United States Department of Agriculture

Natural Resources Conservation Service

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

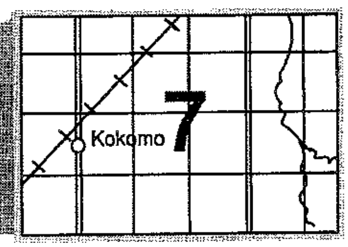
Soil Survey of Lawrence County, Ohio

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.



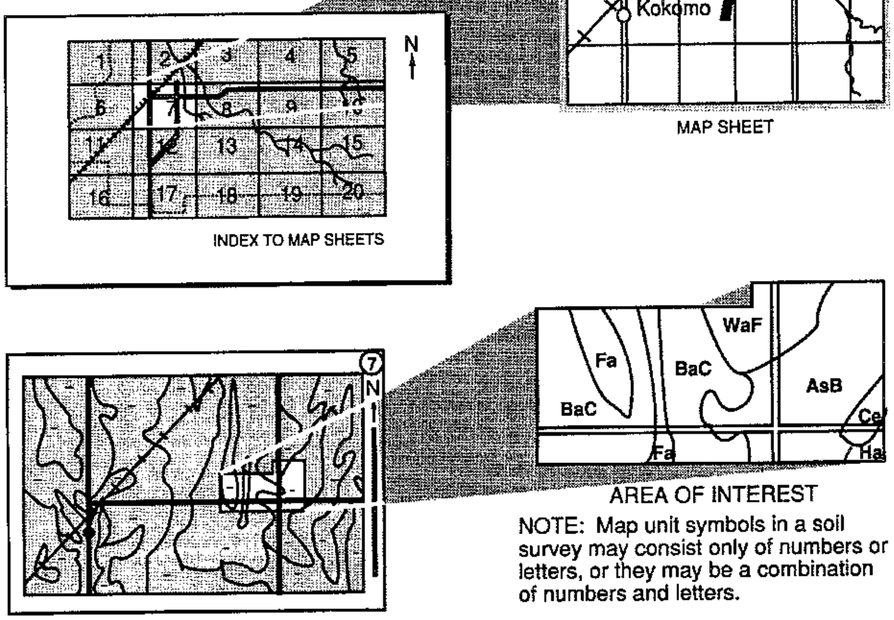
MAP SHEET

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.

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

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



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

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

Major fieldwork for this soil survey was completed in 1988. Soil names and descriptions were approved in 1989. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1989. This survey was made cooperatively by the United States Department of Agriculture, Natural Resources Conservation Service and Forest Service; the Ohio Department of Natural Resources, Division of Soil and Water Conservation; the Ohio Agricultural Research and Development Center; and the Ohio State University Extension. The survey is part of the technical assistance furnished to the Lawrence Soil and Water conservation District. This survey was materially aided by funds provided by the Lawrence County Commissioners.

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

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

Cover: Farmstead in Lawrence County, Ohio. The hillsides are on Upshur-Gilpin-Steinsburg association, steep. The buildings are on Omulga soils. The cropland is on Elkinsville and Sciotoville soils.

Contents

Issued 1998

Foreword

This soil survey contains information that affects land use planning in this survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights soil limitations, 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.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations that affect various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

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

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

Patrick Wolf
State Conservationist
Natural Resources Conservation Service

Soil Survey of
Lawrence County, Ohio

By F.E. McCleary and S.J. Hamilton, Ohio Department of Natural Resources, Division of Soil and Water Conservation

Fieldwork by F.E. McCleary, S.J. Hamilton, and M.M. Feusner, Ohio Department of Natural Resources, Division of Soil and Water Conservation

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

LAWRENCE COUNTY is the southernmost county in Ohio (fig. 1). It is bordered by the Ohio River on the southeast, south, and southwest and by Scioto County on the west. It is bordered by Jackson County on the north and by Gallia County on the northeast. Laid out on section lines, the county covers 291,520 acres, or 456 square miles.

It is irregular in shape. North of Ironton it is about 28 miles east to west. It is about 30 miles north to south from the Ohio River to the Jackson County line, where the county is only one township wide.

The Ohio River has influenced the development of the county. In 1970, 84 percent of the population of the county resided in six townships bordering the river (*28*). In 1980, the population of the county was 63,778. All incorporated municipalities in the county are located on bottom lands of the Ohio River. Ironton is the county seat and largest town. Some other villages in the county are Athalia, Chesapeake, Coal Grove, Hanging Rock, Proctorville, Rome, and South Point.

Figure 1.—Location of Lawrence County in Ohio.

General Nature of the County

This section provides general information about the county. It describes climate; history and development; farming; physiography, relief, and drainage; geology; flooding; and mineral resources.

Climate

Table 1 gives data on temperature and precipitation for the survey area as recorded at Ironton, Ohio, in the period 1951-82. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 35 degrees F and the average daily minimum temperature is 25 degrees. The lowest temperature on record, which occurred on January 24, 1963, is -15 degrees. In summer, the average temperature is 75 degrees and the average daily maximum temperature is 87 degrees. The highest recorded temperature, which occurred on July 14, 1954, is 105 degrees.

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

The total annual precipitation is about 42 inches. Of this, 24 inches, or 57 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 21 inches. The heaviest 1-day rainfall during the period of record was 3.67 inches on June 4, 1951. Thunderstorms occur on about 41 days each year, and most occur in summer.

The average seasonal snowfall is about 16 inches. The greatest snow depth at any one time during the period of record was 9 inches. On the average, 10 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 60 percent of the time possible in summer and 35 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 11 miles per hour, in spring.

History and Development

By 1797, settlers from Kentucky and Pennsylvania arrived at the banks of the Ohio River in what is now Lawrence County (*6*).

By the Legislative Act of December 20, 1816, Lawrence County was created from parts of Washington, Adams, Scioto, and Gallia Counties. It was named for Capt. James Lawrence, U.S.N., who served during the War of 1812 (*28,29*).

The Hanging Rock region is a 25- to 30-mile-wide iron ore deposit. It extends from Logan, Hocking County, Ohio, to Mount Savage, Carter County, Kentucky. Iron was produced in this region from 1818 to 1916.

Lawrence County had 16 furnaces for making iron. A furnace required some 5,000 to 10,000 acres of timber and 50 yoke of oxen. To make 1 ton of pig iron required 150 to 200 bushels charcoal (1 acre virgin timber yielded 1,600 bushels charcoal), 300 to 350 acres timber/year/furnace, 5,000 pounds ore, and about 300 pounds limestone. A blast usually lasted less than 9 months. During a blast, a furnace produced 8 to 12 tons of iron per day. In a year a furnace could produce 2,000 to 3,000 tons of iron (*10,11,29*) (fig. 2).

All resources needed for the furnaces came from the surrounding areas. Cutting timber more than 3 or 4 times caused erosion of the hillsides. Mining scars such as iron ore, limestone, and the stones used to build the furnaces exist in strips and pits around hillsides near the location of the furnaces (fig. 3). Timbering and mining caused erosion, formation of gullies, and siltation of streams. Some cleared areas on hills were as pasture.

The major industries in Lawrence County have included castings, cement, chemical, tile and firebrick, and coke plants (*6*). Most plants closed in the 1960's and 1970's. A few plants are scattered throughout the county. Surface coal mining, wood pulp, and timber are important.

Farming

In 1982, farming took in about 25 percent of the land in Lawrence County. The number of farms in the county was 560 (*9*). The leading sources of farm income were livestock and tobacco, followed by grain and vegetable crops (*4*).

The cropland is mostly on streams. It is on terraces along the Ohio River and on flood plains along Pine Creek in the western part of the county. It is also on flood plains along Symmes and Indian Guyan Creeks in the eastern part of the county.

In recent years, the acreage of farmland in Lawrence County has decreased. Farmland has reverted to brush and trees. Wood pulp and timber are important forest products.

The farmland in Lawrence County is mostly well drained or moderately well drained. In many areas it is moderately steep to very steep. Slope and the hazard of erosion are major management concerns on most farmland and other land. Flooding is a hazard on flood plains of streams. On wet soils artificial drainage is needed.

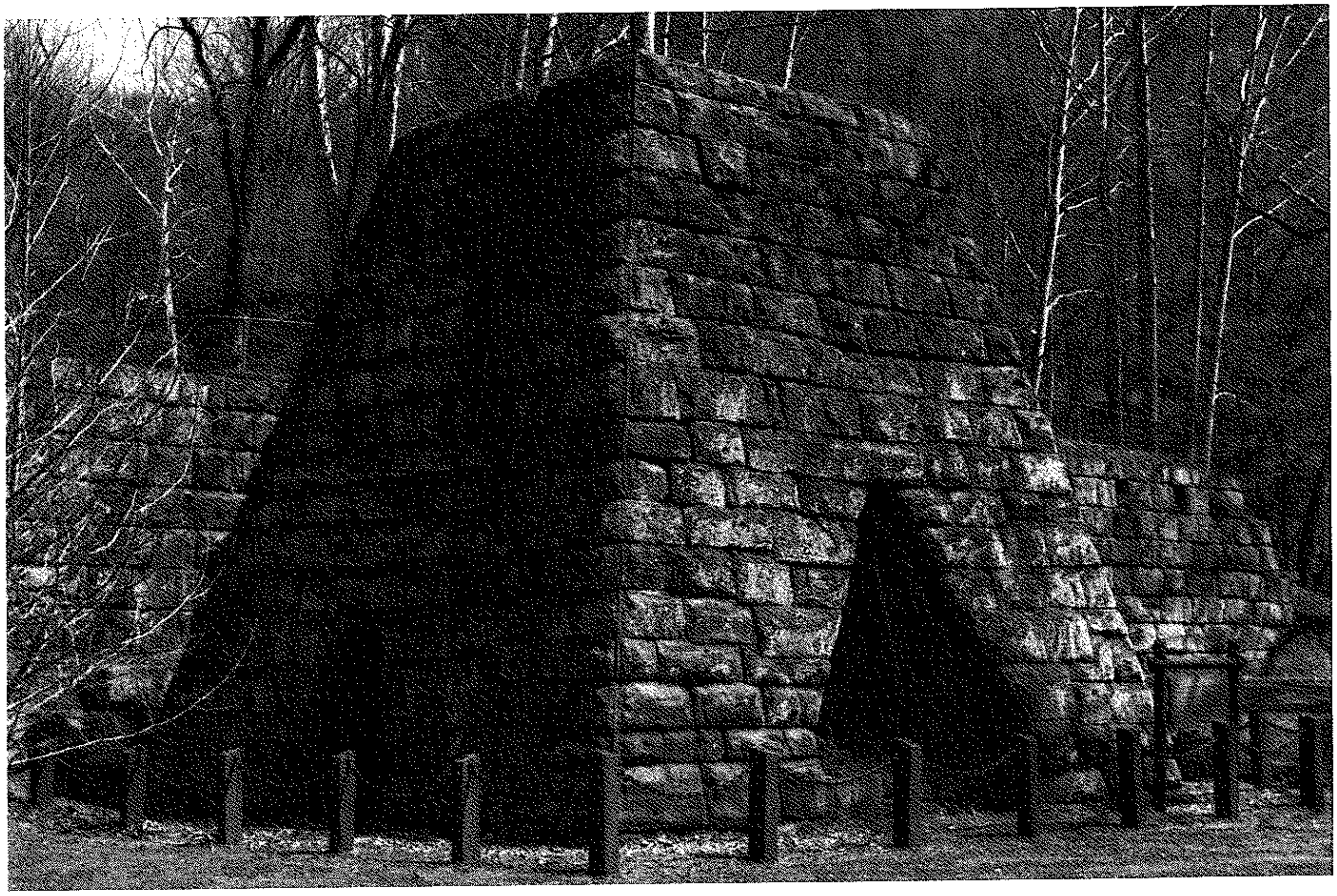


Figure 2.—The Vesuvius furnace was used as a blast furnace in making iron.

Physiography, Relief, and Drainage

Lawrence County is located on the unglaciated Allegheny Plateau in Ohio. Relief in the county consists of steep and very steep slopes and V-shaped valleys. The exceptions are the older, larger stream valleys, such as those of Pine and Symmes Creeks.

The western part of the county is strongly dissected. It consists of concave, dominantly steep or very steep side slopes and convex, narrow ridgetops.

The eastern part consists of benches, side slopes, and ridgetops. The benches and side slopes are convex and dominantly steep or very steep. The ridgetops are rounded and slightly broader than those in the western part.

Before glaciation, the Teays River and its tributaries drained Lawrence County. The tributaries flowed from Ohio, Kentucky, and West Virginia. The headwaters of the Teays River were in the southeast. The river flowed north into the southwestern part of Union Township in Ohio. It followed the present bed of the Ohio River to Wheelersburg. At Wheelersburg it turned north and ran through Scioto, Pike, and Ross Counties.

The southern and western parts of Lawrence County were drained by small tributaries of the Teays River. The northern part was drained by small tributaries of the Marietta River, which joined the Teays River near the border of Pike and Jackson Counties. The deep stage drainage was developed when the outlet of the Teays system was blocked by the advance of the Kansan or pre-Kansan glacier. The main valley of the Teays River and many of its tributaries were impounded.

About this time a general uplift on the land surface raised the valleys in the Teays system and the mature, surrounding land surfaces. Then came the rapid creation of new drainageways and outlets. Consequently, the main Teays channel and many tributaries were abandoned and new courses were entrenched. Many Teays deposits in the county were cut as new drainageways developed. Remnants of the Teays deposits were scattered throughout the county (*15,21*).

At present, drainage in Lawrence County is southerly to the Ohio River. The largest watershed is Symmes Creek. It drains most of the central eastern part of the county. In the western part of the county, the largest watershed is Pine Creek. It extends to Scioto County, joining the Ohio River near Wheelersburg. Many other mid-sized streams and numerous small forks, licks, creeks, and runs are scattered throughout the county. Many of them are torrential streams active only during periods of precipitation. All streams have a dendritic drainage pattern; none follow faults or escarpments.

The lowest elevation in the county is 515 feet above mean sea level (m.s.l.). It is at water's edge of the Ohio River at the boundary between Scioto and Lawrence Counties. The highest elevation is 1,061 feet above m.s.l. in section 1 in Elizabeth Township. The terraces of the Ohio River range from 540 to 600 feet above m.s.l.. The plateaus have an average elevation of about 850 feet above m.s.l..

Geology

Lawrence County is located on the highly dissected Allegheny Plateau. Part of this plateau, the Pennsylvanian system, contains commercially important formations that yield many raw industrial materials. The Pottsville, Allegheny, and Conemaugh Formations are the largest in the Pennsylvanian system. A small part of the Monongahela Formation is in the eastern part of the county. Members of the Conemaugh Formation are in the central part of the county. The Pottsville and Allegheny Formations are in the western part of the county.

The Pottsville Formation is 42 percent sandstone. The rest is shale, clay, thin-bedded limestone, iron ore, and coal. The stratum varies in thickness from one place to another. The Allegheny Formation contains clay beds and major coal seams. Clay makes up about 60 percent of the total; the rest is sandstone and other thin-bedded strata. The Conemaugh Formation consists of shale, limestone, sandstone (about 30 percent), coal, and clay. The rest is saltwater and freshwater limestone. The Monongahela Formation follows the eastern part of Lawrence County. It consists of shale, freshwater limestone and

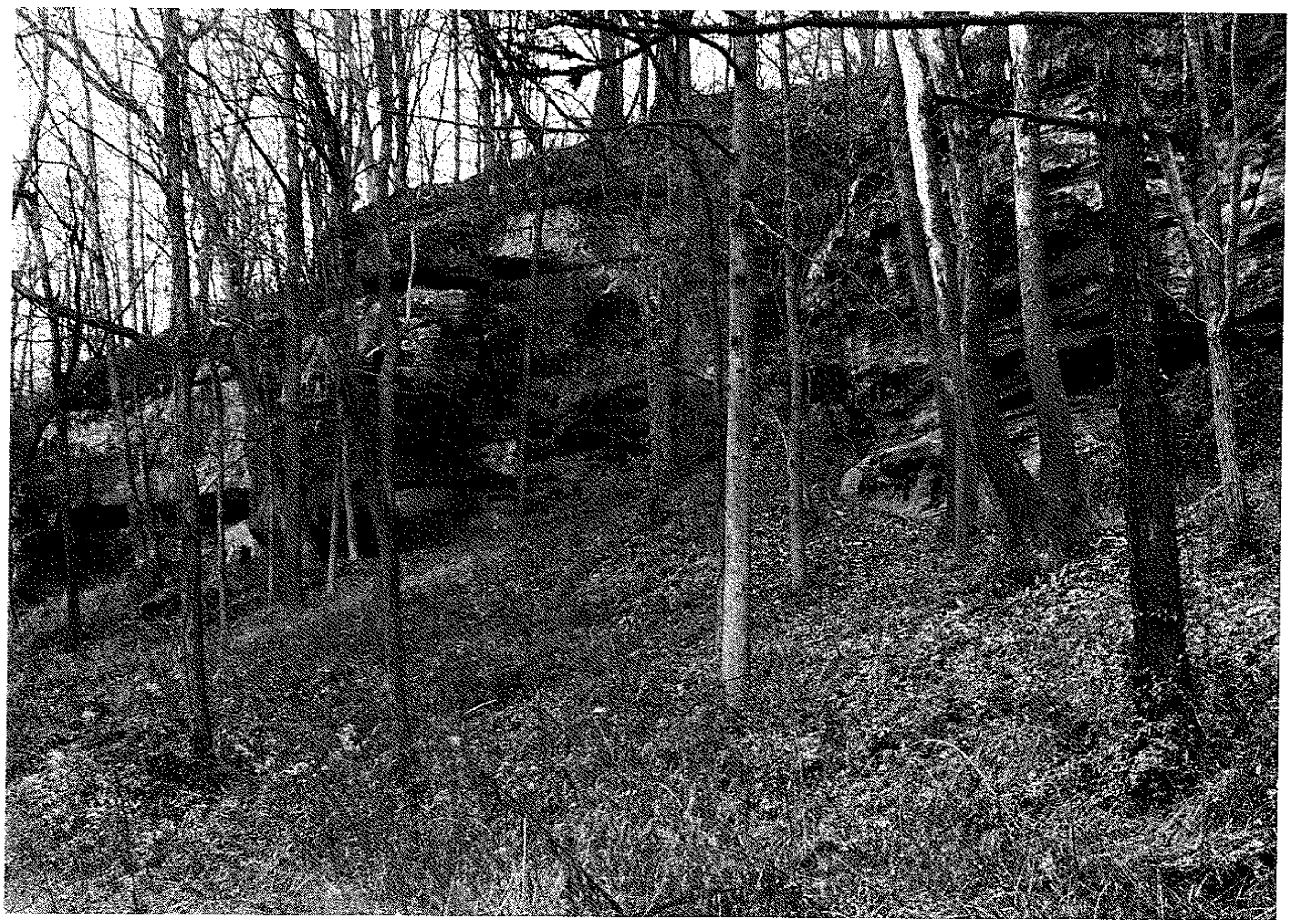


Figure 3.—Mine scar from old blast furnaces on the Shelocta-Latham general soil map unit.

sandstone, and small amounts of clay and iron ore strata (*12,22*).

Flooding

Flooding is a severe hazard along the Ohio River in Lawrence County. Major floods occurred in 1913 and 1937. They caused severe damage in Ironton, Chesapeake, and other urban areas. A flood wall built in 1943 protects Ironton from flooding as high as that of 1937. Flood control structures were built upstream from Lawrence County. With the same amount of rainfall as caused the 1937 flood, the water level is 6 to 9 feet lower. An Intermediate Regional Flood (IRF) is one that will occur, on average, once in 100 years but can occur in any year. An IRF is a major flood, but not an extreme flood. Floods of greater magnitude will occur less often, and floods of lesser magnitude will occur more often. IRF water levels compared to the 1937 flood at selected locations in Lawrence County are shown in figure 4 (*28*).

Mineral Resources

The mineral resources in Lawrence County are coal, limestone, clay, iron ore, sand, and gravel. Limestone, clay, and iron ore, for economic reasons, are not mined. Coal, however, is mined throughout the county. Sand and gravel are also mined (*13,20,22*).

How This Survey Was Made

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

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

Flood	Checkpoint			
	Ironton-Russell Highway Bridge	Old Lock and Dam 28	Old Lock and Dam 27	Miller (mouth of Federal Creek)
	Feet above mean sea level (datum of 1929)			
Intermediate Regional Flood	545.3	552.2	555.7	558.0
Flood of 1937	553.7	559.2	562.3	565.0

Figure 4.—Flood elevations at selected locations.

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

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

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

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

This survey area was mapped at two levels of detail. At the more detailed level, map units are narrowly defined. Map unit boundaries were plotted and verified at closely spaced intervals. At the less detailed level, map units are broadly defined. Boundaries were plotted and verified at wider intervals. In the legend for the detailed soil maps, narrowly defined units are indicated by symbols in which the first letter is a capital and the second is lowercase. For broadly defined units, the first and second letters are capitals.

The descriptions, names, and delineations of the soils in this survey area do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

Soil 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 prior to the start of the project soil survey were among the references used.

Before actual fieldwork began, preliminary boundaries of slopes and landforms were plotted stereoscopically in dissected woodland areas on aerial photographs flown in 1983 at a scale of 1:40,000 and enlarged to a scale of 1:15,840. USGS topographic maps at a scale of 1:24,000 were studied to relate land and image features.

Traverses were made on foot to examine the soils. In areas such as the Elkinsville-Sciotoville-Nolin general soil map unit where the soil pattern is very complex, traverses were as close as 200 yards. In areas such as the Steinsburg-Shelocta general soil map unit, land use and management are limited primarily to woodland and traverses were about a half mile apart.

As the traverses were made, the soil scientists divided the landscape into segments in which use and management of the soil were different. A hillside would be separated from a swale, a gently sloping ridgetop from a very steep side slope, and so on. In most areas, soil examinations along the traverses were made 50 to 800 yards apart, depending on the landscape and soil patterns. Observations of such items as landforms, trees blown down, vegetation, roadbanks, and animal burrows were made continuously 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 hand auger or spade to a depth of about 4 feet or to bedrock if the bedrock was at a depth of less than 4 feet. The pedons described as typical were observed and studied in pits that were dug with shovels, mattocks, and digging bars to a depth of 80 inches. Soil mapping was recorded on the 1983 photo base maps. The drainageways were mapped in the field. Cultural features were recorded from visual observations.

At the beginning of the survey, sample blocks were selected to represent the major landscapes in the county. These were mapped at a rate roughly half that 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 to reach the final assessment of the composition of the individual map units.

Transects were made to determine the composition of soil associations such as the Steinsburg-Shelocta association, very steep, and the Upshur-Gilpin-

Steinsburg association, steep. Soil examinations were made along the transects about 50 to 100 yards apart. The transects on side slopes were made from foot slopes to ridgetops and then a transect was generally made along the ridgetop. These transects were about a half mile apart.

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

After completion of soil mapping on the 1983 aerial photographs, the soil map was transferred by hand to a set of mylars of half-tone film positives of the 1983 photo basemaps.

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 two or more major soils and some minor soils. It is named for the major soils. The soils making up one map 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.

Soil Descriptions

Soils on Uplands

These soils make up about 89 percent of the county. They are well drained and moderately well drained and nearly level to very steep. They are on ridgetops and side slopes on uplands. Some large areas have been surface mined for coal. Maximum difference in local relief is about 400 feet. The soils formed in colluvium and residuum from sandstone, siltstone, and shale and in material mixed by surface mining. Woodland is the dominant land use. Slope, hillside slippage, the erosion hazard, bedrock between depths of 20 and 40 inches, droughtiness, high shrink-swell potential, and slow permeability are major limitations to land use.

