material of the soils in the county can be separated into three broad geologic time periods. The oldest soils formed in residuum and colluvium derived from sedimentary bedrock in the eastern and southwestern parts of the county. These soils show various degrees of horizon development because of the influence of parent material, relief, and other soil-forming factors. Trappist, Berks, Wernock, Opequon, Bratton, Lowell, and Eden are examples of these very old soils.

The next oldest parent material was deposited by the Illinoian glacier about 100,000 to 300,000 years ago. The surface layer of the soils that formed in Illinoian glacial till has been modified by a more recent mantle of loess. Cincinnati, Rossmoyne, and Avonburg soils formed in this parent material.

The youngest parent material in the county is alluvium, or floodwater deposits. This material is still accumulating as fresh sediments are added during periods of flooding. Gessie, Nolin, Skidmore, and Newark soils formed in alluvium on flood plains. They are so young that they show little evidence of horizon development.

Processes of Soil Formation

The soils that make up most of the acreage in Adams County have strongly developed profiles. As a result of the soil-forming processes, distinct horizons have formed in most of the soils. These processes are additions, losses, transfers, and transformations *(8)*. They are controlled or influenced by the factors of soil formation. Some of these processes result in differences among the soils. Others retard or prevent differentiation among the soils.

Most of the organic matter in the soils in Adams County has been added to the surface layer. The organic matter is generally mixed with other soil material by cultivation or animal activities. It contains many chemicals, which are returned to the soil upon decomposition. Lime and fertilizer are added to cropped fields. Sediment is deposited on flood plains or in the lower areas.

Bases and other chemicals, including nitrates, are removed by leaching, and soil material is lost through erosion on some soils. Among the most significant losses in Adams County are the losses of carbonates through leaching.

Most of the transfers in the soils in the county are caused by percolating water. In many of the soils, clay has been transferred from the A horizon to the B horizon. Thus, the B horizon is a zone of illuviation, or gain.

Transformations of mineral compounds occur in most of the soils. The primary silicate minerals are chemically weathered into secondary minerals, mainly those of the layer-lattice silicate clays. Most of the layer-lattice clays remain in the soil profile. Transformation and the illuviation of clay typically result in a B horizon in which the content of clay is about twice that of the original parent material.

As a result of some transformations, weak cementing agents are released. These agents have aided in the formation of a fragipan in Avonburg, Rossmoyne, and Sciotoville soils.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction in which a slope faces.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography. A landscape where the configuration and relief of a landform are determined or strongly influenced by the underlying bedrock.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. The depth to bedrock. Deep soils are more than 40 inches deep over bedrock; moderately deep soils, 20 to 40 inches; and shallow soils, 10 to 20 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group

A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by the wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Perimeter drain. A drain installed around the perimeter of a septic tank absorption field. The drain lowers the water table. Also called curtain drain.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. The slope classes used in this survey are as follows:

Nearly level	0 to 3 percent
Nearly level and gently sloping	1 to 8 percent
Gently sloping	2 to 8 percent
Strongly sloping	6 to 15 percent
Moderately steep	12 to 25 percent
Steep	25 to 50 percent
Very steep	40 to 70 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material that is too thin for the specified use.

Till plain. An extensive area of nearly level to undulating soils underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer of a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Water bar. A shallow trench and a mound of earth constructed at an angle across a road or trail to intercept and divert surface runoff and control erosion.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.