1. Upshur-Gilpin

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

This map unit is on side slopes with narrow to broad ridgetops and narrow valleys. The side slopes commonly have narrow benches and moderately steep, colluvial foot slopes. They are dissected by drainageways. Typically, the ridgetops are narrow and moderately steep or wide and strongly sloping. Slopes range from 8 to 70 percent.

This map unit makes up about 41 percent of the county. It is about 55 percent Upshur soils, 30 percent Gilpin soils, and 15 percent soils of minor extent (fig. 5).

Upshur soils are deep. They are on ridgetops and side slopes. Permeability is slow. Available water capacity is moderate. The shrink-swell potential is high. These soils are subject to hillside slippage.

Gilpin soils are moderately deep. They are on ridgetops and side slopes. Permeability is moderate. Available water capacity is low.

Of minor extent in this map unit are Bethesda, Chagrin, Kanawha, Steinsburg, Vandalia, and Woodsfield soils. Bethesda soils have more coarse fragments than Upshur and Gilpin soils. They are in areas that have been surface mined for coal. Chagrin soils formed in alluvium on flood plains. Kanawha soils formed in alluvium on low terraces and alluvial fans. Steinsburg soils have more sand and less clay than Upshur and Gilpin soils. They are on side slopes. Vandalia soils have more coarse fragments than Upshur soils and are on colluvial foot slopes. Woodsfield soils have a silt cap. They are on gently sloping ridgetops. Also of minor extent are rock outcrops on the steeper parts of some side slopes.

Most of the acreage of Upshur and Gilpin soils is woodland. On the wider ridgetops and in the narrow valleys, these soils are used as cropland and pasture. They are used for roads on ridgetops or along streams.

In the steeper areas these soils are generally unsuited to cropland and urban use. They are well suited or moderately well suited to woodland use. On the wider ridgetops and in the narrow valleys, they are poorly suited to well suited to farming.

On Upshur and Gilpin soils the major limitations to most land uses are the strongly sloping to very steep slopes and the severe erosion hazard. On Upshur soils the slow permeability, hillside slippage, and high shrinking and swelling are also limitations. On Gilpin soils bedrock between depths of 20 to 40 inches is also a limitation. The north- and east-facing slopes of both soils have less evapotranspiration and cooler temperatures than the south- and west-facing slopes. Thus, they are better suited to woodland use.

2. Steinsburg-Shelocta

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

This map unit is on narrow ridgetops and very steep side slopes on deeply dissected uplands. A few rock outcrops are on the side slopes. Slopes range from 2 to 60 percent.

This map unit makes up about 30 percent of the county. It is about 35 percent Steinsburg soils, 35 percent Shelocta soils, and 30 percent soils of minor extent (fig. 6).

Steinsburg soils are moderately deep. They are on narrow ridgetops and on upper, very steep side slopes. Permeability is moderately rapid. Available water capacity is very low.

Shelocta soils are deep. They are on colluvial fans and side slopes. Permeability is moderate. Available water capacity is moderate.

Of minor extent in this map unit are Chagrin,

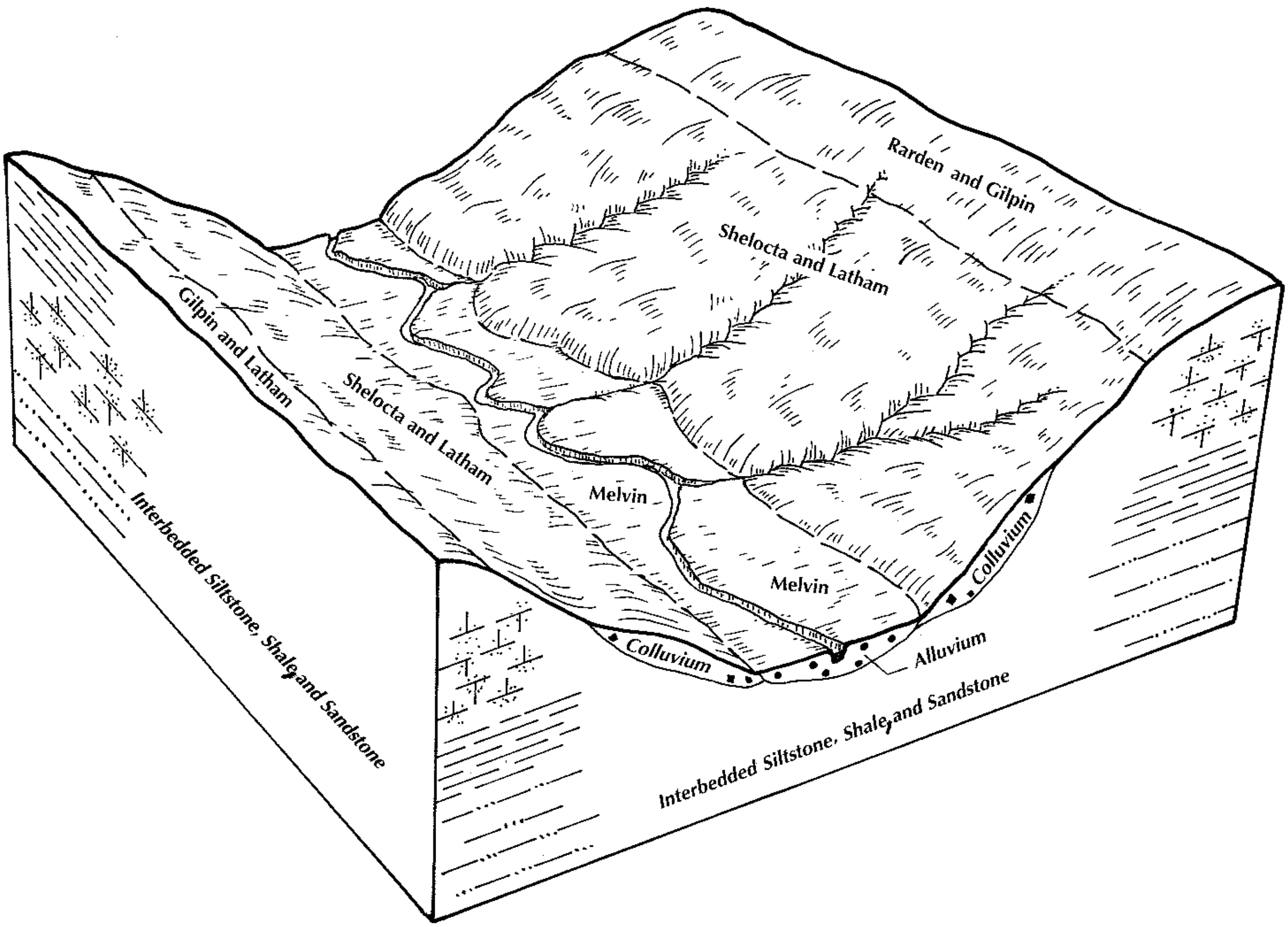


Figure 5.—Typical pattern of soils and parent material in the Upshur-Gilpin general soil map unit.

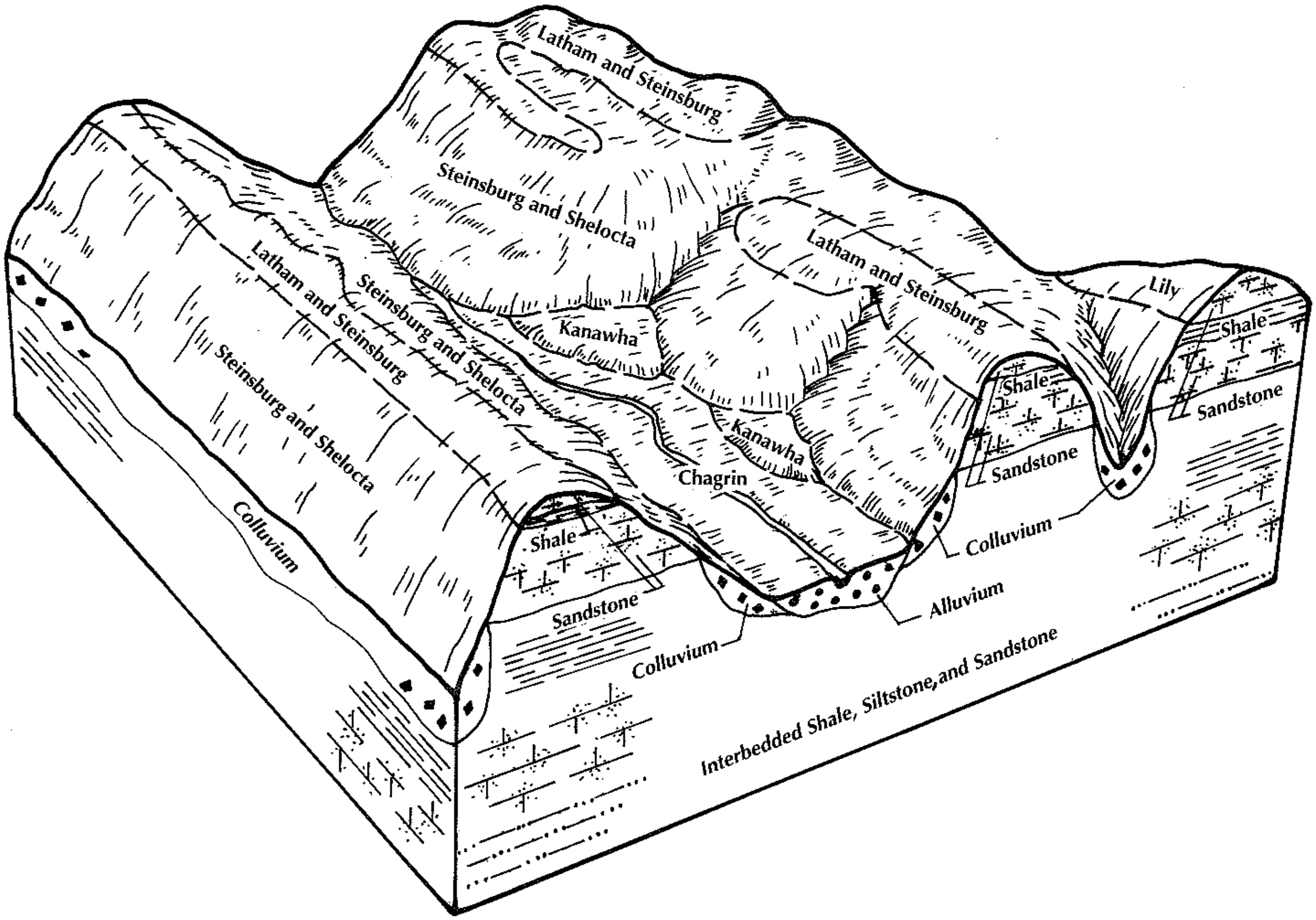


Figure 6.—Typical pattern of soils and parent material in the Steinsburg-Shelocta general soil map unit.

Coolville, Kanawha, Latham, Lily, Morristown, and Pinegrove soils. Chagrin soils have less clay than Steinsburg and Shelocta soils. They are on flood plains. Coolville soils have more clay than Steinsburg and Shelocta soils. They are moderately well drained and are on broad ridgetops. Kanawha soils have a higher base saturation than Steinsburg and Shelocta soils. They are on fans along valley walls. Latham soils are moderately well drained. They are on ridgetops and side slopes. Lily soils are moderately deep and have more clay than Steinsburg soils. They are on ridgetops. Morristown and Pinegrove soils are in areas that have been surface mined for coal. Also of minor extent are rock outcrops on the steeper parts of some side slopes.

Most of the acreage of Steinsburg and Shelocta soils is wooded. They are generally unsuited to cropland and to most urban uses. They are generally unsuited or poorly suited to pasture. They are moderately well suited to woodland.

The limitations of Steinsburg and Shelocta soils for most land uses are slope and a severe hazard of erosion. On Steinsburg soils moderate depth to bedrock and droughtiness are also limitations. The north- and east-facing slopes have less evapotranspiration and cooler temperatures than the south- and west-facing slopes. Thus, they are better suited to woodland use.

3. Shelocta-Steinsburg-Morristown

Deep and moderately deep, nearly level to very steep, well drained soils formed in regolith from surface mining, colluvium, and residuum derived from limestone, sandstone, siltstone, and shale; on uplands

This map unit is in areas surface mined for coal and, in surrounding areas, on undisturbed side slopes and ridgetops. Generally, the surface mined areas have not been reclaimed. The ridgetops are generally narrow. The side slopes are steep to very steep. Slopes range from 0 to 70 percent.

This map unit makes up about 8 percent of the county. It is about 25 percent Shelocta soils, 25 percent Steinsburg soils, 20 percent Morristown soils, and 30 percent soils of minor extent.

Shelocta soils are deep and gently sloping to very steep. They are on colluvial fans and side slopes. Permeability and available water capacity both are moderate.

Steinsburg soils are moderately deep and moderately steep to very steep. They are on narrow ridgetops and on upper side slopes. Permeability is moderately rapid. Available water capacity is very low.

Morristown soils are deep. They are on ridgetops and benches of areas surface mined for coal. Permeability is moderately slow. Available water capacity is low.

Of minor extent in this map unit are Latham, Lily, and Pinegrove soils. Latham soils are moderately well drained. They are on ridgetops and side slopes. Lily soils are moderately deep. They have more clay than Steinsburg soils. Lily soils are on ridgetops. Pinegrove soils are in areas that have been surface mined for coal. Also of minor extent are rock outcrops on the steeper parts of some slopes.

Most of the acreage of Shelocta, Steinsburg, and Morristown soils is wooded. They are generally unsuited to cropland and to most urban uses. They are generally unsuited or poorly suited to pasture. They are moderately well suited or poorly suited to woodland use.

The main limitations of Shelocta, Steinsburg, and Morristown soils for most land uses are slope, unstable fill material, and the severe hazard of erosion. On Morristown soils the moderately slow permeability and low available water capacity are also limitations. On Steinsburg soils the moderately deep bedrock and droughtiness are also limitations. The north- and east-facing slopes have less evapotranspiration and cooler temperatures than the south- and west-facing slopes. Thus, they are better suited to woodland use.

4. Shelocta-Latham

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

This map unit is on steep side slopes, narrow to broad ridgetops, and narrow valleys. The side slopes commonly have dissected benches, large slips, and colluvial foot slopes. Slopes range from 2 to 70 percent.

This map unit makes up about 5 percent of the county. It is about 60 percent Shelocta soils, 30 percent Latham soils, and 10 percent soils of minor extent (fig. 7).

Shelocta soils are deep and well drained. They are on side slopes and foot slopes. Permeability is moderate. Available water capacity is moderate or high.

Latham soils are moderately deep, moderately well drained, and moderately steep and steep. They are on side slopes, shoulder slopes, and ridgetops. Permeability is slow. Available water capacity is low. Shrink-swell potential is high. A seasonal high water table is between a depth of 1.5 and 3 feet during extended wet periods.

Of minor extent in this map unit are Coolville, Gilpin, Melvin, Morristown, Rarden, Steinsburg, and Tilsit soils. Coolville soils have more silt in the upper part of the subsoil than Shelocta and Latham soils. Gilpin soils are moderately deep and well drained. They are on ridgetops and side slopes. Melvin soils are poorly drained. They are on flood plains. Morristown soils are in areas that have been surface mined for coal. Rarden soils have redder colors in the subsoil than Latham soils. They are on ridgetops. Steinsburg soils have less clay and more sand than Shelocta and Latham soils. They are on narrow ridgetops and side slopes. Tilsit soils have a fragipan. Coolville and Tilsit soils are on broad ridgetops.

Most of the acreage of Shelocta and Latham soils is woodland. On many wider ridgetops they are used for cropland and pasture. On ridgetops or along streams they are commonly used for roads.

In the steeper areas the Shelocta and Latham soils are poorly suited or generally unsuited to cropland and most urban uses. In the less sloping areas they are well suited or moderately well suited to woodland use and moderately well suited or poorly suited to pasture.

The strongly sloping to steep slopes and severe erosion hazard limit most land uses of Shelocta and Latham soils. On Latham soils the seasonal high water table, slow permeability, and high shrinking and swelling are also limitations. On Latham soils bedrock between depths of 20 and 40 inches is also a limitation. The north- and east-facing slopes have less evapotranspiration and cooler temperatures than south- and west-facing slopes. Thus, they are better suited to woodland use.

5. Steinsburg-Lily-Rarden

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

This map unit is on side slopes, on narrow to broad ridgetops, and in narrow valleys. The side slopes commonly have narrow benches and moderately steep foot slopes. They are dissected by

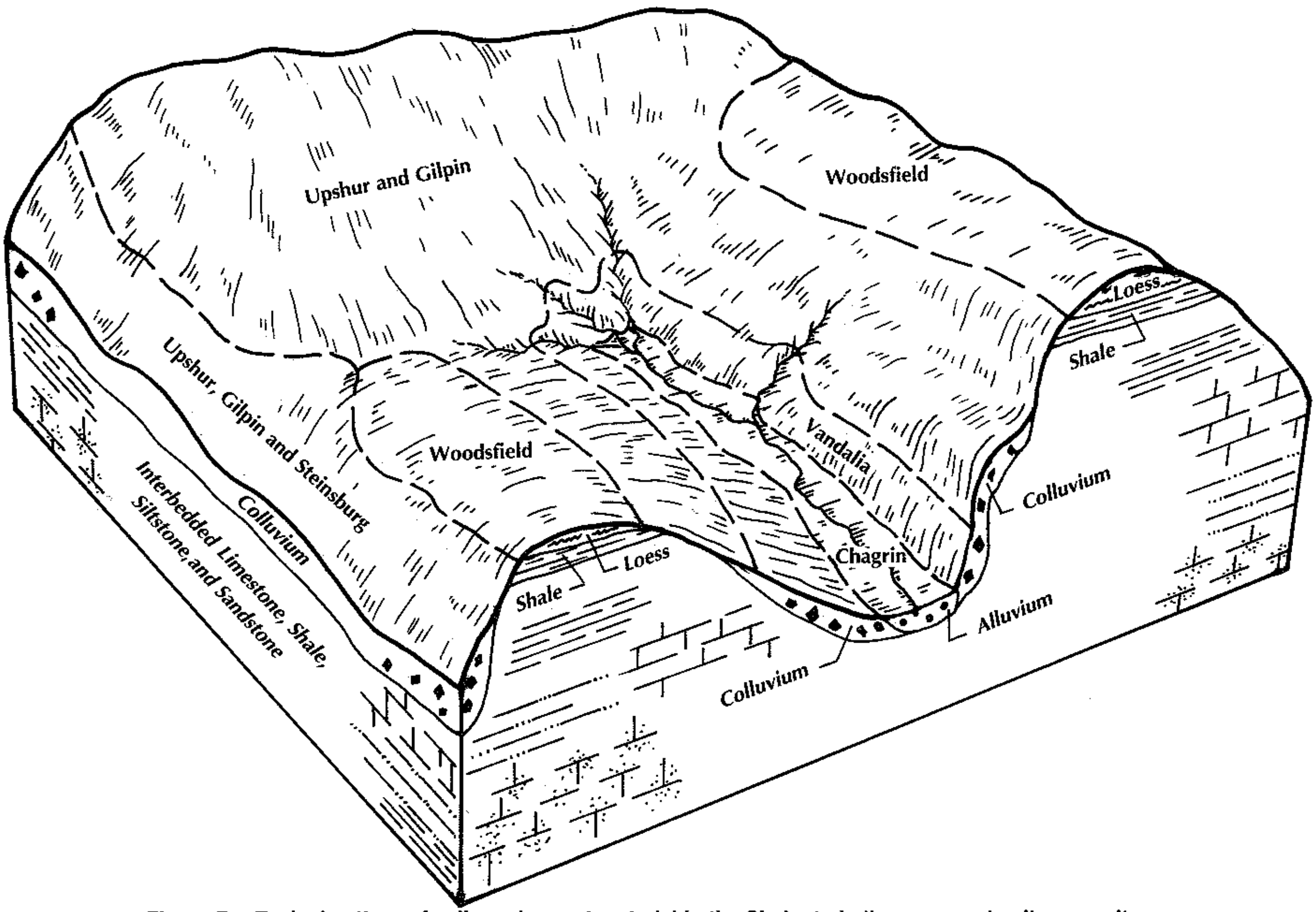


Figure 7.—Typical pattern of soils and parent material in the Shelocta-Latham general soil map unit.

drainageways. Typically, the ridgetops are narrow and moderately steep or wide and strongly sloping. Slopes range from 8 to 70 percent.

This map unit makes up about 4 percent of the county. It is about 40 percent Steinsburg soils, 20 percent Lily soils, 10 percent Rarden soils, and 30 percent soils of minor extent.

Steinsburg and Lily soils are well drained. Steinsburg soils are moderately steep to very steep. They are on side slopes and ridgetops. Lily soils are strongly sloping and moderately steep. They are on ridgetops. On Steinsburg and Lily soils, permeability is moderately rapid. The available water capacity is very low on Steinsburg soils and low on Lily soils.

Rarden soils are moderately well drained. They are on strongly sloping and moderately steep ridgetops. Permeability is slow. Available water capacity is low.

Some of the soils of minor extent in this map unit are Clymer, Coolville, Kanawha, Shelocta, and Tilsit soils. These soils are all deep. Clymer soils are on side slopes. Coolville and Tilsit soils are on broad, gently sloping ridgetops. Kanawha soils are on alluvial fans and terrace remnants. Shelocta soils are on side slopes and colluvial fans.

Most of the acreage of Steinsburg, Lily, and Rarden soils is wooded.

These soils are moderately well suited to generally unsuited to cropland, pasture, and most urban uses. They are well suited or moderately well suited to woodland use.

The main limitations of Steinsburg, Lily, and Rarden soils for most land uses are slope, moderate depth to bedrock, and severe hazard of erosion. On Rarden soils the slow permeability is also a limitation. On Rarden and Lily soils the low available water capacity is also a limitation. On Steinsburg soils the very low available water capacity and droughtiness are also limitations. The north- and east-facing slopes have less evapotranspiration and cooler temperatures than the south- and west-facing slopes. Thus, they are better suited to woodland use.

6. Pinegrove-Upshur-Fairpoint

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

This map unit is in areas surface mined for coal and, in surrounding areas, on undisturbed side slopes and ridgetops. Surface mined areas are graded or rounded ridgetops and side slopes. The ridgetops are narrow to broad. The side slopes are steep and have a few rock outcrops. Slopes range from 8 to 70 percent.

This map unit makes up about 1 percent of the county. It is about 40 percent Pinegrove soils, 30 percent Upshur soils, 20 percent Fairpoint soils, and 10 percent soils of minor extent.

Pinegrove soils are on ridgetops and benches of areas surface mined for coal. Permeability is rapid. Available water capacity is low.

Upshur soils are on ridgetops and side slopes. Permeability is slow. Available water capacity is moderate.

Fairpoint soils are strongly sloping and moderately steep. They are on ridgetops and benches in areas surface mined for coal. Permeability is moderately slow. Available water capacity is low.

Some soils of minor extent in this map unit are Gilpin, Kanawha, and Steinsburg soils. Gilpin and Steinsburg soils are moderately deep. They are on ridgetops and side slopes. Kanawha soils have more coarse fragments than Pinegrove and Upshur soils. They are on low terraces and alluvial fans.

On most of the acreage that has been mined, Pinegrove, Upshur, and Fairpoint soils are grassland. In unmined areas they are woodland. They are generally unsuited to cropland and to most urban uses. They are generally unsuited or poorly suited to pasture. They are moderately well suited or poorly suited to woodland use.

The main limitations of Pinegrove, Upshur, and Fairpoint soils for most land uses are slope, unstable fill material, and a severe erosion hazard. On Pinegrove soils rapid permeability, acidity, and low available water capacity are also limitations. On Upshur soils slow permeability, hillside slippage, and high shrink-swell potential are also limitations. On Fairpoint soils moderately slow permeability and low available water capacity are also limitations

Deep Soils in Preglacial Valleys and on Flood Plains, Terraces, and Fans

These soils make up about 8 percent of the county. They are nearly level to steep and well drained or moderately well drained. They are in preglacial and glacial valleys and on flood plains, terraces, and fans. They formed in alluvium, colluvium, loess, residuum, and lacustrine sediments. They are used as cropland, pasture, or woodland or for urban development. The flood hazard, the erosion hazard, slope, restricted permeability, high shrinking and swelling, and the seasonal high water are limitations to land use.

7. Elkinsville-Sciotoville-Nolin

Deep, nearly level to steep, well drained and moderately well drained soils formed in alluvium; on terraces

This map unit is on nearly level and undulating terraces and on slope breaks in major stream valleys. Some areas of soils of minor extent are subject to rare flooding. Slopes range from 0 to 40 percent.

This map unit makes up about 5 percent of the county. It is about 40 percent Elkinsville soils, 15 percent Wheeling soils, 10 percent Sciotoville soils, and 35 percent soils of minor extent.

Elkinsville and Nolin soils are well drained. Elkinsville soils are on slight rises and slope breaks. On Elkinsville soils permeability is moderate and available water capacity is high. Wheeling soils are gently sloping to strongly sloping. On Wheeling soils permeability is moderate in the subsoil and rapid in the substratum and available water capacity is moderate.

Sciotoville soils are moderately well drained. They are on gently sloping convex slopes. Permeabilty is moderate in the upper part and moderately slow or slow in the lower part. Available water capacity is moderate.

Some of the soils of minor extent in this map unit are Peoga, Watertown, and Weinbach soils. Peoga soils are poorly drained. They are on flats and in depressions on terraces. Watertown soils have more sand and are in higher positions than Elkinsville, Sciotoville, and Nolin soils. Weinbach soils are somewhat poorly drained. They are in somewhat lower positions than Elkinsville, Sciotoville, and Nolin soils.

In most areas Elkinsville, Sciotoville, and Nolin soils are used as cropland. In some areas they are pasture. Generally, on the higher parts of terraces they are used for buildings and local roads.

In the nearly level and gently sloping areas, Elkinsville, Sciotoville, and Nolin soils are well suited to cropland, pasture, and woodland. They are well suited or poorly suited to most urban uses. In the moderately steep and steep areas Elkinsville soils are generally unsuited to cropland and urban uses. They are well suited to woodland. The soils of minor extent that are subject to rare flooding are generally unsuited to urban uses.

In the moderately steep and steep areas of Elkinsville soils, the main limitations for most land uses are the hazard of erosion and slope. On some soils of minor extent flooding is a hazard. If Wheeling soils are used for septic tank absorption fields, ground water pollution is a hazard because rapid permeability in the substratum prevents adequate filtering of effluent. On Sciotoville soils the moderately slow or slow permeability and the seasonal high water table are limitations.

8. Chagrin-Kanawha-Licking

Deep, nearly level to strongly sloping, well drained and moderately well drained soils formed in alluvium on flood plains and in old alluvium or lacustrine deposits; on terraces

This map unit is on relatively broad, flat flood plains and low terraces in valleys with meandering streams. Slopes range from 0 to 12 percent.

This map unit makes up about 3 percent of the county. It is about 35 percent Chagrin soils, 20 percent Kanawha soils, 10 percent Licking soils, and 35 percent soils of minor extent.

Chagrin soils are well drained. They are on nearly level flood plains. Permeability is moderate. Available water capacity is high.

Kanawha soils are well drained and gently sloping and strongly sloping. They are on fans or terrace remnants at the heads of narrow stream valleys. Permeability is moderate. Available water capacity is moderate or high.

Licking soils are moderately well drained and nearly level to strongly sloping. They are on slight rises or slope breaks of low terraces. Permeability is slow. Available water capacity is moderate. A seasonal high water table is between depths of 1.5 and 3.0 feet during extended wet periods. Shrink-swell potential is high.

Some soils of minor extent in this map unit are Cuba, Elkinsville, McGary, Sciotoville, and Wheeling soils. Cuba soils are well drained and on flood plains. Elkinsville soils are well drained and on stream terraces. McGary soils are somewhat poorly drained and in depressions. Sciotoville soils have a fragipan and are on convex terraces. Wheeling soils are well drained and on terraces. They have more sand in the subsoil than Chagrin, Kanawha, and Licking soils.

Most of the acreage of Chagrin, Kanawah, and Licking soils is used for cropland and pasture. These soils are poorly suited to well suited to cropland and pasture and well suited to woodland use. They are well suited to generally unsuited to most urban uses; Kanawha soils are better suited than Chagrin or Licking soils.

The main limitations of Licking soils for most land uses are the seasonal high water table, slow permeability, and high shrinking and swelling. Flooding is a hazard on Chagrin soils. On slope breaks on Kanawha and Licking soils slope and the erosion hazard are limitations.

Deep Soils on Flood Plains

These soils make up about 3 percent of the county. They are well drained and somewhat poorly drained. They formed in alluvium on flood plains. They are subject to occasional or frequent flooding. The soils are used as cropland, pasture, or woodland. The hazard of flooding and the seasonal high water table are major management concerns.

9. Cuba-Stendal-Tioga

Deep, nearly level, well drained and somewhat poorly drained soils formed in alluvium; on flood plains

This map unit is in relatively wide valleys bounded by steep or very steep areas on adjacent uplands. The soils are subject to occasional or frequent flooding. Slopes range from 0 to 3 percent.

This map unit makes up about 3 percent of the county. It is about 40 percent Cuba soils, 30 percent Tioga soils, 25 percent Stendal soils, and 5 percent soils of minor extent.

Cuba and Tioga soils are well drained. Permeability of Cuba soils is moderate and available water capacity is very high. Permeability of Tioga soils is moderate or moderately rapid in the subsoil and moderate to rapid in the substratum. Also, available water capacity of Tioga soils is moderate and the seasonal high water table is at a depth of 3 to 6 feet. Cuba soils are on the higher parts of flood plains. Tioga soils are on flood plains near streams.

Stendal soils are in depressions on flood plains. They are somewhat poorly drained. Permeability is moderate. Available water capacity is very high. A seasonal high table at a depth of 1 to 3 feet.

Of minor extent in this map unit are Melvin and Piopolis soils. They are in depressions on flood plains. Melvin soils are poorly drained and ponded. Piopolis soils are poorly drained and very poorly drained.

This map unit is used as cropland, pasture, and woodland. The cropland is mainly in areas of Cuba and Tioga soils. It is also in adequately drained areas of Stendal soils. Crops such as corn and soybeans can be planted after the flood hazard in spring. In some years in winter and spring flooding and the seasonal high water table cause severe damage to winter wheat. Cuba, Stendal, and Tioga soils are well suited to cropland, pasture, and woodland. They are generally unsuited to most urban uses.

The main limitation of Cuba, Stendal, and Tioga soils for most land uses is the hazard of flooding. If the soils are used for row crops surface crusting is a problem. On Stendal soils the seasonal high water table is also a limitation.

Detailed Soil Map Units

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

A map unit delineation on a map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. A taxonomic class comprises precise, defined limits for the properties of soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena; they have the characteristic variability of all natural phenomena. 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 other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils have properties 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, or similar, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be separated at the scale used for mapping. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes. Rather, it is to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. But if intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit 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, 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, slope, stoniness, salinity, 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, Shelocta silt loam, 6 to 15 percent slopes, is a phase of the Shelocta series.

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

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Upshur-Gilpin complex, 8 to 15 percent slopes, is an example.

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

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, sand and gravel, is an example.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Tables" under "Contents") 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 or miscellaneous areas.

BdD—Bethesda channery silty clay loam, 8 to 25 percent slopes

This is a deep, well drained, strongly sloping and moderately steep soil on ridges and benches of mine spoil in areas of surface coal mines. The slopes are uneven. The soil consists of a mixture of rock fragments and partly weathered fine earth material that was within or below the profile of the original soil. Most rock fragments are flat and less than 10 inches long. Most areas are long, narrow, and winding or are broad, circular, and 150 to 1,000 feet wide. Areas range from 10 to 250 acres in size (fig. 8).

Typically, the surface layer is yellowish brown, friable channery silty clay loam about 5 inches thick. The substratum to a depth of 80 inches is multicolored, firm very channery and extremely channery silty clay loam. In some areas the soil is less acid throughout. In places the soil has fewer coarse fragments throughout. In some areas slope is less than 8 percent or more than 25 percent.

Included with this soil in mapping are small areas of Gilpin, Latham, Lily, Pinegrove, Shelocta, and Steinsburg soils. Except Pinegrove soils, these soils are in unmined areas. They have a subsoil. Pinegrove soils do not have a subsoil. They have more sand throughout than the Bethesda soil. Included soils make up about 15 percent of the unit.

Permeability of the Bethesda soil is moderately slow. The available water capacity is low. Runoff is rapid or very rapid. The depth of the root zone varies within short distances because of differences in the density of the soil material.

Most areas if this soil are in brush or trees. Some areas are used for pasture.

This soil is poorly suited to trees. Species that tolerate acidity, droughtiness, and the restricted root zone are preferred for planting. Laying out logging roads and skid trails on the contour, installing water bars, and maintaining a vegetative cover help to control erosion. Planting seedlings that have been transplanted once will reduce the seedling mortality rate. Removing vines and the less desirable trees and shrubs helps to reduce plant competition. Applying gravel or crushed stone on haul roads and log landings improves soil strength and traction. Laying out haul roads and log landings apart from active slips helps to stabilize the road base and to prevent soil slippage. Building haul roads and skid trails on the contour facilitates the use of equipment. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting.

This soil generally is unsuited to row crops and poorly suited to hay. It is droughty. Fertility is low. The surface layer is channery, has a weak structure, and puddles and crusts easily. Erosion is a severe hazard if cultivated crops are grown. A permanent plant cover helps to control erosion.

This soil is poorly suited to pasture. If the pasture is overgrazed or is plowed during seedbed preparation, erosion is a severe hazard. Proper stocking rates and pasture rotation help to prevent overgrazing and excessive soil loss. No-till seeding also helps to prevent excessive soil loss. Restricted grazing during wet periods helps to prevent surface compaction. Soil tests are needed to determine specific nutrient needs. Ground cover and surface mulch reduce runoff, help to control erosion, and increase the rate of water intake.

This soil is generally unsuited as a site for buildings and septic tank absorption fields. The main limitations are slope, the hazard of slippage, and moderately slow permeability. In settled areas on slopes of 8 to 15 percent the soil is moderately well suited to buildings and poorly suited to septic tank absorption fields. Onsite investigation for depth to bedrock, the hazard of hillside slippage, and stormwater control is needed to determine the suitability for buildings and septic tank absorption fields. Installing the distribution lines on the contour reduces lateral seepage of effluent to the surface. Increasing the size of the absorption field helps to overcome the restricted permeability. In some areas an aeration sewage disposal system is needed.

The land capability classification is VIs. The woodland ordination symbol is 4R. The pasture and hayland suitability group is E-3.

BdF—Bethesda channery silty clay loam, 25 to 70 percent slopes

This is a deep, well drained, steep and very steep soil on side slopes in areas of surface coal mines. The slopes are uneven. The soil consists of a mixture of rock fragments and partly weathered fine earth material that was within or below the profile of the original soil. The rock fragments consist mainly of shale, siltstone, and sandstone. Active hillside slips are common on this soil. Most areas are on the outer slopes of surface mines where the spoil was placed on hillsides. Other areas consist of narrow spoil ridges below a highwall and long, narrow pools of water. Most areas are long, narrow, and winding or are broad, circular, and 100 to 800 feet wide. Areas range from 5 to 200 acres in size.

Typically, the surface layer is brown, friable channery silty clay loam about 2 inches thick. The substratum to a depth of 80 inches is multicolored, firm very channery loam, clay loam, and silty clay loam. Some areas of this soil are more acid throughout. In places it has fewer coarse fragments. In some areas it is not as steep. In some areas the soil is less acid throughout.

Included with this soil in mapping are small areas of Gilpin, Lily, Latham, Pinegrove, Shelocta, and Steinsburg soils. Except Pinegrove soils, these soils have not been disturbed by mining activities. They have a subsoil. Pinegrove soils do not have a subsoil. The substratum of Pinegrove soils has been disturbed

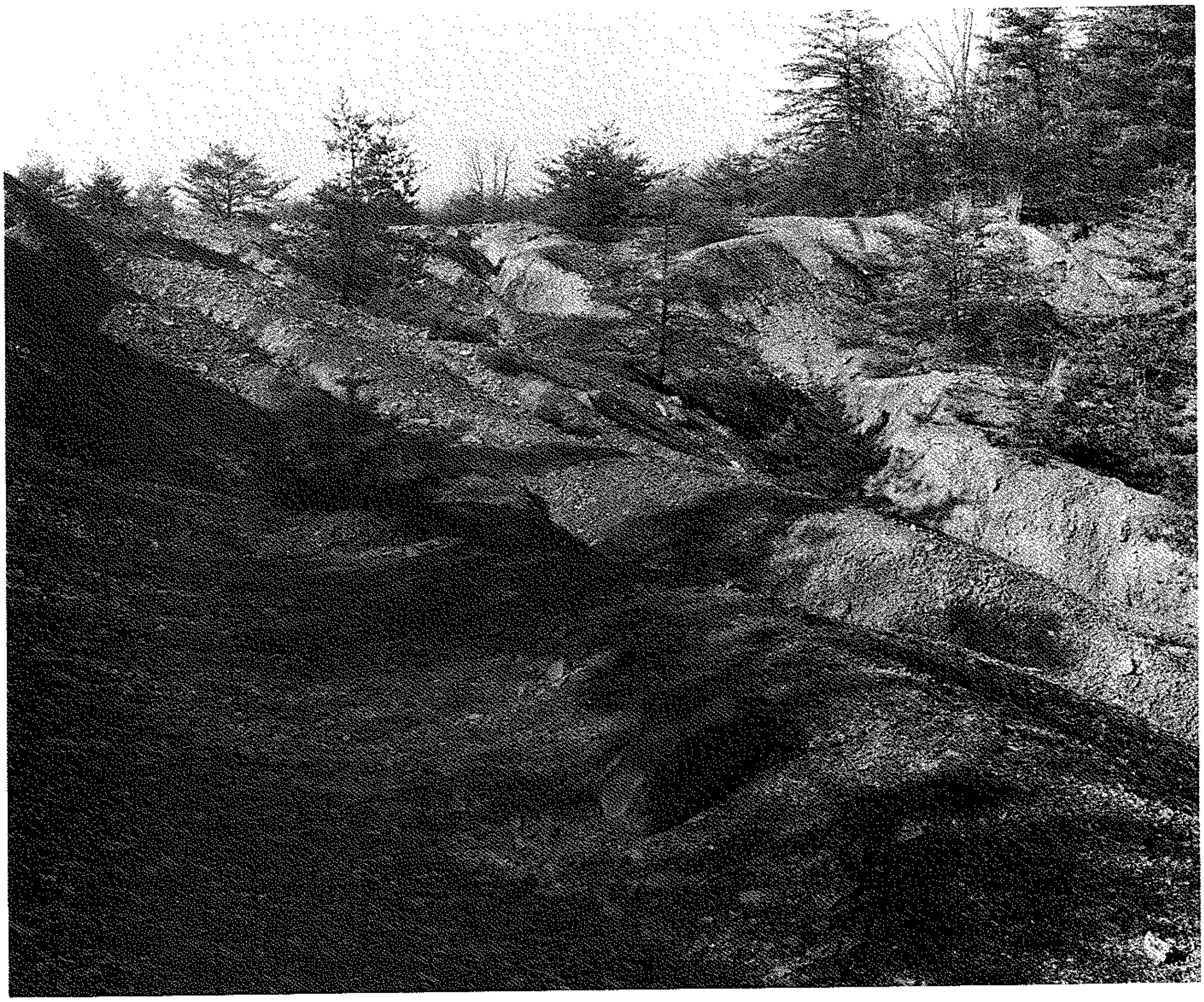


Figure 8.—Abandoned mine land. Erosion is a serious hazard in unreclaimed mining areas on Bethesda channery silty clay loam, 8 to 25 percent slopes.

by mining and has more sand. Also included are small areas of toxic soils that do not support vegetation. Included areas make up about 15 percent of the unit.

Permeability of the Bethesda soil is moderately slow. The available water capacity is low. Runoff is very rapid. The depth of the root zone varies within short distances because of differences in the density of the soil material.

Most areas are in brush or trees. Some areas support thin stands of grasses interspersed with barren spots.

This soil is poorly suited to trees. Species that tolerate acidity and dry conditions are preferred for planting. Mechanical planting is not practical because of steep and very steep slope and rock fragments throughout. Slope is a severe limitation to use of equipment. Slope length is short; thus, trees can be harvested from either above or below this unit. Laying out logging roads and skid trails on or near the contour, installing water bars, and maintaining a vegetative cover help to control erosion. Laying out haul roads and skid trails on the contour facilitates the use of equipment. Cutting and filling to a more desirable slope improves sites for log landings. Special equipment is needed for site preparation and planting.

This soil is generally unsuited to cropland and pasture. The main limitations are steep and very steep slope, droughtiness, low fertility, and very low organic matter content. Erosion is a severe hazard. Maintaining a vegetative cover and mulching help to reduce runoff and to control erosion and increase water infiltration.

This soil is generally unsuited to septic tank absorption fields and building site development. The main limitations are slope, the possibility of hillside slippage, and moderately slow permeability.

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

Cg—Chagrin loam, frequently flooded

This is a deep, well drained, nearly level soil on flood plains. Most areas are long and narrow. They range from 5 to 100 acres in size. Slope is 0 to 3 percent.

Typically, the surface layer is brown, friable loam about 10 inches thick. The subsoil is about 32 inches thick. In the upper part it is yellowish brown and dark yellowish brown, friable loam. In the lower part it is dark yellowish brown, mottled, friable silt loam. The substratum to a depth of 80 inches is dark yellowish brown and yellowish brown, mottled, friable silt loam and sandy loam. In a few areas the surface layer is silt loam. In some areas the subsoil has more or less sand.

Included with this soil in mapping are small areas of Kanawha and Orrville soils. Kanawha soils have more coarse fragments in the subsoil and substratum and are on alluvial fans and terraces. Orrville soils are somewhat poorly drained and are in slight depressions. Included soils make up about 10 percent of the unit.

Permeability of the Chagrin soil is moderate. Available water capacity is high. Runoff is slow. The surface layer can be easily tilled throughout a fairly wide range in moisture content. A seasonal high water table is at a depth of 4.0 to 6.0 feet during extended wet periods. Most areas are in row crops. Some areas are in native hardwoods or in pasture and hay.

This soil is well suited to corn and soybeans. Flooding in winter and early spring damages small grain, such as winter wheat. In some years flooding in spring delays planting. Crop residue returned to the soil and regular additions of other organic material improve fertility, reduce crusting, and increase the rate of water infiltration. A conservation tillage system reduces field preparation time, improves soil structure and tilth, and reduces surface compaction.

This soil is well suited to hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, increased runoff, and reduced forage yields. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of fertilizer and lime help to maintain a maximum stand of key forage species.

This soil is well suited to trees. Species tolerant of flooding are preferred for planting on this soil. Removing vines and the less desirable trees and shrubs helps to reduce plant competition. Trees can be harvested or planted when the soil is not flooded.

This soil is generally unsuited to buildings and septic tank absorption fields. It is moderately well suited to campgrounds and playgrounds. Flooding is the main limitation to these uses. It is well suited to picnic areas, paths, and trails.

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

CtB—Coolville-Tilsit silt loams, 2 to 6 percent slopes

These are deep, moderately well drained soils on broad ridgetops. The Coolville soil is on the more sloping parts of ridgetops. The Tilsit soil is on the less sloping parts. Most areas of these soils are long and 150 to 600 feet wide. Areas range from 10 to 50 acres in size. Most areas consist of about 60 percent Coolville silt loam and 25 percent Tilsit silt loam. The two soils are in areas so intricately mixed or so small in size that separating them in mapping was not practical.

Typically, the Coolville soil has a surface layer of dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is 3 inches of yellowish brown, friable silt loam. The subsoil is about 46 inches thick. In the upper part it is strong brown, friable silt loam and silty clay loam. In the lower part it is red and yellowish red, mottled, firm silty clay and yellowish red, mottled, firm silty clay loam. Weathered interbedded shale and siltstone are at a depth of about 46 inches. Some areas are well drained. Some areas have a thinner silt mantle. A few areas are moderately deep to bedrock.

Typically, the Tilsit soil has a surface layer of brown, friable silt loam about 5 inches thick. The subsurface layer is yellowish brown, friable silt loam about 8 inches thick. The subsoil is about 47 inches thick. In the upper part it is yellowish brown, friable silt loam. In the middle part it is a yellowish brown and strong brown, mottled, firm and very firm and brittle silt loam fragipan. In the lower part it is strong brown, firm silty clay loam. Siltstone is at a depth of about 60 inches. In some areas the middle part of the subsoil is not as dense.

Included with these soils in mapping are areas of Gilpin, Latham, and Steinsburg soils. These soils are moderately deep and are commonly on the narrower ridgetops or shoulder slopes. Included areas are less than 10 acres in size. They make up about 15 percent of the complex.

Permeability is moderate in the surface and subsurface layers and in the upper part of the subsoil in the Coolville soil and slow below. It is moderate above the fragipan in the Tilsit soil and slow within. Available water capacity is moderate on the Coolville soil. The root zone of the Tilsit soil is mainly restricted to the 18- to 28-inch zone above the fragipan. The available water capacity of the root zone is low. Runoff is medium. A perched seasonal high water table is at a depth of 1.5 to 3.0 feet in the Coolville soil and 1.5 to 2.5 feet in the Tilsit soil during extended wet periods.

Most areas of this soil are in native hardwoods. A few areas have been cleared.

These soils are well suited to corn, soybeans, tobacco, and small grain. If cultivated crops are grown, erosion is a hazard. Cultivated crops can be grown year after year with erosion control and improved management. Conservation measures that maintain tilth and the organic matter content are needed. A conservation tillage system that leaves crop residue on the surface, a cropping sequence that includes grasses and legumes, incorporating crop residue into the plow layer, contour farming or contour stripcropping, and grassed waterways help to maintain tilth, to reduce runoff, and to control erosion. Tilling within the optimum moisture range reduces surface compaction.

These soils are well suited to hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and reduced forage yields. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a maximum stand of the key forage species.

These soils are well suited to trees. Removing vines and the less desirable trees and shrubs helps to reduce plant competition. On the Coolville soil planting seedlings that have been transplanted once will reduce the seedling mortality rate. On the Coolville soil harvesting without leaving the remaining trees widely spaced or isolated will reduce the windthrow hazard. Applying gravel or crushed stone on haul roads and log landings improves soil strength.

These soils are poorly suited to septic tank absorption fields. The seasonal high water table and slow or very slow permeability are severe limitations. Increasing the size of the absorption area helps to overcome these limitations. Installing perimeter drains around septic tank absorption fields helps to lower the seasonal high water table. In some areas an aeration sewage disposal system is needed.

These soils are moderately well suited as a site for buildings and local roads. Because of the seasonal high water table, these soils are better suited to houses without basements. Installing drains at the base of footings and coating the exterior basement walls will help keep wet basements dry. Proper landscaping of building sites helps to keep surface water away from foundations. On the Coolville soil backfilling along foundations with a low shrink-swell material reduces the damage caused by shrinking and swelling. Providing artificial drainage and suitable base material helps to reduce the damage to local roads caused by frost action and low strength. Maintaining as much vegetation as possible on the construction site helps to control erosion.

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

Cu—Cuba silt loam, occasionally flooded

This is a deep, well drained, nearly level soil on flood plains. Most areas are long and narrow or are circular. They range from 5 to 50 acres in size. Slope is 0 to 2 percent (fig. 9).

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is dark yellowish brown and yellowish brown, friable silt loam about 32 inches thick. It is mottled in the lower part. The substratum to a depth of about 80 inches is yellowish brown, mottled, friable silt loam. In some areas the soil is moderately well drained. In a few areas the subsoil has less clay. In some areas the subsoil has more sand.

Included with this soil in mapping are small areas of Kanawha, Shelocta, and Tioga soils. Kanawha and Shelocta soils have more coarse fragments and are on alluvial fans. Tioga soils have more sand and are in landscape positions similar to those of the Cuba soil. Included soils make up about 15 percent of the unit.

Permeability of the Coolville soil is moderate. The available water capacity is very high. Runoff is slow. The surface layer can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cropland. A few small areas are in native hardwoods.

This soil is well suited to corn and soybeans. Small grain, such as winter wheat, are damaged by flooding in winter and spring. In some years flooding in spring delays crop planting. Crop residue returned to the soil and regular additions of other organic material improve fertility, reduce crusting, and increase the rate of water infiltration. Tilling within the optimum moisture range increases the rate of water infiltration, reduces surface compaction, maintains soil structure, and improves tilth.

This soil is well suited to hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, increased runoff, and reduced forage yields. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help maintain a maximum stand of key forage species.

This soil is well suited to trees. Species that tolerate occasional flooding are preferred for planting. The trees can be harvested or planted when the soil is not flooded.

This soil is generally unsuited as a site for buildings and septic tank absorption fields. It is moderately well

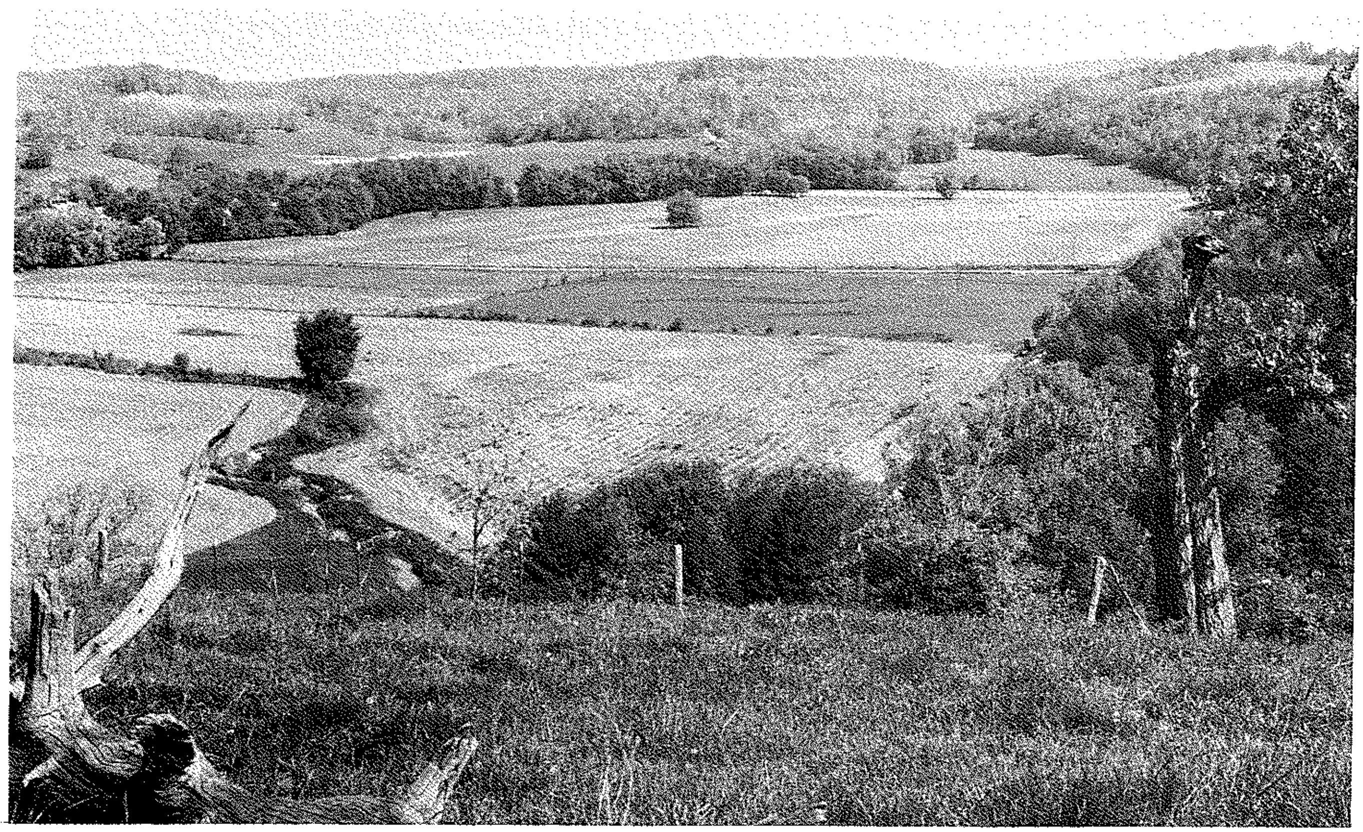


Figure 9.—Symmes Creek Valley. The cropland is on Cuba silt loam, occasionally flooded. Upshur and Gilpin soils are on the hillsides.

suited to campgrounds and playgrounds. Flooding is the main limitation to these uses. It is well suited to picnic areas and paths and trails.

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

Dp—Dumps

This map unit consists mainly of areas used for disposing cement, bricks, cinders, slag, refuse, and other debris from strip mines. A thin blanket of spoil material has been placed over the surface. The unit is one area of 45 acres.

The physical characteristics for plant growth are very poor. The existing fine earth is subject to erosion unless it can support a protective plant cover. Blanketing the surface with a thicker layer of soil material will enhance vegetation and help to control erosion.

The unit was not assigned a land capability classification, woodland ordination symbol, and pasture and hayland suitability group.

EkB—Elkinsville silt loam, 1 to 6 percent slopes

This is a deep, well drained, nearly level and gently sloping soil on stream terraces. Most areas of this soil are long and narrow or circular. Areas range from 3 to 90 acres in size.

Typically, the surface layer is brown, friable silt loam about 12 inches thick. The subsoil is about 46 inches thick. It is strong brown and brown, friable and firm silt loam and loam. The substratum to a depth of about 80 inches is brown, friable loam that has thin strata of gravelly loamy sand. Some areas are moderately well drained. Some areas have a dark colored surface layer.

Included with this soil in mapping are small areas of poorly drained Peoga soils and somewhat poorly drained Weinbach soils along drainageways and depressions. Also included are a few small areas of Wheeling soils that have more sand in the subsoil. Some included areas are subject to rare flooding. Also included are areas that have very gravelly loamy sand below a depth of 10 feet and that are a probable source of sand and gravel. Included soils make up about 15 percent of most areas.

Permeability of the Elkinsville soil is moderate and available water capacity is high. The surface layer can be easily tilled throughout a fairly wide range in moisture content. Runoff is slow or medium.

Most of the acreage is row cropped. A few small areas are in native hardwoods (fig. 10).

This soil is well suited to corn, soybeans, tobacco, and small grain. Erosion is a hazard if cultivated cultivated crops are grown. Cultivated crops can be grown year after year if erosion is controlled and management is improved. Conservation practices that maintain tilth and the organic matter content are needed. A conservation tillage system that leaves crop residue on the surface, a cropping sequence that includes grasses and legumes, incorporating crop residue into the plow layer, contour farming or contour stripcropping, and grassed waterways help to maintain tilth, to reduce runoff, and to control erosion. Tilling within the optimum moisture range reduces surface compaction.

This soil is well suited to hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and reduced forage yields. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species.

This soil is well suited to trees. Removing vines and the less desirable trees and shrubs helps to reduce plant competition.

This soil is well suited as a site for buildings and septic tank absorption fields. Moderate shrinking and swelling limits use of the soil as building sites. Laying properly designed foundations and footings and backfilling along foundations with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Providing suitable base material for local roads and streets reduces the damage caused by low strength and frost action. The included areas that are subject to flooding are generally unsuitable for building site development. Some included areas are a probable source of sand and gravel.

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

EkE—Elkinsville silt loam, 15 to 40 percent slopes

This is a deep, well drained, moderately steep and steep soil on slope breaks between terrace levels or between terraces and flood plains. Most areas are long and narrow and range from 5 to 25 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 44 inches thick. In the upper part it is dark yellowish brown and brown, friable silt loam. In the lower part it is strong

Figure 10.—Bales of hay on Elkinsville silt loam, 1 to 6 percent slopes. Cuba and Tioga soils are in the background.

brown, friable loam. The substratum to a depth of about 60 inches is strong brown, friable loam. Some areas are moderately well drained. In a few areas the subsoil has more sand.

Included with this soil in mapping are areas of soils that are subject to rare flooding. Included soils make up about l0 percent of most areas.

Permeability of the Elkinsville soil is moderate. Available water capacity is high. Runoff is very rapid.

Most areas of this soil are in native hardwoods. Some areas are used for pasture.

This soil is generally unsuited to row crops and hay. The main limitations are moderately steep and steep slope and the severe erosion hazard. It is poorly suited to pasture. If the soil is plowed for seedbed preparation or if the pasture is overgrazed, erosion is a severe hazard. No-till helps to control erosion.

This soil is well suited to trees. Seeding log landings, skid trails, and logging roads after harvesting helps to control erosion. Installing water bars on skid trails and logging roads also helps to control erosion. Slope limits use of this soil for haul roads and log landings. Building haul roads and skid trails on the contour facilitates the use of equipment. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting. Removing vines and the less desirable trees and shrubs helps to reduce plant competition.

This soil is generally unsuited to dwellings and septic tank absorption fields. The main limitation is moderately steep and steep slope. Developing sites for recreation and urban uses is very difficult. Erosion is a severe hazard if the vegetative cover is removed. Laying out trails in recreation areas across the slope, if possible, and installing erosion control practices on trails are suitable management practices.

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

EmB—Elkinsville-Urban land complex, 1 to 8 percent slopes

This map unit consists of Elkinsville soil and areas of Urban land on stream terraces. The Elkinsville soil is deep, well drained, and nearly level and gently sloping. Areas are irregularly shaped and range from 25 to 150 acres in size. Most areas consist of about 40 percent Elkinsville silt loam and 40 percent Urban land. The Elkinsville soil and Urban land are in areas so intricately mixed or so small in size that separating them in mapping was not practical.

Typically, the surface layer is brown, friable silt loam about 12 inches thick. The subsoil is about 55 inches thick. In the upper part it is yellowish brown, friable silt loam. In the lower part it is strong brown and yellowish brown, friable silt loam and yellowish brown, friable loam. In some areas the soil is moderately well drained. In a few areas the subsoil has more sand. In some low areas the soil has been filled or leveled during construction. In small areas it has been cut, built up, or smoothed.

Urban land consists of areas covered by buildings, streets, parking lots, and other structures. These structures so obscure or alter the soil that identification of the soil was not feasible.

Included in this map unit are small areas of poorly drained Peoga soils and somewhat poorly drained Weinbach soils in depressions. Also included are small areas of Shelocta soils on toe slopes and alluvial fans. Shelocta soils have a higher content of coarse fragments in the subsoil than the Elkinsville soil. Also included are areas of soils that are subject to rare flooding. Also included are areas of soils that have very gravelly loamy sand below a depth of 10 feet and that are probable sources of sand and gravel. Included areas make up about 20 percent of the unit.

Permeability is moderate in the Elkinsville soil. Available water capacity is high. Runoff is slow or medium.

The Elkinsville soil is used for lawns, gardens, and parks. It is well suited to lawns, trees, shrubs, and vegetable and flower gardens. Adding lime, fertilizer, mulch, and organic matter helps in establishing lawns and gardens. The surface layer crusts after hard rains. Establishing vegetation is difficult in the small included cut and fill areas unless covered with topsoil.

This Elkinsville soil is well suited to dwellings and septic tank absorption fields. Moderate shrinking and swelling limits the use of the soil for buildings. Laying properly designed foundations and footings and backfilling along foundations with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Providing a suitable base material for local roads and streets reduces the damage caused by low strength and frost action. Included areas that are subject to flooding are generally unsuited as a site for buildings.

The Elkinsville soil and Urban land are not assigned a capability classification, woodland ordination symbol, or pasture and hayland suitability group.

FaD—Fairpoint channery silty clay loam, 8 to 25 percent slopes

This is a deep, well drained, strongly sloping and moderately steep soil on mine spoil ridges in areas of surface mines for coal. The slopes are uneven. Some areas have been reclaimed by grading. The substratum consists of a mixture of rock fragments and partly weathered fine earth material that was within or below the profile of the original soil. The rock fragments are mostly shale and siltstone. They are flat and less than 10 inches long. Areas of this soil are long and narrow or irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is brown, friable channery silty clay loam about 2 inches thick. The substratum to a depth of 60 inches is multicolored, firm, very channery silty clay loam and very channery clay loam. Some areas have layers of substratum that are more acid or more alkaline. Some places have fewer coarse fragments. Some areas are either steeper or not as steep.

Included with this soil are small areas of Pinegrove soils. Also included are areas of Rarden, Lily, Clymer, Steinsburg, Upshur, and Gilpin soils. These soils have not been disturbed by mining activities. They have a subsoil. Pinegrove soils do not have a subsoil, are sandier, and are in areas derived from coarse, weakly cemented, acid sandstone. Included soils make up about 15 percent of the unit.

Permeability of the Fairpoint soil is moderately slow. The available water capacity is low. Runoff is rapid or very rapid. The depth of the root zone varies within short distances because of differences in the density of the soil material.

Most areas of this soil are idle grassland or brushland and woodland. Some areas are pasture.

This soil is generally unsuited to row crops and hay. The main limitations are droughtiness, numerous rock fragments throughout, and low fertility and organic matter content. Erosion is a severe hazard if this soil is plowed for seedbed preparation. Rock fragments on or near the soil surface may interfere with tillage equipment. Maintaining vegetative cover and mulching help to reduce runoff and to control erosion and improves infiltration and retention of water.

This soil is poorly suited to pasture. Some areas of this soil are in grasses. Areas that have not been limed and fertilized have thin stands of grass. No-till grass and legume mixtures work well where rock fragments on the surface are neither too large or numerous. Orchardgrass, tall fescue, and Korean lespedeza are some of the forages that grow best on this soil. Maintaining a vegetative cover helps to reduce runoff and to control erosion and improves infiltration and retention of water. Overgrazing causes surface compaction, excessive runoff, and reduced forage yields. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species.

This soil is moderately well suited to trees. Laying out logging roads and skid trails on or near the contour, installing water bars, and maintaining a vegetative cover help to control erosion. Trees selected for planting should tolerate droughty conditions. The surface layer is sticky when wet. Applying gravel or crushed stone on haul roads and log landings improves soil strength and traction. Laying out haul roads and log landings apart from active slips helps to stabilize the road base and to prevent soil slippage. Building haul roads and skid trails on the contour facilitates the use of equipment. Cutting and filling to a more desirable slope improve sites for landings. Special equipment is needed for site preparation and planting.

This soil is poorly suited to septic tank absorption fields. The moderately slow permeability, unstable fill material, and slope limit use of this soil for septic tank absorption fields. Enlarging the size of the leach field, backfilling trenches, and placing distribution lines on the contour help to overcome both slope and permeability. In regraded and settled spoil areas sanitary systems can be installed. In some areas an aeration sewage disposal system is needed.

In settled areas on slopes of 8 to 15 percent this soil is moderately well suited to buildings. Onsite investigation for depth to bedrock, the hazard of hillside slippage, and stormwater control is needed to determine the suitability for buildings. In yet unsettled areas or on slopes of 15 to 25 percent the soil is generally unsuited to buildings and septic tank absorption fields. In these areas the main limitations are slope and the hazard of slippage.

Providing artificial drainage and a suitable base material reduces the damage caused by low strength and frost action. Laying out local roads on the contour reduces the need for cutting and filling.

The land capability classification is VIs. A woodland ordination symbol is not assigned. The pasture and hayland suitability group is E-3.

GmD—Gilpin-Latham silt loams, 15 to 25 percent slopes

These are moderately deep, moderately steep soils on ridgetops and shoulder slopes. The Gilpin soil is well drained. It is on linear shoulder slopes. The Latham soil is moderately well drained. It is on convex summits of ridgetops and on some shoulder slopes. Areas of these soils generally are long and 60 to 300 feet wide. They range from 10 to 100 acres in size. Most areas are about 50 percent Gilpin silt loam and 35 percent Latham silt loam. The two soils are in areas so intricately mixed or so small in size that separating them in mapping was not practical.

Typically, the Gilpin soil has a surface layer of brown, friable silt loam about 2 inches thick. The subsoil is about 26 inches thick. In the upper part it is light yellowish brown and yellowish brown, friable silt loam. In the lower part it is strong brown, friable and firm silt loam and channery silt loam. Fractured sandstone and siltstone are at a depth of about 28 inches. In places bedrock is deeper. In some areas the subsoil has less sand and fewer coarse fragments. In some areas the lower part of the subsoil has gray mottles. In places the subsoil has more sand.

Typically, the Latham soil has a surface layer of dark brown, friable silt loam about 2 inches thick. The subsoil is about 25 inches thick. In the upper part it is yellowish brown and strong brown mottled, friable and firm silty clay loam and silty clay. In the lower part it is light yellowish brown and light brownish gray, mottled, firm silty clay. Weathered siltstone is at a depth of about 27 inches. In places bedrock is deeper. In some areas the subsoil has less clay. In small areas the subsoil has redder colors.

Included with this soil in mapping are areas of Coolville and Tilsit soils. Coolville and Tilsit soils are on wider, flatter ridgetops where the thick layer of silt loam has not been eroded. Also included are areas of shallow soils on narrow ridgetops and on small knobs. Included areas are less than 10 acres in size. They make up about 15 percent of the complex.

Permeability is moderate in the Gilpin soil and slow in the Latham soil. Available water capacity is low in both soils. Runoff is rapid. The shrink-swell potential is high in the Latham soil and low in the Gilpin soil. A perched seasonal high water table is at a depth of 1.5 to 3.0 feet in the Latham soil.

In most areas this soil is in native hardwoods. In some areas this soil is used for hay and pasture.

This soil is moderately well suited to trees. North- and east-facing slopes and coves are better sites for woodland than south- and west-facing slopes because of less evapotranspiration and cooler temperatures. Laying out logging roads and skid trails on or near the contour, installing water bars, and maintaining a vegetative cover help to control erosion. Planting seedlings that have been transplanted once will reduce the seedling mortality rate. The surface layer of the Latham soil is sticky when wet. Applying gravel or crushed stone on haul roads and log landings improves soil strength and traction. Laying out haul roads and log landings apart from active slips helps to stabilize the road base and to prevent soil slippage. Building haul roads and skid trails on the contour facilitates the use of equipment. On the Latham soil harvesting without leaving the remaining trees widely spaced or isolated will reduce the windthrow hazard. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting.

These soils are poorly suited to corn and small grain. They can be cropped successfully if the cropping sequence includes a high proportion of long-term hay or pasture. These soils are generally unsuited to soybeans. Erosion is a serious hazard, especially on long slopes. A conservation tillage system that leaves crop residue on the soil surface, cover crops, tillage at proper moisture content, and grassed waterways help to control erosion, to improve tilth, and to maintain organic matter content.

These soils are moderately well suited to hay and pasture. Overgrazing or grazing when the soils are wet causes surface compaction, excessive runoff, and reduced forage yields. Cover crops, companion crops, and no-till help to control erosion when the pasture is seeded. Proper stocking rates, pasture rotation, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species.

These soils are poorly suited to septic tank absorption fields. The main limitations are depth to bedrock and slope on both soils and slow permeability and the seasonal high water table on the Latham soil. On the Latham soil adding suitable fill material can elevate the absorption fields a sufficient distance above the bedrock and can improve the absorption of effluent. On the Latham soil installing interceptor drains upslope from the absorption fields helps to lower the seasonal high water table. On the Latham soil increasing the size of the absorption field helps to overcome slow permeability. On both soils installing distribution lines across the slope helps to prevent seepage of the effluent to the surface. In some areas an aeration sewage disposal system is needed.

These soils are poorly suited as a site for buildings. The main limitations are slope on both soils and the seasonal high water table, hazard of slippage, and high shrinking and swelling on the Latham soil. Designing the buildings to conform to the natural slope of the land reduces the need for cutting, filling, and land shaping in most areas and reduces the hazard of hillside slippage. On the Latham soil installing drains at the base of footings and coating the exterior basement walls help to overcome the seasonal high water table. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling of the Latham soil. Maintaining as much vegetation as possible on the construction site helps to control erosion. During building site development, erecting a retaining wall where an area has been cut and filled will prevent soil from moving downslope. Laying out local roads on the contour reduces cutting and filling. On the Latham soil providing a suitable base material and installing a drainage system reduce the damage to roads caused by frost action and low strength.

The land capability classification is IVe. The woodland ordination symbol is 4R for the Gilpin soil; on the Latham soil it is 4R for north aspect and 3R for south aspect. The pasture and hayland suitability group is F-1 for both aspects of both soils.

KaB—Kanawha silt loam, 2 to 6 percent slopes

This is a deep, well drained, gently sloping soil on fans along valley walls and terrace remnants at the heads of narrow stream valleys. Areas are long and narrow or fan-shaped. They range from 4 to 30 acres in size.

Typically, the surface layer is brown, friable silt loam about 11 inches thick. The subsoil is about 34 inches thick. In the upper part it is yellowish brown and strong brown, friable loam. In the lower part it is yellowish brown, friable clay loam and channery clay loam. The substratum to a depth of 80 inches is yellowish brown, friable loam and channery loam. In some areas the soil has less sand. In places the subsoil is strongly acid.

Included with this soil in mapping are small areas of Chagrin, Cuba, Orrville, and Stendal soils. These soils are on flood plains and are less developed in the subsoil. Orrville and Stendal soils are somewhat poorly drained. Also included, in narrow stream valleys of large watersheds, are some areas of soils subject to flash floods after intensive rainfall. Included soils make up about 10 percent of the unit.

Permeability of the Kanawha soil is moderate. The available water capacity is moderate or high. Runoff is medium.

Most acreage is cropland and pasture. A few small areas are used as woodland. Some areas are used for homesites.

This soil is well suited to corn, tobacco, soybeans, and small grain. If cultivated, erosion is a management concern. Cultivated crops can be grown year after year if erosion is controlled and management is improved. Conservation measures that maintain tilth and content of organic matter are needed. A conservation tillage system that leaves some crop residue on the soil surface, a cropping sequence that includes grasses and legumes, crop residue incorporated into the plow layer, contour farming or contour stripcropping, and grassed waterways help to maintain tilth, to reduce runoff, and to control erosion. Tilling within the optimum moisture range reduces surface compaction.

This soil is well suited to hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and reduced forage yields. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species.

This soil is well suited to trees. Removing vines and the less desirable trees and shrubs helps to reduce plant competition.

This soil is well suited to septic tank absorption fields. It is well suited to buildings. During construction maintaining a cover onsite for as long as possible helps to control erosion.

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

KaC—Kanawha silt loam, 6 to 12 percent slopes

This is a deep, well drained, strongly sloping soil on fans along valley walls and at the heads of narrow stream valleys. Areas are long and narrow or fan shaped and range from 5 to 30 acres in size.

Typically, the surface layer is brown, friable silt loam about 4 inches thick. The subsoil is yellowish brown, friable silt loam, loam, and channery loam about 42 inches thick. The substratum to a depth of about 60 inches is yellowish brown, friable loam. Some areas are moderately well drained. Some areas are more acid in the subsoil.

Included with this soil in mapping are small areas of Chagrin, Cuba, and Vandalia soils. Chagrin and Cuba soils are on flood plains. They are less developed in the subsoil. Vandalia soils are on foot slopes. They have more clay in the subsoil. Included soils make up about 10 percent of the unit.

Permeability of the Kanawha soil is moderate. The available water capacity is moderate or high. Runoff is rapid.

Most areas of this soil are in cropland, hay, or pasture. A few small areas are in native hardwoods.

This soil is moderately well suited to corn, soybeans, and small grain. It can be cropped successfully if the cropping sequence includes a high proportion of long-term hay or pasture. Erosion is a hazard, especially if slopes are long. A conservation tillage system that leaves crop residue on the surface, cover crops, tillage at the proper moisture content, and grassed waterways help to control erosion, to improve tilth, and to maintain the organic matter content.

This soil is well suited to hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and reduced forage yields. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a good stand of key forage species.

This soil is well suited to trees. Cutting and filling to a more desirable slope improve sites for log landings. Removing vines and less desirable trees and shrubs helps to reduce plant competition.

This soil is moderately well suited to dwellings and septic tank absorption fields. Designing buildings to conform to the natural slope of the land reduces the need for cutting, filling, and land shaping in most areas and reduces the hazard of hillside slippage. Installing septic tank distribution lines on the contour helps to prevent seepage of the effluent to the surface. In some areas an aeration sewage disposal system is needed. Maintaining as much vegetation as possible on the construction site helps to control erosion.

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

Kg—Kyger loamy sand, frequently flooded

This is a deep, very poorly drained, nearly level soil on flood plains and alluvial fans. It is subject to flooding several times a year. Mine sediment has built up at the edge of the stream. In some areas ponds remain for several months after floodwaters recede. Acidity in the surface layer is high. Most areas of this soil are long and narrow and range from 10 to 65 acres in size. Slope ranges from 0 to 3 percent.

Typically, this soil consists of more than 40 inches of overwash sediments. The surface layer is yellowish brown, loose loamy sand about 12 inches thick. The substratum extends to a depth of about 60 inches. In the upper part it is stratified, brown, loose loamy sand and gray, very friable loam. In the lower part it is gray and grayish brown, friable silt loam. In places the surface layer has less sand. In some areas the soil is somewhat poorly drained.

Included with this soil in mapping and making up about 10 percent of most areas are small areas of soils along stream channels. These soils consist of acid, sandy outwash sediment to a depth of more than 3.0 feet.

Permeability of the Kyger soil is moderate or moderately rapid. Available water capacity is moderate or high. Runoff is very slow or ponded. A seasonal high water table is near or above the soil surface during extended wet periods.

This soil is used for habitat for wetland wildlife and for woodland.

This soil is generally unsuited for cropland, pasture, or woodland. Drainage is not practical because sediment in stream channels blocks drainage outlets. Many drainageways and stream channels block drainage outlets. Sediment has completely filled many drainageways and stream channels. Fluctuating water levels limit the survival of many trees. Most areas provide habitat for ducks, muskrat, beaver, and other wetland wildlife.

This soil is generally unsuited to septic tank absorption fields and buildings. The main limitations are flooding and the seasonal high water table.

The land capability classification is VIw. The woodland ordination symbol and pasture and hayland suitability group are not assigned.

LaD—Lakin loamy fine sand, 8 to 25 percent slopes

This is a deep, strongly sloping to moderately steep, excessively drained soil. It is on terrace slope breaks and on the leeward side of major stream valleys. Areas of this soil are long and broad or irregular in shape. They range from 5 to 50 acres in size.

Typically, the surface layer is brown, very friable loamy fine sand about 11 inches thick. The subsurface layer is yellowish brown, loose fine sand about 6 inches thick. The subsoil is about 34 inches thick. It is yellowish brown, loose fine sand that has thin bands of dark brown, loose loamy fine sand. The substratum is yellowish brown, loose fine sand to a depth of about 80 inches. In some areas the soil has less sand and more clay. In some places the subsoil has more gravel.

Included with this soil in mapping are small areas of Shelocta, Steinsburg, Watertown, and Wheeling soils. Shelocta and Steinsburg soils are well drained and are on upper side slopes. Watertown and Wheeling soils have more gravel in the lower part of the subsoil and in the substratum. They are intermingled with this Lakin soil on terrace slope breaks. Included soils make up about 20 percent of most areas of this Lakin soil.

Permeability of the Lakin soil is rapid. Available water capacity is low. Runoff is medium or rapid.

Most areas of this soil are used for hayland and pasture. A few small areas are in native hardwoods.

This soil is poorly suited to corn, soybeans, and small grain on slopes of 8 to 15 percent and generally unsuited on slopes of 15 to 25 percent. Droughtiness is a hazard, especially during long, dry periods. It can be cropped successfully on slopes of 8 to 15 percent if the cropping sequence includes a high proportion of long-term hay or pasture. Erosion is a hazard if this soil is used for cultivated crops. A conservation tillage system that leaves crop residue on the surface, cover crops, tillage at the proper moisture content, and grassed waterways help to control erosion, to improve tilth, and to maintain the organic matter content.

The soil is moderately well suited to hay and pasture on slopes of 8 to 15 percent and poorly suited on slopes of 15 to 25 percent. In spring it dries early and is well suited to grazing. Overgrazing or grazing when the soil is wet causes surface compaction, increased runoff, and reduced forage yields. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species.

This soil is moderately well suited to drought-resistant trees. Planting seedlings that have been transplanted once and mulching around seedings will reduce the seedling mortality rate. Building haul roads and skid rails on the contour facilitates the use of equipment. Cutting and filling to a more desirable slope improve sites for log landings.

This soil is moderately well suited as a site for buildings and septic tank absorption fields. Because of the rapid permeability in the substratum, the effluent in septic tank absorption fields is not adequately filtered and can pollute the ground water. Installing the absorption field in suitable fill material or installing an aeration sewage disposal system reduces the hazard of ground water pollution. Buildings should be designed to conform to the natural slope of the land. Laying out local roads on the contour reduces cutting and filling. Seeding roadcuts helps to control erosion.

The land capability classification is VIs. The woodland ordination symbol is 3S. The pasture and hayland suitability group is B-1.

LhD—Latham-Steinsburg complex, 15 to 25 percent slopes

These are moderately deep, moderately steep soils on shoulder slopes and narrow ridgetops on uplands. The Latham soil is moderately well drained. It is on the wider shoulder slopes. The Steinsburg soil is well drained. It is on narrow ridgetops and on a few shoulder slopes. Most areas of these soils are long and about 20 to 150 feet wide. Areas range from 5 to 50 acres in size. They are about 40 percent Latham silt loam and 35 percent Steinsburg sandy loam. Because of present and anticipated use of these soils, separating them in mapping was considered impractical or unnecessary.

Typically, the Latham soil has a surface layer of dark grayish brown, friable silt loam about 3 inches thick. The subsoil is about 29 inches thick. In the upper part it is yellowish brown, friable silt loam and silty clay loam. In the lower part it is brownish yellow and light gray, mottled, firm silty clay loam. Slightly weathered siltstone is at a depth of about 32 inches. In some areas the subsoil has less clay. In a few areas the soil is redder.

Typically, the Steinsburg soil has a surface layer of dark grayish brown, friable sandy loam about 2 inches thick. The subsoil is about 15 inches thick. It is yellowish brown and strong brown, friable sandy loam. The substratum to a depth of 25 inches is yellowish red, friable channery sandy loam. Weakly cemented sandstone is at a depth of 25 inches. In places sandstone or siltstone is at a depth of less than 24 or more than 40 inches. In some areas the surface layer is channery sandy loam. In other areas the subsoil has a higher content of clay or more coarse fragments.

Included with these soils in mapping are areas of Coolville, Gilpin, Lily, and Tilsit soils. Coolville and Tilsit soils are on wide ridgetops. They are deep to bedrock. Gilpin and Lily soils, in the subsoil, have more clay than the Steinsburg soil and less clay than the Latham soil. Gilpin and Lily soils are on wider parts of ridgetops and shoulder slopes. Included areas are less than 10 acres in size. They make up about 15 percent of the complex.

Permeability is slow in the Latham soil and moderately rapid in the Steinsburg soil. Available water capacity is low in the Latham soil and very low in the Steinsburg soil. Surface runoff is very rapid. Shrink-swell potential is high in the Latham soil. The Latham soil has a perched seasonal high water table at a depth of 1.5 to 3.0 feet during extended wet periods.

Most areas of these soils are in native hardwoods.

These soils are moderately well suited to trees. North- and east-facing slopes and coves are better sites for woodland than south- and west-facing slopes because of less evapotranspiration and cooler temperatures. Laying out logging roads and skid trails on or near the contour, installing water bars, and maintaining a vegetative cover help to control erosion. Planting seedlings that have been transplanted once will reduce the seedling mortality rate. The surface layer of the Latham soil is sticky when wet. Applying gravel or crushed stone on haul roads and log landings improves soil strength and traction. Laying out haul roads and log landings apart from active slips helps to stabilize the road base and to prevent soil slippage. Building haul roads and skid trails on the contour facilitates the use of equipment. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting. Harvesting without leaving the remaining trees widely spaced or isolated will reduce the windthrow hazard.

These soils are generally unsuited to row crops. The main limitations are slope and the severe erosion hazard.

These soils are poorly suited to hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and reduced forage yields. Cover crops, companion crops, and no-till help to control erosion when the pasture is seeded. Proper stocking rates, pasture rotation, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species.

These soils are generally unsuited to septic tank absorption fields and dwellings. The main limitations are slope and depth to bedrock on both soils and the seasonal high water table, high shrinking and swelling, hazard of slippage, and slow permeability on the Latham soil.

The land capability classification is VIe. The woodland ordination symbol for both soils is 4R on north aspect and 3R on south aspect. The pasture and hayland suitability group is F-1 for both soils.

LkB—Licking silt loam, 1 to 6 percent slopes

This is a deep, moderately well drained, nearly level and gently sloping soil on high terraces along major streams. Most areas of this soil are rounded or irregular in shape. Areas range from 5 to 120 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 47 inches thick. In the upper part it is yellowish brown, friable silty clay loam. In the lower part it is yellowish brown, mottled, firm silty clay. The substratum to a depth of 80 inches is brown, mottled, firm silty clay. In some areas the upper part of the subsoil has less silt.

Included with this soil in mapping are small areas of Elkinsville, Kanawha, McGary, Omulga, and Vandalia soils. Elkinsville soils have less clay in the subsoil than the Licking soil. They are on slightly lower terraces along streams. Kanawha soils have more coarse fragments throughout the soil than the Licking soil. They are on alluvial fans. McGary soils are somewhat poorly drained. They are in slight depressions. Omulga soils, which have a fragipan, are in similar positions to those of the Licking soil. Vandalia soils have redder colors in the subsoil than the Licking soil. They are on slope breaks to uplands. Included soils make up about 15 percent of this soil.

Permeability of the Licking soil is slow. The available water capacity is moderate. Runoff is medium. The shrink-swell potential is high in the substratum. A seasonal high water table is between depths of 1.5 and 3.0 feet during extended wet periods.

Most areas are used for cropland and pasture. Some small areas are in native hardwoods.

This soil is well suited to corn, soybeans, small grain, and tobacco. Erosion is a serious hazard, especially on long slopes. A conservation tillage system that leaves crop residue on the soil surface, cover crops, tillage at the proper moisture content, and grassed waterways help to control erosion, to improve tilth, and to maintain the organic matter content.

This soil is well suited to hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and reduced forage yields. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a good stand of key forage species.

This soil is well suited to trees. Applying gravel or crushed stone on haul roads and log landings improves soil strength. Removing vines and the less desirable trees and shrubs helps to reduce plant competition. Harvesting without leaving the remaining trees widely spaced or isolated will reduce the windthrow hazard.

This soil is poorly suited to septic tank absorption fields. The main limitations are the restricted permeability and the seasonal high water table. Increasing the size of the absorption area helps to overcome these limitations. Installing perimeter drains around the absorption field helps to lower the seasonal high water table. In some areas an aeration sewage disposal system is needed.

This soil is poorly suited to dwellings. Because of the seasonal high water table and high shrinking and swelling, it is better suited to houses without basements than to houses with basements. Laying out properly designed foundations and footings and backfilling excavations around walls and foundations with a low shrink-swell material help to prevent the structural damage caused by shrinking and swelling. Drains at the base of footings and exterior basement wall coatings to help prevent wet basements. Maintaining as much vegetative cover as possible on the site during construction helps to control erosion. Providing artificial drainage and a suitable base material reduces the damage to local roads caused by the seasonal high water table and shrinking and swelling.

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

LnC2—Licking silty clay loam, 6 to 12 percent slopes, eroded

This is a deep, moderately well drained, strongly sloping soil on high terraces. Erosion has removed part of the original surface layer. The present surface layer consists of a mixture of the original surface layer and the subsoil. Most areas of this soil are circular or long and narrow. Areas range from 5 to 20 acres in size.

Typically, the surface layer is brown, friable silty clay loam about 6 inches thick. The subsoil is about 54 inches thick. In the upper part it is strong brown, firm silty clay loam. In the lower part it is strong brown and yellowish brown, mottled, firm silty clay. The substratum is brown, mottled, firm silty clay to a depth of 80 inches. In some areas the surface layer is silt loam. In a few places the subsoil has less clay. In places the soil is well drained.

Included with this soil in mapping are small areas of Omulga and Vandalia soils. Omulga soils, which have a fragipan, are in landscape positions similar to those of the Licking soil. Vandalia soils are well drained. They are on slope breaks to uplands. Included soils make up about 10 percent of this soil.

Permeability of the Licking soil is slow. Available water capacity is moderate. Runoff is rapid. The shrink-swell potential is high in the substratum. A perched high water table is between depths of 1.5 and 3.0 feet during extended wet periods.

Most areas are used as cropland and pasture. A few areas along streams are in woodland.

This soil is poorly suited to corn, soybeans, and small grain. It can be cropped successfully if the cropping sequence includes long-term hay or pasture. Erosion is a serious hazard, especially on long slopes. A conservation tillage system that leaves crop residue on the soil surface, cover crops, tillage at proper moisture content, and grassed waterways help to control erosion, to improve tilth, and to maintain the organic matter content.

This soil is moderately well suited to hayland and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and reduced forage yields. Cover crops, companion crops, and no-till help to control erosion when the pasture is seeded. Proper stocking rates, pasture rotation, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species.

This soil is moderately well suited to trees. Removing vines and the less desirable trees and shrubs helps to reduce plant competition. Applying gravel or crushed stone on haul roads and log landings improves soil strength. Harvesting without leaving the remaining trees widely spaced or isolated reduces the windthrow hazard.

This soil is poorly suited to septic tank absorption fields. The main limitations are the restricted permeability and the seasonal high water table. Enlarging the absorption area helps to overcome these limitations. Installing the distribution lines across the slope reduces the seepage of effluent to the surface. Installing perimeter drains around the absorption field helps to lower the seasonal high water table. In some areas an aeration sewage disposal system is needed.

This soil is poorly suited to dwellings. Because of the seasonal high water table and high shrinking and swelling, it is better suited to houses without basements than to houses with basements. Laying properly designed foundations and footings and backfilling excavations around walls and foundations with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Designing buildings to conform to the natural slope of the land helps to control erosion. Maintaining as much vegetation as possible on the construction site also helps to control erosion. Installing a drainage system and providing a suitable base material reduce the damage to local roads caused by low strength and by shrinking and swelling.

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

LtC—Lily loam, 8 to 15 percent slopes

This is a moderately deep, well drained, strongly sloping soil on ridgetops and shoulder slopes. Most areas of this soil are long, narrow, and 100 to 200 feet wide. Areas range from 5 to 75 acres in size.

Typically, the surface layer is brown, friable loam about 2 inches thick. The subsurface layer is yellowish brown, friable loam 6 inches thick. The subsoil is about 22 inches thick. It is yellowish brown and strong brown, friable loam and sandy clay loam. Sandstone is at a depth of about 30 inches. In places the depth to bedrock is more than 40 inches. Some areas have less sand in the subsoil.

Included with this soil in mapping are small areas of Latham, Rarden, and Steinsburg soils. Latham and Rarden soils have more clay in the subsoil. They are on the wider, flatter parts of ridgetops. Steinsburg soils have less clay in the subsoil and are in positions similar to those of the Lily soil. Also included are areas of shallow soils. These soils have more fragments in the subsoil than the Lily soil. They are on narrow parts of the ridge and in higher areas. Included soils make up about 10 percent of the unit.

Permeability of the Lily soil is moderately rapid. The available water capacity is low. Runoff is rapid.

Most areas of this soil are used for woodland. Some areas are used for hayland and pasture.

This soil is moderately well suited to corn, soybeans, and small grain. It can be cropped successfully if the cropping system includes a high proportion of long-term hay or pasture. Erosion is a serious hazard, especially on long slopes. A conservation tillage system that leaves crop residue on the soil surface, cover crops, tillage at the proper moisture content, and grassed waterways help to control erosion, to improve tilth, and to maintain the organic matter content.

This soil is well suited to hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and reduced forage yields. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species.

This soil is well suited to trees. Depth to bedrock and slope are moderate limitations for haul roads and log landings. Building haul roads and skid trails on or near the contour facilitates the use of equipment and helps to control erosion. Blasting is required in deep excavations for haul roads and log landings, which can be located on better suited soils nearby. Cutting and filling to a more desirable slope improve sites for log landings.

These soils are poorly suited to septic tank absorption fields. The main limitation is depth to bedrock. Adding a suitable fill material will elevate the absorption field a sufficient distance above the bedrock. In some areas an aeration sewage disposal system is needed.

This soil is moderately well suited to dwellings. The main limitations are slope and depth to bedrock. In most areas land shaping is needed. Because of depth to bedrock, this soil is better suited to houses without basements than to houses with basements. Maintaining as much vegetative cover as possible on the site during construction helps to control erosion. Laying out local roads on the contour reduces cutting and filling.

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

LtD—Lily loam, 15 to 25 percent slopes

This is a moderately deep, well drained, moderately steep soil on narrow ridgetops, shoulders, and saddle positions. Most areas of this soil are long, narrow, and 60 to 200 feet wide. Areas range from 5 to 80 acres in size.

Typically, the surface layer is brown, friable loam about 1 inch thick. The subsoil is about 23 inches thick. In the upper part it is yellowish brown, friable loam. In the lower part it is strong brown and yellowish red, friable clay loam. Yellowish brown sandstone is at a depth of 24 inches or more. In some areas the subsoil has less sand. In a few small areas the lower part of the subsoil has gray colors. In places the surface layer is silt loam or sandy loam.

Included with this soil in mapping are small areas of Latham, Rarden, and Steinsburg soils. Latham and Rarden soils are moderately well drained and on the wider parts of ridgetops. Steinsburg soils are close to slope breaks or in higher areas. They have less clay than the Lily soil.

Permeability of the Lily soil is moderately rapid. Available water capacity is low. Runoff is very rapid.

Most areas of this soil are used for woodland. Some areas are used for hay and pasture.

This soil is poorly suited to corn, soybeans, and small grain. It can be cropped successfully if the cropping system includes a high proportion of long-term hay or pasture. Erosion is a serious hazard, especially on long slopes. A conservation tillage system that leaves crop residue on the soil surface, cover crops, tillage at proper moisture content, and grassed waterways help to control erosion, to improve tilth, and to maintain the organic matter content.

This soil is moderately well suited to hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and reduced forage yields. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species. Mulching the surface when reseeding or using a no-till seeder conserves moisture and helps to control erosion during pasture renovation. In some areas deep-rooted legumes are difficult to maintain. Highly dissected areas on moderately steep slopes hinder use of some farm machinery. Many areas of this soil that were in pasture are reverting to brush and woodland.

This soil is moderately well suited to trees. North- and east-facing slopes and coves are better sites for woodland than south- and east-facing slopes because of less evapotranspiration and cooler temperatures. Laying out logging roads and skid trails on or near the contour, installing water bars, and maintaining a vegetative cover help to control erosion. On south aspects planting seedlings that have been transplanted once reduces the seedling mortality rate. Removing vines and the less desirable trees and shrubs helps to reduce plant competition. Blasting is required in deep excavations for haul roads and log landings. Some of the bedrock is rippable with construction equipment. Building haul roads and skid trails on the contour facilitates the use of equipment. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting.

This soil is poorly suited to septic tank absorption fields. The main limitations are moderately steep slope and moderately deep bedrock. Adding a suitable fill material will elevate the absorption field a sufficient distance above bedrock. Installing the distribution lines across the slope helps to prevent the seepage of effluent to the surface. In some areas an aeration sewage disposal system is needed.

This soil is poorly suited to dwellings. The main limitations are moderately steep slopes and moderately deep bedrock, which makes excavation difficult. This soil is better suited to dwellings without basements than to those with basements. Regrading a potential homesite helps to offset slope. Bedrock between depths of 20 to 40 inches limits regrading. Laying out properly landscaped building sites helps to divert surface water away from the foundation and to overcome slope. Providing artificial drainage improves local roads. Building roads on the contour, where possible, reduces cutting and filling. Maintaining as much vegetation as possible on the construction site helps to control erosion.

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

McA—McGary silt loam, 0 to 2 percent slopes

This deep, somewhat poorly drained, nearly level soil is on flats on high terraces in valleys. Most areas are long and broad or irregularly shaped. Areas range from 5 to 20 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 8 inches thick. The subsoil is about 36 inches thick. In the upper part it is light yellowish brown and light brownish gray, mottled, friable, silty clay loam. In the lower part it is yellowish brown, mottled, firm silty clay. The substratum to a depth of 80 inches is brown, mottled, friable silty clay loam. In some places the upper part of the subsoil has less clay.

Included with this soil in mapping are narrow strips of moderately well drained Licking soils on slight rises and small areas of poorly drained Peoga soils in depressions. Also included are some areas of soils that are subject to ponding. Included areas make up about 15 percent of most areas.

Permeability of the McGary soil is slow or very slow. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is high. A perched seasonal high water table is between depths of 1.0 and 3.0 feet during extended wet periods.

Most areas of this soil are used for pasture or cropland.

In drained areas, this soil is moderately well suited to row crops and small grain. In undrained areas, it is poorly suited to row crops. The seasonal high water table is the main limitation for row crops. Surface and subsurface drains are used to remove excess water where adequate outlets are available. Subsurface drains are more effective if placed close together because of the high clay content. Returning crop residue to the soil and regularly adding other organic material help to improve fertility, to reduce crusting, and to increase the rate of water infiltration. Tilling within the optimum moisture range reduces surface compaction and improves tilth.

In drained areas this soil is well suited to hay and pasture. In undrained areas it is poorly suited to grazing early in spring. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and reduced forage yields. Stands of deep-rooted legumes are difficult to maintain. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species. In establishing new stands, forage species that tolerate the seasonal high water table are preferred for planting.

This soil is moderately well suited to trees. The seasonal high water table and low strength restrict logging to when the soil is frozen or drier. Site preparation and planting can be done during dry periods. Planting techniques that spread the roots of seedlings and that increase soil-root contact reduce the seedling mortality rate. Harvesting without leaving the remaining trees widely spaced or isolated will reduce the windthrow hazard. Trees that tolerate the seasonal high water table are needed for planting on this soil.

This soil is poorly suited as a site for septic tank absorption fields. The main limitations are very slow permeability and the seasonal high water table. Increasing the size of the absorption field helps to overcome the restricted permeability. Installing perimeter drains around the absorption field helps to lower the seasonal high water table. In some areas an aeration sewage disposal system is needed.

This soil is poorly suited to buildings. Because of the seasonal high water table and high shrinking and swelling, it is better suited to houses without basements than to houses with basements. Laying out properly landscaped building sites helps to keep surface water away from foundations. Laying properly designed foundations and footings and backfilling excavations around walls and foundations with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Maintaining as much vegetative cover as possible during construction helps to control erosion. Installing a roadside drainage system and providing a suitable base material reduce the damage to local roads caused by shrinking and swelling and low strength. The included soils that are subject to ponding are generally unsuitable to buildings.

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

Me—Melvin silt loam, ponded

This is a deep, poorly drained, nearly level soil on flood plains. It is subject to frequent flooding of long duration. It is ponded most of the year. The depth of ponded water fluctuates with the amount of runoff from surrounding, higher, adjacent soils. Slope is 0 to 1 percent. Most areas are irregularly shaped and range from 2 to 25 acres in size.

Typically, the surface layer is dark grayish brown, mottled, friable silt loam about 6 inches thick. The substratum to a depth of about 60 inches is olive gray, mottled, friable silty clay loam and silt loam. In places the soil has more sand throughout. In some areas it has more clay.

Permeability of the Melvin soil is moderate. Available water capacity is very high. Runoff is ponded. The seasonal high water table is near or above the surface.

Most areas are in wetland vegetation and are used as habitat for wetland wildlife.

This soil is generally unsuited to cropland, pasture, woodland, building site development, and septic tank absorption fields. The main limitations are frequent flooding, ponding, and moderate permeability. Drainage outlets cannot be easily established. The fluctuating water level limits the survival of many trees. Most areas provide good habitat for beavers, ducks, muskrats, and other wetland wildlife.

The land capability classification is Vw. A woodland ordination symbol or pasture and hayland suitability group is not assigned.

MrB—Morristown channery silty clay loam, 0 to 8 percent slopes

This is a deep, well drained, nearly level and gently sloping soil on ridges of mine spoil in areas of surface coal mines. The soil has been graded and smoothed. It consists of a mixture of rock fragments and partly weathered fine earth material that was within or below the profile of the original soil. Rock fragments are flat and less than 10 inches long. Most areas of this soil are long, narrow, and winding or are broad, circular, and 150 to 1,000 feet in width. Areas range from 10 to 30 acres in size.

Typically, the surface layer is yellowish red, friable channery silty clay loam about 4 inches thick. The substratum to a depth of 60 inches is multicolored, firm channery silty clay loam and very channery silty clay loam. In some areas the soil is more acid throughout or is steeper.

Included with this soil in mapping are small areas of Gilpin and Upshur soils. These soils have not been disturbed by mining. They have a subsoil. Also included are small areas of toxic soils that do not support vegetation. Included soils make up about 10 percent of the unit.

Permeability of the Morristown soil is moderately slow. Available water capacity is low. Runoff is slow or medium. The depth of the root zone varies within short distances because of differences in the density of soil material.

Most areas of this soil are used for pasture.

This soil generally is unsuited to row crops and poorly suited to hay. It is a poor growing medium for roots because of its droughtiness and low fertility. The surface layer is channery, has a weak structure, and puddles and crusts easily. Erosion is a severe hazard if the soil is tilled for reseeding. Maintaining a permanent plant cover helps to control erosion.

This soil is moderately well suited or poorly suited to pasture. If the pasture is overgrazed or plowed during seedbed preparation, erosion is a severe hazard. No-till with grass and legume mixtures works well on this soil. Orchardgrass, tall fescue, and Korean lespedeza grow well on this soil. Overgrazing causes surface compaction, excessive runoff, and reduced forage yields. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species.

This soil is moderately well suited to trees. Planting seedlings that have been transplanted once and mulching around seedlings reduce the seedling mortality rate. The surface layer is sticky when wet. Applying gravel or crushed stone on haul roads and log landings helps to improve soil strength and traction.

This soil is suited to alkaline- and drought-tolerant trees. Grasses and legumes provide ground cover during the establishment of trees. Mechanical planting is practical on this soil. The surface layer is sticky when wet.

In settled areas this soil is moderately well suited to buildings and poorly suited to septic tank absorption fields. Onsite investigation for depth to bedrock and stormwater control is needed to determine the suitability for buildings and septic tank absorption fields. The main limitation for septic tank absorption fields is the moderately slow permeability. Increasing the size of the absorption field increases the absorption of effluent. In unsettled areas the soil is generally unsuited to buildings and septic tank absorption fields. Providing suitable material under local roads and streets reduces the damage of frost action.

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

MrD—Morristown channery silty clay loam, 8 to 25 percent slopes

This is a deep, well drained, strongly sloping and moderately steep soil on ridges, side slopes, and benches in areas surface mined for coal. The slopes are uneven. The soil consists of a mixture of rock fragments and partly weathered fine earth material that was within or below the profile of the original soil. The rock fragments consist mainly of shale, siltstone, limestone, and sandstone. Most areas are long and narrow or irregular in shape. Areas range from 5 to 250 acres in size.

Typically, the surface layer is light olive brown, friable channery silty clay loam about 3 inches thick. The substratum is multicolored, friable, channery to extremely channery silty clay loam to a depth of about 60 inches. In some areas it is more acid. In some areas slope is more than 25 percent.

Included with this soil in mapping are small areas of Gilpin, Latham, Lily, Upshur, and Steinsburg soils. These soils have not been disturbed by mining. They have a subsoil. Included soils make up about 15 percent of the unit.

Permeability of the Morristown soil is moderately slow. Available water capacity is low. Runoff is rapid or very rapid. The depth of the root zone varies within short distances because of differences in the density of soil material.

Most areas of this soil are in grass. A few areas are woodland.

This soil is generally unsuited to row crops and hay. The main limitations are droughtiness, numerous rock fragments throughout, and low fertility and organic matter content. Erosion is a severe hazard if this soil is plowed for seedbed preparation. Rock fragments on or near the soil surface may interfere with tillage equipment. Maintaining a vegetative cover and mulching help to reduce runoff and to control erosion and improve infiltration and retention of water.

This soil is poorly suited to pasture. No-till grass and legume mixtures work well where rock fragments on the surface are not too large or numerous. Orchardgrass, tall fescue, and Korean lespedeza are some of the forages that grow well on this soil. Maintaining vegetative cover helps to reduce runoff, to control erosion, and to improve infiltration and retention of water. Overgrazing causes surface compaction, excessive runoff, and reduced forage yields. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a good stand of key forage species.

This soil is moderately well suited to trees. Laying out logging roads and skid trails on or near the contour, installing water bars, and maintaining a vegetative cover help to control erosion. Planting seedlings that have been transplanted once and mulching around seedlings will reduce the seedling mortality rate. The surface layer is sticky when wet. Applying gravel or crushed stone on haul roads and log landings improves soil strength and traction. Laying out haul roads and log landings apart from active slips helps to stabilize the road base and to prevent soil slippage. Building haul roads and skid trails on the contour facilitates the use of equipment. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting.

In settled areas on slopes of 8 to 15 percent this soil is moderately well suited to buildings and poorly suited to septic tank absorption fields. Onsite investigation for depth to bedrock, the hazard of hillside slippage, and stormwater control is needed to determine the suitability for buildings and septic tank absorption fields. The main limitations for septic tank absorption fields are slope and moderately slow permeability. Placing distribution lines on the contour reduces lateral seepage of effluent to the surface. Increasing the size of the absorption field helps to overcome the moderately slow permeability. In yet unsettled areas or on slopes of 15 to 25 percent this soil is generally unsuited to buildings and septic tank absorption fields. The main limitations are slope and the hazard of slippage. Laying out local roads on the contour reduces the need for cutting and filling.

The land capability classification is VIs. A woodland ordination symbol is not assigned. The pasture and hayland suitability group is E-3.

MrF—Morristown channery silty clay loam, 25 to 70 percent slopes

This is a deep, well drained steep and very steep soil on side slopes in areas surface mined for coal. The slopes are uneven. Slope is dominantly 25 to 70 percent. In some areas it is more than 70 percent. This soil consists of a mixture of rock fragments and partly weathered fine earth material that was within or below the profile of the original soil. Rock fragments are mainly limestone, shale, siltstone, and some sandstone. Most areas are on outer slopes of surface-mined areas where the spoil was placed on hillsides. Other areas are narrow spoil ridges below a highwall and contain long, narrow pools of water. Most areas are long and narrow or irregularly shaped. Areas range from 5 to 60 acres in size.

Typically, the surface layer is brown, friable channery silty clay loam about 1 inch thick. The substratum to a depth of 80 inches is multicolored, firm and very firm channery silty clay loam and very channery silty clay loam. Some areas have layers that are more acid. Some places have fewer coarse fragments. Some areas are not as steep.

Included with this soil in mapping are small areas of Latham, Pinegrove, Shelocta, Steinsburg, and Upshur soils. Latham, Shelocta, Steinsburg, and Upshur soils have not been disturbed by mining. They have a subsoil. Pinegrove soils have more sand throughout. Also included are small areas of toxic soils that do not support vegetation. Included soils make up about 15 percent of the unit.

Permeability of the Morristown soil is moderately slow. Available water capacity is low. Runoff is very rapid. The depth of the root zone varies within short distances because of differences in the density of the soil material.

Most areas of this soil have a sparse cover of pasture or woodland.

This soil is generally unsuited to cropland and pasture. The main limitations are steep and very steep slope, droughtiness, low fertility, and very low organic matter content. The high content of rock fragments in the surface layer impedes or prevents conventional tillage. Erosion is a severe hazard. Areas that have been limed and fertilized generally support thin stands of grasses interspersed with barren spots. Maintaining a vegetative cover and mulching help to reduce runoff, to control erosion, and to increase water infiltration.

This soil is moderately well suited to trees. Laying out logging roads and skid trails on or near the contour, installing water bars, and maintaining a vegetative cover help to control erosion. Planting seedlings that have been transplanted once and mulching around seedlings reduce the seedling mortality rate. Laying out haul roads and log landings apart from active slips helps to stabilize the road base and to prevent soil slippage. Building haul roads and skid trails on the contour facilitates the use of equipment. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting.

This soil is generally unsuited to sanitary facilities and buildings. The main limitations are slope, the hazard of hillside slippage, and moderately slow permeability.

The land capability classification is VIIe. A woodland ordination symbol is not assigned. The pasture and hayland suitability group is H-1.

No—Nolin silt loam, occasionally flooded

This is a deep, well drained, nearly level soil on flood plains. Most areas are wide, long and narrow, and circular or irregularly shaped. They range from 5 to 400 acres in size. Slope ranges from 0 to 3 percent.

Typically, the surface layer is dark grayish brown, friable silt loam about 11 inches thick. The subsoil, to a depth of 54 inches, is brown and dark yellowish brown, friable silt loam. The substratum to a depth of 80 inches is dark brown, friable silt loam. Some areas have a darker colored surface layer. In places the subsoil has more sand. In a few places the surface layer has more gravel. In places the subsoil is more acid. In some areas the soil is subject to frequent flooding.

Included with this soil in mapping are small areas of Peoga and Stendal soils. Peoga soils are poorly drained and are in swales on low stream terraces. Stendal soils are somewhat poorly drained and are in slight depressions and in drainageways. Included soils make up about 15 percent of the unit.

Permeability of the Nolin soil is moderate. Available water capacity is very high. Runoff is slow. The surface layer can be easily tilled throughout a fairly wide range in moisture content. The seasonal high water table is at a depth of 3.0 to 6.0 feet during extended wet periods.

Most areas of this soil have been cleared for cropland. A few small areas are in native hardwoods.

This soil is well suited to corn and soybeans. Flooding in winter and spring damages small grain, such as winter wheat. In some years flooding in spring delays planting. Returning crop residue to the soil and regularly adding other organic material improve fertility, reduce crusting, and increase the rate of water infiltration. Tilling within the optimum moisture range reduces surface compaction, maintains soil structure, and improves tilth.

This soil is well suited to hay and pasture. Overgrazing or grazing when the soils are wet causes surface compaction, increased runoff, and reduced forage yields. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a good stand of key forage species.

This soil is well suited to trees. Spraying, cutting, or girdling undesirable trees and shrubs helps to reduce plant competition. Adding gravel or crushed stone on haul roads and log landings improves soil strength.

This soil is generally unsuitable as a site for dwellings and septic tank absorption fields. The main limitation is flooding. It is well suited to picnic areas and paths and trails. If protected from flooding, it is moderately well suited to campgrounds and playgrounds.

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

OmC2—Omulga silt loam, 6 to 15 percent slopes, eroded

This is a deep, moderately well drained, strongly sloping soil on terrace remnants in dissected parts of preglacial valleys. Most areas of this soil are long and narrow. Areas 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 45 inches thick. In the upper part it is yellowish brown and strong brown, friable and firm silt loam. In the middle part it is a yellowish brown, very firm and brittle silt loam fragipan. In the lower part it is yellowish brown, firm silty clay loam. The subsoil is mottled below a depth of about 26 inches. The substratum to a depth of about 80 inches is light brownish gray, firm silty clay and light olive brown, firm silty clay loam. In a few areas the soil has more sand throughout. In places the upper part of the subsoil has gray mottles. In some areas the soil is less sloping and less eroded.

Included with this soil in mapping are small areas of Gilpin soils. These soils are well drained and on short, steep slopes. Also included are small areas of Licking soils. These soils have more clay in the subsoil and are in positions slightly lower than those of the Omulga soil. Also included are soils that do not have a fragipan and that are intermingled with the Omulga soil. Included soils make up about 15 percent of most areas.

Permeability of the Omulga soil is moderate above the fragipan and slow in the fragipan. Runoff is rapid. The root zone is mainly restricted to the 18- to 36-inch zone above the fragipan. The available water capacity of this zone is low or moderate. A perched seasonal high water table is between depths of 2.0 and 3.5 feet during extended wet periods.

Most areas of this soil are used for cropland and pasture. Some areas are woodland.

This soil is moderately well suited to corn, soybeans, and small grain. It can be cropped successfully, but the cropping system should include long-term hay or pasture. Erosion is a serious hazard, especially on long slopes. A conservation tillage system that leaves crop residue on the surface, cover crops, tillage at the proper moisture content, and grassed waterways help to control erosion, to improve tilth, and to maintain the organic matter content.

This soil is moderately well suited to hay. It is well suited to pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and reduced forage yields. Mulching the surface when reseeding or using a no-till seeder conserves moisture and helps to control erosion during pasture renovation. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species.

This soil is well suited to trees. Applying gravel or crushed stone on haul roads and log landings improves soil strength. Spraying, cutting, or girdling undesirable trees and shrubs helps to reduce plant competition. Harvesting without leaving the remaining trees widely spaced or isolated will reduce the windthrow hazard. Cutting and filling to a desirable slope improve sites for log landings.

This soil is poorly suited to septic tank absorption fields. The seasonal high water table and slow permeability are severe limitations. Enlarging the absorption field helps to overcome the restricted permeability. Installing perimeter drains around the absorption field helps to lower the seasonal high water table. In some areas an aeration sewage disposal system is needed.

This soil is moderately well suited to buildings. Because of the seasonal high water table, it is better suited to houses without basements than to houses with basements. Drains at the base of footings and exterior basement wall coatings help to prevent wet basements and crawl spaces. Buildings should be designed to conform to the natural shape of the land. Backfilling along foundations with material that has a low shrink-swell potential reduces the structural damage caused by shrinking and swelling. Providing artificial drainage and a suitable base material reduces the damage to roads caused by frost action and low strength. Maintaining as much cover as possible on the site during construction helps to control erosion.

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

Or—Orrville silt loam, frequently flooded

This is a deep, somewhat poorly drained, nearly level soil on flood plains. Slope is 0 to 2 percent. Most areas of this soil are long and narrow. Areas range from 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 26 inches thick. In the upper part it is brown, mottled friable silt loam. In the lower part it is grayish brown, mottled friable silt loam and loam. The substratum to a depth of about 60 inches is dark gray, friable loam and yellowish brown, friable gravelly loam. In places the subsoil is more acid. In some areas the subsoil has less clay or sand.

Included with this soil in mapping are small areas of well drained Chagrin, Kanawha, and Tioga soils. Chagrin and Tioga soils are on natural levees adjacent to streams. Kanawha soils are on alluvial fans. Included soils make up about 15 percent of the unit.

Permeability of the Orrville soil is moderate. Available water capacity is high. Runoff is slow. A seasonal high water table is between depths of 1.0 and 2.5 feet during extended wet periods. The surface layer can be easily tilled throughout a fairly wide range in moisture content.

Most of the acreage of this soil is cropland and pasture. Some areas are woodland.

In drained areas this soil is well suited to corn and soybeans and moderately well suited to small grain. In undrained areas it is moderately well suited or poorly suited to row crops. The seasonal high water table and flooding are the main limitations. Surface or subsurface drains can remove excess water in areas where adequate outlets are available. Returning crop residue to the soil and regularly adding other organic material improve fertility, reduce crusting, and increase the rate of water infiltration. Tilling within the optimum moisture range reduces surface compaction, maintains soil structure, and improves tilth. Planting cover crops helps to maintain organic matter content and protects the soil surface during flooding.

In drained areas this soil is well suited to grasses and legumes for hay and pasture. In undrained areas it is moderately well suited because of the seasonal high water table and flooding. This soil is poorly suited to grazing early in spring. It is better suited to grasses and shallow-rooted legumes than to deep-rooted legumes. Surface and subsurface drains can remove excess water in areas where adequate outlets are available. Proper stocking rates, pasture rotation, mowing for weed control, and restricted grazing during wet periods help to keep the pasture in good condition. Timely applications of lime and fertilizer help to maintain a maximum stand of key forage species. In establishing new stands, forage species that tolerate the seasonal high water table are preferred for planting.

This soil is well suited to trees. Trees can be harvested or planted when the soil is either not flooded or dry. Removing vines and less desirable trees and shrubs helps to reduce plant competition.

This soil is generally unsuited to septic tank absorption fields. The main limitations are flooding and the seasonal high water table.

This soil is generally unsuited to buildings. The main limitations are flooding and the seasonal high water table. Fill is needed to raise local roads above normal flood levels. Providing a suitable base material reduces the damage to local roads caused by frost action.

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

Pe—Peoga silt loam, rarely flooded

This is a deep, poorly drained, nearly level soil on flats and in depressions on stream terraces. Slope is 0 to 2 percent. Most areas are long and narrow or irregular in shape. Areas range from 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is light brownish gray, friable silt loam about 41 inches thick. In the lower part it is mottled. The substratum is light brownish gray and dark yellowish brown, mottled friable loam to a depth of about 80 inches. In places the subsoil has more clay.

Included with this soil in mapping are narrow strips of moderately well drained Sciotoville soils and somewhat poorly drained Weinbach soils in positions slightly higher than those of the Peoga soil. Included soils make up about 15 percent of the unit.

Permeability of the Peoga soil is slow. Available water capacity is high. Runoff is slow. This soil can be easily tilled. A seasonal high water table is near the surface during extended wet periods.

This soil is used mainly as cropland.

This soil is moderately well suited to corn, soybeans, and small grain. The seasonal high water table and flooding are the main limitations. Surface and subsurface drains can improve drainage, but adequate drainage outlets are not available in many low-lying areas. Returning crop residue to the soil and regularly adding other organic material improve fertility, reduce crusting, and increase the rate of water infiltration. Tilling within the optimum moisture range reduces surface compaction and improves tilth.

This soil is moderately well suited to grasses and legumes for hay and pasture. The main limitations are the seasonal high water table and flooding. Surface and subsurface drainage can be used to remove excess water where adequate outlets are available. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition. In establishing new stands, forage species that tolerate the seasonal high water table are preferred for planting.

This soil is moderately well suited to trees. Removing vines and the less desirable trees and shrubs helps to reduce plant competition. Timber planting and harvesting can be done during dry periods or by using modified equipment. Species that tolerate the seasonal high water table are preferred for planting on this soil. The windthrow hazard can be reduced by using harvesting techniques that do not leave the remaining trees widely spaced or isolated. Maintaining a thick, wooded edge or planting a woodland border of conifers on the open edges of the stand will also lessen the windthrow hazard. Planting seedlings that have been transplanted once reduces the seedling mortality rate.

This soil is generally unsuited to dwellings and septic tank absorption fields. The main limitations are the seasonal high water table, flooding, and slow permeability.

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

PgD—Pinegrove loamy coarse sand, 8 to 25 percent slopes

This is a deep, excessively drained, strongly sloping and moderately steep soil on sandy mine spoil ridgetops and shoulder slopes in areas surface mined for coal. The slopes are uneven. A few areas have been regraded. The soil consists of a mixture of highly weathered sandstone and coal and partly weathered fine earth material that was within or below the profile of the original soil. Most of the rock fragments are easily broken down. Most areas are long and narrow or broad and circular and 150 to 1,000 feet in width. Areas range from 10 to 200 acres in size.

Typically, the surface layer is olive yellow, loose loamy coarse sand about 2 inches thick. The substratum to a depth of 80 inches is olive yellow, loose loamy sand and loamy coarse sand. In some areas the soil has more clay throughout. In some areas the soil has more coarse fragments throughout.

Included with this soil in mapping are small areas of Gilpin, Latham, Lily, Steinsburg, and Upshur soils in unmined areas. These soils have a subsoil. Included soils make up about 15 percent of the unit.

Permeability of the Pinegrove soil is rapid. Available water capacity is low. Runoff is medium to very rapid.

In most areas this soil is idle and is covered with sparse vegetation.

This soil generally is unsuited to row crops, hay, and pasture.

Management practices that make extensive modifications to this soil are needed to create a favorable root zone. They include neutralizing the acid reaction, adding plant nutrients, and covering the soil with a suitable soil material. If large amounts of sewage sludge, manure, fly ash, and the natural soil material present before mining are incorporated into the soil, it is suited to acid-tolerant plants.

This soil is poorly suited to trees. Trees that tolerate acidity, droughtiness, and a restricted root zone are best suited. Laying out logging roads and skid trails on or near the contour, installing water bars, and maintaining a vegetative cover help to control erosion.

On slopes of 15 to 25 percent the soil is generally unsuited to septic tank absorption fields and buildings. In settled areas on slopes of 8 to 15 percent the soil is moderately well suited to buildings and poorly suited to septic tank absorption fields. Onsite investigation for depth to bedrock and stormwater control is needed to determine suitability. Concrete and uncoated steel in foundations, floors, and buried utility lines are subject to severe corrosion. The soil readily absorbs, but does not adequately filter, the effluent from septic tanks. In some areas the poor filtering can result in ground water pollution. Installing absorption fields in suitable fill material reduces the hazard of ground water pollution. Covering lawns with a suitable soil material provides a more favorable root zone and increases the available water capacity.

The land capability classification is VIIs. A woodland ordination symbol is not assigned. The pasture and hayland suitability group is H-1.

PgF—Pinegrove loamy coarse sand, 25 to 70 percent slopes

This is a deep, excessively drained, steep and very steep, soil on side slopes of sandy mine spoil in areas of surface coal mines. The slopes are uneven. The soil consists of a mixture of highly weathered sandstone and coal and partly weathered fine earth material that was within or below the profile of the original soil. Most of the rock fragments are easily broken down. Most areas are long and narrow or broad and circular and 150 to 1,000 feet in width. Areas range from 8 acres to 280 acres in size.

Typically, the surface layer is yellowish brown, loose loamy coarse sand about 2 inches thick. The substratum to a depth of about 80 inches is multicolored, loose loamy coarse sand. Some areas have more clay throughout. A few areas contain more coarse fragments throughout.

Included with this soil in mapping are small areas of Gilpin, Latham, Lily, Steinsburg, and Upshur soils in unmined areas. These soils have a subsoil. Included soils make up about 15 percent of the unit.

Permeability of the Pinegrove soil is rapid. Available water capacity is low. Runoff is very rapid.

In most areas this soil is idle and covered by sparse vegetation.

This soil generally is unsuited to row crops, hay, and pasture. The main limitations are the erosion hazard and slope.

Management practices that make extensive modifications to this soil are needed to create a favorable root zone. They include neutralizing the acid reaction, adding plant nutrients, and covering the soil with a suitable soil material. If large amounts of sewage sludge, manure, fly ash, and the natural soil material present before mining are incorporated into the soil, it is suited to acid-tolerant plants.

Conservation practices are needed to make extensive modifications to the soil and to create a favorable for root zone. They include neutralizing the acid reaction, adding plant nutrients, and covering the soil with a suitable soil material. If large amounts of sewage sludge, manure, fly ash, and the natural soil materials present before mining are incorporated into the soil, it is suited to acid-tolerant plants.

Erosion and sedimentation of drainageways are severe hazards. Maintaining a vegetative cover helps to control erosion and to prevent water contamination.

This soil is poorly suited to trees. Trees that are acid- and drought-tolerant are preferred for planting. Laying out logging roads and skid trails on or near the contour, installing water bars, and maintaining a vegetative cover help to control erosion. Regraded areas that are planted to trees are suitable for use as habitat for openland wildlife.

This soil is unsuited to sanitary facilities and buildings. The main limitations are slope, the hazard of hillside slippage, and the hazard of sloughing in excavations.

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

PkD—Pinegrove silty clay loam, 8 to 25 percent slopes

This is a deep, excessively drained, strongly sloping and moderately steep soil on reshaped mine spoil ridges in areas of surface coal mines. The slopes are rolling. The soil consists of a mixture of highly weathered sandstone and coal and partly weathered fine earth material that was within or below the profile of the original soil. Most of the rock fragments are easily broken down. Most areas are broad and 500 to 2,000 feet in width. Areas range from 50 to 400 acres or more in size.

Typically, the surface layer is dark reddish brown, firm silty clay loam about 8 inches thick. The substratum is multicolored, loose loamy sand to a depth of 60 inches. In some areas the soil has more clay throughout. In a few areas it has more coarse fragments throughout. In some areas it has not been reshaped. In some areas the surface layer is silty clay.

Included with this soil in mapping are small areas of Gilpin, Lily, Steinsburg, and Upshur soils in unmined areas. These soils have a subsoil. Included soils make up about 15 percent of the unit.

Permeability of the Pinegrove soil is rapid. Available water capacity is low. Runoff is very rapid. Depth to the root zone is variable.

In most areas this soil is in grasses.

This soil is generally unsuited to row crops and hay. It is a poor growing medium for roots.

This soil is poorly suited to pasture. If the pasture is overgrazed or is plowed during seedbed preparation, erosion is a severe hazard. Proper stocking rates and pasture rotation help to prevent overgrazing. Along with no-till, they help to control erosion. Restricted grazing during wet periods helps to prevent surface compaction. It is very droughty and very low in fertility below the surface layer. Soil tests are needed to determine specific nutrient needs. Maintaining a vegetative cover and mulching help to reduce runoff, to control erosion, and to increase the rate of water intake.

This soil is poorly suited to trees. Species that tolerate droughtiness and the restricted root zone are preferred for planting. Laying out logging roads and skid trails on or near the contour, installing water bars, and maintaining a vegetative cover help to control erosion.

In settled areas on slopes of 8 to 15 percent this soil is moderately well suited to buildings and poorly suited to septic tank absorption fields. Onsite investigation for depth to bedrock, the hazard of hillside slippage, and stormwater control is needed to determine the suitability for buildings and septic tank absorption fields. In yet unsettled areas or on slopes of 15 to 25 percent this soil is generally unsuited to buildings and septic tank absorption fields. In these areas the main limitations are slope and the hazard of slippage. Laying out local roads on the contour reduces cutting and filling.

The slope and rapid permeability are severe limitations to use of this soil for septic tank absorption fields. Installing distribution lines on the contour reduces lateral seepage of effluent to the surface. Because of the rapid permeability in the substratum, effluent from absorption fields is not adequately filtered and can pollute ground water. Installing absorption fields in suitable fill material reduces the hazard of ground water pollution. In some areas an aeration sewage disposal system is needed.

The land capability classification is VIs. A woodland ordination symbol is not assigned. The pasture and hayland suitability group is G-1.

Pn—Piopolis silty clay loam, frequently flooded

This is a deep, poorly drained and very poorly drained, nearly level soil on flood plains. Slope is 0 to 1 percent. Most areas are broad or long and narrow. Areas range from 4 to 25 acres in size.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 8 inches thick. The substratum to a depth of about 80 inches is light brownish gray and gray mottled, friable silty clay loam. In some areas the surface layer is silt loam.

Included with this soil in mapping are small areas of Stendal and Orrville soils. Orrville and Stendal soils are somewhat poorly drained and are in higher positions on flood plains. Also included, in the lower parts of depressions, are areas of soils that are ponded for extended periods. Included soils make up about 15 percent of most areas.

Permeability of the Piopolis soil is slow. Available water capacity is high. Runoff is very slow or ponded. A seasonal high water table is near or above the soil surface during extended wet periods. The root zone is deep, but the seasonal high water table restricts it.

Most areas of this soil are in cropland. Some areas are in pasture.

This soil is poorly suited to corn, soybeans, hay, and pasture. Flooding and the seasonal high water table limit use of this soil for cultivated crops, hay, and pasture. In drained areas it is moderately well suited to corn and soybeans and poorly suited to small grain. Surface drains are used to remove ponded water. Subsurface drains are also used where outlets are available. In many areas establishing drainage outlets is difficult in low-lying areas. Crops such as corn and soybeans can generally be grown without flood damage. In most years the seasonal high water table delays planting. If the soil is artificially drained, no-till is well suited. Returning crop residue to the soil and regularly adding other organic material improve fertility, reduce crusting, and increase the rate of water infiltration. Tilling within the optimum moisture range reduces surface compaction, maintains soil structure, and improves tilth.

In drained areas this soil is moderately well suited to grasses and legumes for hay and pasture. In undrained areas it is poorly suited because of the seasonal high water table and flooding. The soil is poorly suited to grazing early in spring. Surface and subsurface drains can remove excess water in areas where adequate outlets are available. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture in good condition. In establishing new stands, forage species that tolerate the seasonal high water table are preferred for planting.

This soil is well suited to trees. Woodland can be harvested when the soil is dry, frozen, or not flooded. Site preparation and planting can be done during dry periods. Using planting techniques that spread the roots of seedlings and that increase soil-root contact reduce the seedling mortality rate. Harvesting without leaving the remaining trees isolated or widely spaced will reduce the windthrow hazard. Removing vines and the less desirable trees and shrubs helps to reduce plant competition.

This soil is generally unsuited to dwellings and septic tank absorption fields. The main limitations are frequent flooding, prolonged wetness, and slow permeability. Filling raises local roads above high flood levels. Providing a suitable base material reduces the damage to local roads caused by frost action and low soil strength.

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

Ps—Pits, sand and gravel

This map unit consists of surface mines from which material has been removed for use in construction. It is on terraces along streams. Typically, it is adjacent to areas of Lakin, Watertown, Wheeling, and other soils that overlie sand or gravel. Most pits range from 5 to 70 acres in size. Actively mined pits are undergoing continual enlargement. Most pits have a high wall on one or more sides.

The mined material consists of stratified sand and gravel in layers of various thickness and orientation. The kind and grain size of the material are relatively uniform within any one layer but commonly differ from layer to layer. Some layers contain a significant amount of silt and sand. Selectivity in mining is commonly feasible. The material that remains after mining is poorly suited to plants. The organic matter content and available water capacity are low. Most unused pits can be developed for use as wildlife habitat or as recreation areas. Pits excavated to or below the water table can be developed as wetland wildlife habitat.

A land capability classification, woodland ordination symbol, or pasture and hayland suitability group is not assigned.

RbC—Rarden-Gilpin silt loams, 8 to 15 percent slopes

These are moderately deep soils on ridgetops and shoulder slopes. The Rarden soil is moderately well drained. It is commonly in the middle of the ridgetop. The Gilpin soil is well drained. It is on the edge of ridgetops and on shoulder slopes. Areas are long and commonly 200 to 400 feet wide. They range from 15 to 100 acres in size. Most areas are about 50 percent Rarden silt loam and 40 percent Gilpin silt loam. The two soils are in areas so intricately mixed or so small in size that separating them in mapping was not practical.

Typically, the Rarden soil has a brown, friable silt loam surface layer about 3 inches thick. The subsurface layer is light yellowish brown, friable silt loam about 3 inches thick. The subsoil is about 31 inches thick. In the upper part it is yellowish brown, friable silt loam and strong brown, firm silty clay loam. In the lower part it is yellowish red, mottled, firm silty clay and pale brown, mottled, firm silty clay loam. Siltstone is at a depth of about 37 inches. In some areas the subsoil is not as red. In other places the upper part of the subsoil has more silt.

Typically, the Gilpin soil has a brown, friable silt loam surface layer about 2 inches thick. The subsoil is about 36 inches thick. In the upper part it is yellowish brown, friable silt loam. In the lower part it is strong brown and yellowish brown, friable and firm silt loam. Siltstone is at a depth of about 38 inches. In places the bedrock is deeper. In some areas the subsoil has less sand and fewer coarse fragments. In some areas the lower part of the subsoil has gray mottles. In some areas the subsoil has more sand.

Included with these soils in mapping are small areas of Coolville, Tilsit, and Upshur soils. These soils are more than 40 inches to bedrock. Coolville and Tilsit soils are on wider and flatter ridgetops. Upshur soils are in positions on ridgetops similar to those of the Rarden soil. Included soils make up about 10 percent of most areas.

Permeability is slow in the Rarden soil and moderate in the Gilpin soil. Available water capacity is low in both soils. Runoff is rapid. The shrink-swell potential is high in the subsoil of the Rarden soil and low throughout the Gilpin soil. The Rarden soil has a perched seasonal high water table between depths of 1.5 and 3.0 feet during extended wet periods (fig. 11).

Most areas of these soils are woodland. A few areas are used for cropland, hayland, and pasture.

These soils are moderately well suited to corn, soybeans, and small grain. They can be cropped successfully if the cropping sequence includes a high proportion of long-term hay or pasture. Erosion is a serious hazard. A conservation tillage system that leaves crop residue on the surface, cover crops, tillage at the proper moisture content, and grassed waterways help to control erosion, to improve tilth, and to maintain the organic matter content.

Most areas of these soils are moderately well suited to hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and reduced forage yields. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species. Controlling grazing in winter and other wet periods helps to prevent surface compaction.

These soils are well suited to trees. On the Rarden soil planting seedlings that have been transplanted once reduces the seedling mortality rate. Removing vines and the less desirable trees and shrubs helps to reduce plant competition. On the Rarden soil the windthrow hazard can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced. Applying gravel and crushed stone on haul roads and log landings improves soil strength. Laying out haul roads and log landings apart from active slips helps to stabilize the road base and to prevent soil slippage. Building haul roads and skid trails on the contour facilitates the use of equipment. Cutting and filling to a more desirable slope improve sites for log landings.

These soils are poorly suited to septic tank absorption fields. Depth to bedrock on both soils and the seasonal high water table and slow permeability on the Rarden soil are severe limitations. The bedrock is rippable with heavy construction equipment. Enlarging the absorption field helps to overcome slow permeability. Installing the distribution lines in a mound of suitable fill material elevates the absorption field above the bedrock. Installing perimeter drains with adequate fill and backfilling with a suitable material help to lower the seasonal high water table. In some areas an aeration sewage disposal system is needed.

These soils are poorly suited to dwellings. The main limitations are slope and depth to bedrock on both soils and the seasonal high water table and high shrinking and swelling on the Rarden soil. These soils are moderately deep to bedrock and thus are better suited to homes without basements than homes with basements. In many areas land shaping is needed. In most areas the bedrock can be ripped. On the Rarden soil installing drains at the base of footings helps to lower the seasonal high water table and coating the exterior of basement walls is needed. On the Rarden soil backfilling along foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. On both soils proper layout and landscaping of building sites helps to overcome slope and to divert surface water away from foundations. Maintaining as much vegetation as possible on the construction site helps to control erosion. Providing artificial drainage and a suitable base material reduces the damage to local roads caused by low strength and frost action.

The land capability classification is IVe. The woodland ordination symbol is 4C on the Rarden soil and 4A on the Gilpin soil. The pasture and hayland suitability group is F-1.

RbD—Rarden-Gilpin silt loams, 15 to 25 percent slopes

These are moderately deep soils on ridgetops and shoulder slopes. The Rarden soil is moderately well drained soil. It is commonly in the middle of the ridgetop. The Gilpin soil is well drained. It is on the edge of ridgetops and on shoulder slopes. Areas are long and commonly 100 to 300 feet wide. They range from 15 to 100 acres in size. Most areas are about 50 percent Rarden silt loam and 40 percent Gilpin silt loam. The two soils are in areas so intricately mixed or so small in size that separating them in mapping was not practical.

Figure 11.—No-till corn on Rarden-Gilpin silt loams, 8 to 15 percent slopes. No-till helps to control erosion.

Typically, the Rarden soil has a brown, friable silt loam surface layer about 2 inches thick. The subsurface layer is yellowish brown, friable silt loam about 4 inches thick. The subsoil is about 29 inches thick. In the upper part it is strong brown, friable silt loam. In the lower part it is yellowish red and pale brown, mottled, friable silty clay loam and silty clay. Shale is at a depth of about 35 inches. In some areas the subsoil is not as red. In places the upper part of the subsoil has more silt.

Typically, the Gilpin soil has a brown, friable silt loam surface layer about 3 inches thick. The subsurface layer is yellowish brown, friable silt loam about 5 inches thick. The subsoil is yellowish brown, friable silt loam and channery silt loam to a depth of 27 inches. Slightly weathered siltstone is at a depth of about 27 inches. In some areas the lower part of the subsoil has gray mottles. In places bedrock is more than 40 inches deep. In some areas the subsoil has less sand and fewer coarse fragments. In places the subsoil has more sand.

Included with these soils in mapping are small areas of Steinsburg and Upshur soils. Steinsburg soils have more sand in the subsoil than the Rarden and Gilpin soils and are on the highest part of the landscape. Upshur soils are more than 40 inches deep to bedrock and are in positions on the landscape similar to those of the Rarden and Gilpin soils. Included soils make up about 10 percent of the unit.

Permeability is slow in the Rarden soil and moderate in the Gilpin soil. Available water capacity is low in both soils. Runoff is very rapid. The shrink-swell potential is high in the subsoil of the Rarden soil and low in the Gilpin soil. On the Rarden soil a perched seasonal high water table is between depths of 1.5 and 3.0 feet during extended wet periods.

These soils are used primarily for pasture and woodland. A few areas are used for hay production.

These soils are poorly suited to cultivated crops and small grain. They can be cropped successfully if the cropping sequence includes a high proportion of long-term hay or pasture. Erosion is a serious hazard, especially on long slopes. A conservation tillage system that leaves crop residue on the surface, cover crops, tillage at the proper moisture content, and grassed waterways help to control erosion, to improve tilth, and to maintain the organic matter content.

These soils are poorly suited to hayland and pasture. If the soil is overgrazed or plowed for seedbed preparation, erosion is a severe hazard. When renovating pasture, reseeding using trash mulch, no-till, or companion crops helps to reduce runoff and to control erosion. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species. Limiting grazing in winter and other wet periods helps to prevent surface compaction.

These soils are moderately well suited to trees. North- and east-facing slopes and coves are better sites for woodland than the south- and west-facing slopes because of less evapotranspiration and cooler temperatures. Laying out logging roads and skid trails on or near the contour, installing water bars, and maintaining a vegetative cover help to control erosion. Planting seedlings that have been transplanted once reduces the seedling mortality rate. Using planting techniques that spread the roots of seedlings and that increase soil-root contact reduces the seedling mortality rate. On the Rarden soil the windthrow hazard can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced. Applying gravel or crushed stone on haul roads and log landings improves soil strength. Laying out haul roads and log landings apart from active slips helps to stabilize the road base and to prevent soil slippage. Building haul roads and skid trails on the contour facilitates the use of equipment. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting.

These soils are poorly suited to septic tank absorption fields. The main limitations are depth to bedrock and slope on both soils and the slow permeability and the seasonal high water table on the Rarden soil. On the Rarden soil adding a suitable fill material will elevate the absorption field a sufficient distance above bedrock and will improve the absorbance of effluent. On the Rarden soil installing interceptor drains upslope from absorption fields helps to lower the seasonal high water table. On the Rarden soil enlarging the absorption field helps to overcome the restricted permeability. On both soils installing the distribution lines across the slope helps to prevent seepage of the effluent to the surface. In some areas an aeration sewage disposal system is needed.

These soils are poorly suited to buildings. The main limitations are slope and depth to bedrock on both soils and the seasonal high water table, high shrinking and swelling, and the hazard of slippage on the Rarden soil. Designing buildings to conform to the natural slope of the land reduces the need for cutting, filling, and land shaping in most areas and reduces the hazard of hillside slippage. On the Rarden soil installing drains at the base of footings and coating the exterior of basement walls help to overcome the seasonal high water table. On the Rarden soil backfilling along foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Maintaining as much vegetation as possible on the construction site helps to control erosion. Laying out local roads on the contour reduces cutting and filling. On the Rarden soil providing a suitable base material and installing a drainage system reduce the damage to local roads caused by frost action and low strength.

The land capability classification is VIe. The woodland ordination symbol is 3R for the Rarden soil and 4R for the Gilpin soil. The pasture and hayland suitability group is F-1.

RnD—Rarden-Lily complex, 15 to 25 percent slopes

These are moderately deep soils on ridgetops and shoulders. The Rarden soil is moderately well drained. It is commonly in the middle of the ridgetops. The Lily soil is well drained. It is on the edges of the ridgetops and on shoulder slopes. Areas are long and commonly 100 to 300 feet wide. They range from 15 to 100 acres in size. Most areas are about 50 percent Rarden silt loam and 30 percent Lily loam. The two soils are in areas so intricately mixed or so small in size that separating them in mapping was not practical.

Typically, the Rarden soil has a brown, friable silt loam surface layer about 2 inches thick. The subsurface layer is light yellowish brown, friable silt loam about 5 inches thick. The subsoil is about 29 inches thick. In the upper part it is yellowish red, firm silty clay loam. In the lower part it is yellowish red, strong brown, and yellowish brown mottled, firm silty clay and silty clay loam. Shale is at a depth of about 36 inches. In some areas the subsoil is not as red. In places the upper part of the subsoil has more silt.

Typically, the Lily soil has a brown, friable loam surface layer about 2 inches thick. The subsurface layer is light yellowish brown, friable loam about 5 inches thick. The subsoil is about 28 inches thick. In the upper part it is yellowish red, friable clay loam. In the lower part it is yellowish red, friable loam. Sandstone is at a depth of about 35 inches. In places the bedrock is deeper. In some areas the subsoil has less sand and fewer coarse fragments. In some areas the subsoil has gray mottles.

Included with these soils in mapping are small areas of Steinsburg and Upshur soils. Steinsburg soils have less clay in the subsoil and are on the highest part of the landscape. Upshur soils are more than 40 inches deep over bedrock. They are in positions similar to those of the Rarden and Upshur soils. Included soils make up about 20 percent of most areas.

Permeability is slow in the Rarden soil and moderately rapid in the Lily soil. Available water capacity is low in both soils. Runoff is very rapid. The shrink-swell potential is high in the subsoil of the Rarden soil and low in the Lily soil. On the Rarden soil during extended wet periods a perched seasonal high water table is between depths of 1.5 and 3.0 feet.

Most areas of these soils are woodland. Some areas are used for hayland and pasture.

These soils are poorly suited to corn, soybeans, and small grain. Because of slope and the severe erosion hazard, they can be cropped successfully if the cropping sequence includes a high proportion of long-term hay or pasture. Erosion is a severe hazard, especially on long slopes. A conservation tillage system that leaves crop residue on the surface, cover crops, tillage at the proper moisture content, and grassed waterways help to control erosion, to improve tilth, and to maintain the organic matter content.

These soils are poorly suited to hay and pasture. If the soil is overgrazed or plowed for seedbed preparation, erosion is a severe hazard. When renovating pasture, reseeding using trash mulch, no-till, or companion crops helps to reduce runoff and to control erosion. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species. Limiting grazing in winter and other wet periods helps to prevent surface compaction.

These soils are moderately well suited to trees. North- and east-facing slopes and coves are better sites for woodland than south- and west-facing slopes because of less evapotranspiration and cooler temperatures. Laying out logging roads and skid trails on near the contour, installing water bars, and maintaining a vegetative cover help to control erosion. Planting techniques that spread the roots of seedlings and that increase soil-root contact reduces the seedling mortality rate. On the Rarden soil harvest methods that do not leave the remaining trees isolated or widely spaced reduces the windthrow hazard. On the Rarden soil bedrock is rippable with construction equipment. On the Lily soil blasting through bedrock is needed for deep excavations for haul roads and log landings. Haul roads and log landings can be laid out on better suited soils nearby. Applying gravel or crushed stone on haul roads and log landings improves soil strength. Laying out haul roads and log landings apart from active slips helps to stabilize the road base and to prevent soil slippage. Building haul roads and skid trails on the contour facilitates the use of equipment. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting.

These soils are poorly suited to septic tank absorption fields. The main limitations are depth to bedrock and slope on both soils and the slow permeability and the seasonal high water table on the Rarden soil. On the Rarden soil adding a suitable fill material will elevate the absorption field a sufficient distance above bedrock and will improve the absorbance of effluent. On the Rarden soil installing interceptor drains upslope from the absorption fields helps to lower the seasonal high water table. On the Rarden soil enlarging the absorption field helps to overcome the slow permeability. On both soils installing the distribution lines across the slope helps to prevent seepage of the effluent to the surface. In some areas an aeration sewage disposal system is needed.

These soils are poorly suited to dwellings. The main limitations are slope and depth to bedrock on both soils and the seasonal high water table, the hazard of slippage, and high shrinking and swelling on the Rarden soil. Designing buildings to conform to the natural slope of the land reduces the need for cutting, filling, and land shaping in most areas and reduces the hazard of hillside slippage. On the Rarden soil installing drains at the base of footings helps to overcome the seasonal high water table and coating the exterior of basement walls is needed. On the Rarden soil backfilling along foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Maintaining as much vegetation as possible on the construction site helps to control erosion. Laying out local roads on the contour reduces cutting and filling. On the Rarden soil providing a suitable base material and installing a drainage system reduce the damage to local roads caused by frost action and low strength.

The land capability classification is VIe. The woodland ordination symbol is 3R for the Rarden soil, and 4R for the Lily soil, north aspect, 3R, south aspect. The pasture and hayland suitability group for both soils is F-1.

SaB—Sciotoville silt loam, 1 to 6 percent slopes

This is a deep, moderately well drained, nearly level and gently sloping soil on convex slopes on terraces. Most areas of this soil are long and narrow or irregularly shaped. Areas range from 5 to 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 71 inches thick. In the upper part it is yellowish brown, mottled, friable silt loam. In the middle part it is a fragipan of brown, mottled, firm and very firm silt loam. In the lower part it is brown, friable loam. In some areas the middle part of the subsoil is not as dense.

Included with this soil in mapping are small areas of Elkinsville, Weinbach, and Wheeling soils. Weinbach soils are somewhat poorly drained. They are in small depressions and along drainageways. Elkinsville and Wheeling soils are well drained and on slight rises. Also included are areas of soils that are subject to rare flooding. Included soils make up about 15 percent of most mapped areas.

Permeability of the Sciotoville soil is moderate above the fragipan and moderately slow or slow within. The root zone is restricted to a depth of 18 to 38 inches above the fragipan. Available water capacity in the root zone is low. Runoff is slow or medium. The surface layer can be easily tilled. A perched seasonal high water table is at a depth of 1.5 to 3.0 feet during extended wet periods.

In most areas this soil is farmed. A few areas are in native hardwoods.

This soil is well suited to corn, soybeans, tobacco, and small grain. If the soil is cultivated, erosion is a hazard. Cultivated crops can be grown year after year with erosion control and improved management. Conservation measures that maintain tilth and the organic matter content are needed. A conservation tillage system that leaves crop residue on the surface, a cropping sequence that includes grasses and legumes, incorporating crop residue into the plow layer, contour farming or contour stripcropping, and grassed waterways help to maintain tilth, to reduce runoff, and to control erosion. Tilling within the optimum moisture range reduces surface compaction.

This soil is well suited to hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and reduced forage yields. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species.

This soil is well suited to trees. Applying gravel or crushed stone on haul roads and log landings improves soil strength. Removing vines and the less desirable trees and shrubs helps to reduce plant competition.

This soil is poorly suited to septic tank absorption fields. The seasonal high water table and slow or moderately slow permeability are severe limitations. Enlarging the absorption field helps to overcome the restricted permeability. Installing perimeter drains around the absorption field helps to lower the seasonal high water table. In some areas an aeration sewage disposal system is needed.

This soil is moderately well suited to dwellings. Because of the seasonal high water table, it is better suited to houses without basements than to houses with basements. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements day. Landscaping on building sites is needed to keep surface water away from foundations. Installing a drainage system and providing a suitable base material reduce the damage to local roads caused by frost action. Maintaining as much vegetation as possible on the construction site helps to control erosion. Included areas that are subject to flooding are generally unsuited as a site for buildings.

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

SbB—Shelocta silt loam, 2 to 6 percent slopes

This is a deep, well drained gently sloping soil on colluvial fans in narrow stream valleys and along valley walls. Areas are long and narrow or fan shaped. Areas 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 38 inches thick. In the upper part it is brown and yellowish brown, friable silt loam and channery silt loam. In the lower part it is yellowish brown, friable silt loam and channery silt loam. The substratum is light yellowish brown, friable channery loam to a depth of 80 inches. In some areas the soil is moderately well drained. In a few areas the substratum is not as acid.

Included with this soil in mapping are small areas of Cuba, Piopolis, and Stendal soils on flood plains. These soils have fewer coarse fragments between depths of 10 and 40 inches. Piopolis soils are poorly drained. Stendal soils are somewhat poorly drained. Some areas in narrow stream valleys with large watersheds are subject to flash flooding after intensive rainfall. Included soils make up about 10 percent of the unit.

Permeability of the Shelocta soil is moderate. Available water capacity is moderate. Runoff is medium.

Most areas of this soil are used for homesites. Some areas are used for cropland. A few small areas are in native hardwoods.

This soil is well suited to corn, soybeans, tobacco, and small grain. If the soil is cultivated, erosion is a hazard. Cultivated crops can be grown year after year with erosion control and improved management. Conservation practices are needed to maintain tilth and the organic matter content. A conservation tillage system that leaves crop residue on the surface, a cropping sequence that includes grasses and legumes, incorporating crop residue into the plow layer, contour farming or contour stripcropping, and grassed waterways help to maintain tilth, to reduce runoff, and to control erosion. Tilling within the optimum moisture range reduces surface compaction.

This soil is well suited to hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and reduced forage yields. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species.

This soil is well suited to trees. Applying gravel or crushed stone on haul roads and log landings improves soil strength. Removing vines and the less desirable trees and shrubs helps to reduce plant competition.

This soil is well suited dwellings and septic tank absorption fields. Bedrock is as shallow as 48 inches in some places, so the soil is better suited to buildings without basements than to buildings with basements. In some areas suitable fill material is needed to elevate the septic tank absorption field a sufficient distance above the bedrock. Increasing the size of the absorption field helps to overcome the moderate permeability.

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

SbC—Shelocta silt loam, 6 to 15 percent slopes

This is a deep, well drained, strongly sloping soil on colluvial foot slopes and colluvial fans. A few areas are on colluvial fans in narrow stream valleys and along valley walls. Areas are long and narrow or irregularly shaped. Areas range from 5 to 30 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is yellowish brown, friable silt loam and silty clay loam about 42 inches thick. The substratum is yellowish brown, friable channery silt loam. Weathered siltstone is at a depth of about 60 inches. In some areas the soil is moderately well drained. In some areas the subsoil and the substratum have a higher base saturation.

Included with this soil in mapping are small areas of Latham and Steinsburg soils. Latham soils are moderately well drained and are moderately deep over bedrock. Latham and Steinsburg soils are on hillsides and ridgetops. Steinsburg soils are moderately deep over bedrock. They have less clay in the subsoil. Included soils make up about 10 percent of the unit.

Permeability and available water capacity of the Shelocta soil both are moderate. Runoff is rapid.

Most areas of this soil are used for pasture or hay. Some areas are used for cropland. A few small areas are in native hardwoods.

This soil is moderately well suited to corn, soybeans, and small grain. It can be cropped successfully if the cropping sequence includes a high proportion of long-term hay or pasture. Erosion is a hazard, especially on long slopes. A conservation tillage system that leaves crop residue on the surface, cover crops, tillage at the proper moisture content, and grassed waterways help to control erosion, to improve tilth, and to maintain the organic matter content.

This soil is well suited to hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and reduced forage yields. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species.

This soil is well suited to trees. Applying gravel or crushed stone on haul roads and log landings improves soil strength. Cutting and filling to a more desirable slope improve sites for log landings. Removing vines and the less desirable trees and shrubs helps to reduce plant competition.

This soil is moderately well suited to dwellings and septic tank absorption fields because of slope and moderate permeability. Because of bedrock as shallow as 48 inches in some places, it is better suited to buildings without basements than to buildings with basements. Designing buildings to conform to the natural slope of the land reduces the need for cutting, filling, and land shaping in most areas and reduces the hazard of hillside slippage. In some areas a suitable fill material is needed to elevate the septic tank absorption field a sufficient distance above bedrock. Installing septic tank distribution lines on the contour helps to prevent seepage of the effluent to the surface. Increasing the size of the absorption field helps to overcome the moderate permeability. In some areas an aeration sewage disposal system is needed. Maintaining as much vegetation as possible on the construction site helps to control erosion.

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

SbD—Shelocta silt loam, 15 to 25 percent slopes

This is a deep, well drained, moderately steep soil on colluvial foot slopes and on side slopes. Areas are long and narrow or irregularly shaped. They range from 5 to 30 acres in size.

Typically, the surface layer is brown, friable silt loam about 4 inches thick. The subsoil is yellowish brown, friable silt loam and channery silt loam about 56 inches thick. In some areas the soil is moderately well drained.

Included with this soil in mapping are small areas of Latham soils on side slopes. Latham soils have more clay in the subsoil. Included soils make up about 15 percent of the unit.

Permeability of the Shelocta soil is moderate. Available water capacity is moderate. Runoff is very rapid.

Most areas of this soil are used for pasture or hay. A few small areas are in native hardwoods.

This soil is poorly suited to corn, soybeans, and small grain. It can be cropped successfully if the cropping sequence includes a high proportion of long-term hay or pasture. Erosion is a serious hazard, especially on long slopes. A conservation tillage system that leaves crop residue on the surface, cover crops, tillage at the proper moisture content, and grassed waterways help to control erosion, to improve tilth, and to maintain the organic matter content.

This soil is moderately well suited to hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and reduced forage yields. Cover crops, companion crops, or no-till helps to control erosion when the pasture is seeded. Proper stocking rates, pasture rotation, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species.

This soil is well suited to trees. North- and east-facing slopes and coves are better sites for woodland than south- and west-facing slopes because of less evapotranspiration and cooler temperatures. Building haul roads and skid trails on the contour facilitates the use of equipment. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting. Removing vines and the less desirable trees and shrubs helps to reduce plant competition. Laying out logging roads and skid trails on or near the contour, installing water bars, and maintaining a vegetative cover help to control erosion. Planting seedlings that have been transplanted once will reduce the seedling mortality rate on south-facing slopes.

This soil is poorly suited to dwellings and septic tank absorption fields. The main limitations are slope and depth of bedrock. In most areas land shaping is needed. Where a building site is developed by cutting and filling a foot slope, a retaining wall is needed to prevent downslope movement of the soil. Bedrock is as shallow as 48 inches in some places, so this soil is better suited to buildings without basements than to buildings with basements. A diversion is needed upslope from some buildings. Installing distribution lines of septic tank absorption fields on the contour reduces lateral seepage of effluent to the surface. In some areas an aeration sewage disposal system is needed. Maintaining as much cover as possible on the construction site helps to control erosion. Laying out local roads around the slope will reduce the angle of incline.

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

SdE—Shelocta-Latham association, steep

These soils are on side slopes and foot slopes on uplands. The Shelocta soil is deep and well drained. It is on the steeper side slopes and on foot slopes. The Latham soil is moderately deep and moderately well drained. It is commonly in strips on side slopes. Hillside slips are common on these soils. Slope is dominantly 25 to 40 percent. Areas of these soils are irregularly shaped and range from 100 to 2,000 acres in size. Generally, they are 60 percent Shelocta silt loam and 25 percent Latham silt loam. Because of present and anticipated uses of these soils, separating them in mapping was not practical.

Typically, the Shelocta soil has a surface layer of brown, friable silt loam about 2 inches thick. The subsoil is about 53 inches thick. In the upper part it is yellowish brown, friable silt loam. In the middle part it is yellowish brown and strong brown, friable silt loam and silty clay loam. In the lower part it is strong brown, friable silty clay loam and channery silty clay loam. The substratum is yellowish brown, friable silty clay loam. Weathered siltstone and sandstone are at a depth of about 64 inches. In places sandstone or siltstone is at a depth of 20 to 40 inches. In places the subsoil is thinner. In a few areas the soil is moderately well drained. In some areas the subsoil has more sand.

Typically, the Latham soil has a surface layer of brown, friable silt loam about 3 inches thick. The subsoil is about 23 inches thick. In the upper part it is yellowish brown, friable silty clay loam and firm silty clay. In the lower part it is light yellowish brown and light brownish gray, firm silty clay and shaly silty clay. Olive brown, weathered siltstone and shale are at a depth of about 26 inches. In some places the subsoil is redder.

Included with these soils in mapping are areas of Steinsburg soils. Steinsburg soils are on ridgetops and side slopes. They have less clay in the subsoil. Also included are small areas of soils disturbed by mining. Included areas are less than 20 acres in size. Included soils make up about 15 percent of the association.

Permeability is moderate in the Shelocta soil and slow in the Latham soil. Available water capacity is moderate in the Shelocta soil and low in the Latham soil. Runoff is very rapid. The shrink-swell potential is low in the Shelocta soil and high in the Latham soil. In the Latham soil a perched seasonal high water table is at a depth of 1.5 to 3.0 feet during extended wet periods.

Most areas of these soils are in native hardwoods. Some areas are used for pasture.

These soils are moderately well suited to trees. North- and east-facing slopes and coves are better sites for woodland than south- and west-facing slopes because of less evapotranspiration and cooler temperatures. Laying out logging roads and skid trails on or near the contour, installing water bars, and maintaining a vegetative cover help to control erosion. Planting seedlings that have been transplanted once will reduce the seedling mortality rate. Removing vines and the less desirable trees and shrubs helps to reduce plant competition. On the Latham soil the windthrow hazard can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced. Applying gravel or crushed stone on haul roads and log landings improves soil strength and traction. Laying out haul roads and log landings apart from active slips helps to stabilize the road base and to prevent soil slippage. Filter strips or undisturbed buffer strips between harvested areas and watercourses reduce stream siltation. Building haul roads and skid trails on the contour facilitates the use of equipment. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting.

These soils are generally unsuited to cultivated crops and hay. The main limitations are slope and the severe erosion hazard.

These soils are poorly suited to pasture. Slope severely limits the use of equipment. Overgrazing or grazing when the soils are wet causes surface compaction, excessive runoff, and reduced forage yields. No-till helps to control erosion.

These soils are generally unsuitable to dwellings and septic tank absorption fields. The main limitations are slope on both soils and depth to bedrock, shrinking and swelling, the seasonal high water table, and the hazard of slippage on the Latham soil. Developing sites for recreation and urban uses is very difficult. Cutting and filling increase the hazard of hillside slippage. Some scenic areas are potential sites for hiking trails and lookout points. Erosion is a severe hazard if the plant cover is removed. In recreation areas laying out trails across the slope if possible and protecting them helps to control erosion. Laying out local roads on the contour reduces cutting and filling. Seeding and mulching roadbanks helps to control erosion.

The land capability classification is VIe. The woodland ordination symbol for the Shelocta soil is 4R on the north aspect and 3R on the south aspect; for the Latham soil, it is 4R on the north aspect and 3R on the south aspect. The pasture and hayland suitability group is A-3 for the Shelocta soil and F-2 for the Latham soil.

SfE—Steinsburg-Clymer association, steep

These are well drained soils on shoulder slopes and side slopes on uplands. The Steinsburg soil is moderately deep. It is on the upper side slopes and on shoulder slopes. The Clymer soils is deep. It is on mid and lower side slopes and on some shoulder slopes. Slope is dominantly 25 to 50 percent. Areas are irregularly shaped and range from 100 to 400 acres in size. Generally, they are 50 percent Steinsburg sandy loam and 30 percent Clymer loam. Because of present and anticipated use of these soils, separating them in mapping was not practical.

Typically, the Steinsburg soil has a surface layer of brown, friable sandy loam about 3 inches thick. The subsurface layer is yellowish brown, friable sandy loam about 7 inches thick. The subsoil is about 17 inches thick. The subsoil is strong brown, friable sandy loam. The substratum to a depth of about 31 inches is strong brown, friable channery sandy loam. Soft sandstone is at a depth of about 31 inches. In places the soil is deeper over bedrock.

Typically, the Clymer soil has a surface layer of brown, friable loam about 4 inches thick. The subsoil is about 33 inches thick. In the upper part it is yellowish brown, friable loam. In the lower part it is strong brown, friable loam, clay loam, and sandy loam. The substratum is brownish yellow, friable sandy loam. Brownish yellow, weathered sandstone is at a depth of about 50 inches. In some areas the subsoil has less clay. In places the soil is moderately well drained.

Included with these soils in mapping are areas of Latham and Lily soils. Latham and Lily soils are moderately deep. Also included are deep, moderately well drained soils that have more clay in the subsoil. These soils and Latham soils have gray mottles in the subsoil and are on side slopes and ridgetops. Lily soils have more clay in the subsoil than the Steinsburg soil. They are on ridgetops. Included areas are less than 20 acres in size. Included soils make up about 20 percent of this unit.

Permeability is moderately rapid in the Steinsburg soil and moderate in the Clymer soil. Available water capacity is low in both soils. Runoff is very rapid.

These soils are in native hardwoods.

These soils are moderately well suited to trees. North- and east-facing slopes and coves are better sites for woodland than south- and west-facing slopes because of less evapotranspiration and cooler temperatures. Laying out logging roads and skid trails on or near the contour, installing water bars, and maintaining a vegetative cover help to control erosion. Mulching around seedlings will reduce seedling mortality. Removing vines and the less desirable trees and shrubs helps to reduce plant competition. Building haul roads and skid trails on the contour facilitates the use of equipment. Cutting and filling to a more desirable slope improves sites for log landings. Special equipment is needed for site preparation and planting. Filter strips or undisturbed buffer strips between harvested areas and water courses reduces the siltation of streams.

These soils are generally unsuited to cultivated crops, hay, and pasture. The main limitations are slope, the severe erosion hazard, and droughtiness.

These soils generally are unsuited to sanitary facilities and buildings. The main limitations are slope and, on the Steinsburg soil, moderately deep bedrock. Developing sites for recreation and urban uses is very difficult. Erosion is a severe hazard if the vegetative cover is removed. In recreation areas laying out trails across the slope, if possible, and protecting them help to control erosion. Laying out local roads on the contour reduces cutting and filling. Seeding and mulching roadbanks help to control erosion.

The land capability classification is VIIe. The woodland ordination symbol for the Steinsburg soil is 4R on the north aspect and 3R on the south aspect;

for the Clymer soil it is 4R. The pasture and hayland suitability group is F-2 for the Steinsburg soil and A-3 for the Clymer soil.

SsF—Steinsburg-Shelocta association, very steep

These are well drained soils on shoulder slopes and side slopes on uplands. The Steinsburg soil is moderately deep. It is on upper side slopes and on shoulder slopes. The Shelocta soil is deep. It is on mid and lower side slopes. Slopes are dominantly 40 to 70 percent. Areas are irregularly shaped and range from 150 to 400 acres in size. They generally are about 50 percent Steinsburg loam and 35 percent Shelocta silt loam. Because of present and anticipated use of these soils, separating them in mapping was impractical or unnecessary.

Typically, the Steinsburg soil has a surface layer of dark grayish brown, friable loam about 4 inches thick. The subsoil is about 26 inches thick. The subsoil is yellowish brown, friable loam and sandy loam. Soft sandstone is at a depth of 30 inches. Some areas are shallow to bedrock. In a few areas the subsoil has more coarse fragments.

Typically, the Shelocta soil has a surface layer of very dark brown, friable silt loam about 5 inches thick. The subsoil is about 55 inches thick. The subsoil is brown and yellowish brown, friable silt loam and channery silt loam. Light olive brown, soft siltstone and shale are at a depth of about 60 inches. In places the soil is moderately deep to sandstone or siltstone. In some areas the slope is more than 70 percent. In a few places the soil is moderately well drained. In other places the subsoil has more sand. In some areas slope is less than 40 percent.

Included with this association in mapping are areas of moderately well drained Latham soils and deep, moderately well drained, fine soils. The included soils are on ridgetops and side slopes. Also included, on side slopes, are some old mining scars that are generally too small to delineate at the scale used for mapping. Included areas are less than 20 acres in size. They make up about 15 percent of the map unit.

Permeability is moderately rapid in the Steinsburg soil and moderate in the Shelocta soil. Available water capacity is low in the Steinsburg soil and moderate in the Shelocta soil. Runoff is very rapid.

In most areas these soils are in native hardwoods.

These soils generally are unsuited to cultivated crops, hay, and pasture. The main limitations are slope and the severe hazard of erosion.

These soils are moderately well suited to trees. North- and east-facing slopes and coves are better sites for woodland than south- and west-facing slopes because of less evapotranspiration and cooler temperatures. Laying out logging roads and skid trails on or near the contour, installing water bars, and maintaining a vegetative cover help to control erosion. Planting seedlings that have been transplanted once will reduce the seedling mortality rate. Removing vines and the less desirable trees and shrubs helps to reduce plant competition. Laying out haul roads and log landings apart from active slips helps to stabilize the road base and to prevent soil slippage. Building haul roads and skid trails on the contour facilitates the use of equipment. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting. Filter strips or undisturbed buffer strips between harvested areas and water courses reduce the siltation of streams. On the Steinsburg soil the windthrow hazard can be reduced by harvest methods that do not leave the remaining trees widely spaced or isolated.

These soils are generally unsuitable to dwellings and septic tank absorption fields. The main limitations are very steep slope on both soils and bedrock between depths of 24 and 40 inches on the Steinsburg soil. Construction for recreation and urban uses is very difficult. Some scenic areas are potential sites for hiking trails and lookout points. Erosion is a severe hazard if the plant cover is removed. Laying out trails in recreation areas across the slope, if possible, and protecting them help to control erosion. Laying out local roads on the contour reduces cutting and filling. Seeding and mulching roadbanks reduces gullying.

The land capability classification is VIIe. The woodland ordination symbol for the Steinsburg and Shelocta soils is 4R on the north aspect and 3R on the south aspect. The pasture and hayland suitability group is H-1 for both soils.

St—Stendal silt loam, occasionally flooded

This deep, somewhat poorly drained, nearly level soil is on flood plains. Most areas are circular or long and narrow. Areas range from 10 to 100 acres in size. Slope is 0 to 2 percent.

Typically, the surface layer is brown, friable silt loam about 10 inches thick. The substratum is gray and brown, mottled, friable silt loam to a depth of about 80 inches. Some areas are poorly drained. A few areas have more sand and coarse fragments throughout.

Included with this soil in mapping are small areas of Cuba and Tioga soils. Cuba and Tioga soils are well drained. Cuba soils are on slight rises near streams.

Tioga soils are on natural levees adjacent to streams. Included soils make up about 15 percent of the unit.

Permeability of the Stendal is moderate. Available water capacity is very high. Runoff is slow. The surface layer can be easily tilled throughout a fairly wide range in moisture content. A seasonal high water table is at a depth of 1.0 to 3.0 feet during extended wet periods.

In most areas this soil is used as cropland. In some areas it is used for hayland or pasture.

In drained areas this soil is well suited to corn and soybeans and moderately well suited to small grain. In undrained areas it is moderately well suited or poorly suited to row crops and poorly suited to small grain. The seasonal high water table and flooding are the main limitations for cultivated crops. Surface or subsurface drains can remove excess water where adequate outlets are available. Returning crop residue to the soil and regularly adding other organic material improves fertility, reduces crusting, and increases the rate of water infiltration. Tilling within the optimum moisture range reduces surface compaction, maintains soil structure, and improves tilth.

In drained areas this soil is well suited to grasses and legumes for hay and pasture. In undrained areas it is moderately well suited to these uses. The main limitations are the seasonal high water table and flooding. The soil is poorly suited to grazing early in spring. Surface and subsurface drains can remove excess water where adequate outlets are available. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture in good condition. In establishing new stands, forage species that tolerate the seasonal high water table are preferred for planting.

This soil is well suited to trees. Logging is possible when the soil is dry or frozen. Site preparation and planting can be done during dry periods. Removing vines and the less desirable trees and shrubs helps to reduce plant competition.

This soil is generally unsuited to dwellings and septic tank absorption fields. The main limitations are flooding and the seasonal high water table (fig. 12).

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

Tg—Tioga loam, occasionally flooded

This is deep, well drained, nearly level soil on flood plains. Slope ranges from 0 to 3 percent. Most areas are circular or long and narrow. Areas range from 5 to 20 acres in size.

Typically, the surface layer is brown, friable loam about 10 inches thick. The subsoil is brown, friable loam and sandy loam about 25 inches thick. The substratum to a depth of about 60 inches is dark brown, friable sandy loam. In some areas the substratum has more clay or less sand. In a few areas the subsoil is more acid.

Included with this soil in mapping are small areas of Cuba and Stendal soils. Cuba soils have more silt in the subsoil and are in landscape positions slightly higher than those of the Tioga soil. Stendal soils are somewhat poorly drained and are in small depressions on flood plains. Included soils make up about 10 percent of the unit.

Permeability of the Tioga soil is moderate or moderately rapid. Available water capacity is moderate. Runoff is slow. The surface layer can be easily tilled throughout a fairly wide range in moisture content. A seasonal high water table is at a depth of 3.0 to 6.0 feet during extended wet periods.

Most areas of this soil are used as cropland and hayland. A few small areas are in native hardwoods.

This soil is well suited to corn and soybeans. Small grain, such as winter wheat, are damaged by flooding in winter and spring. In some years flooding in spring delays planting. Returning crop residue to the soil and regularly adding other organic material improve fertility, reduce crusting, and increase water infiltration. Tilling within the optimum moisture range reduces surface compaction, maintains soil structure, and improves tilth.

This soil is well suited to hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, increased runoff, and reduced forage yields. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species.

This soil is well suited to trees. Spraying, cutting, or girdling undesirable trees and vines helps to reduce plant competition. Trees can be harvested or planted when the soil is not flooded.

This soil is generally unsuited as a site for dwellings and septic tank absorption fields. The main limitation is flooding. It is well suited to picnic areas and paths and trails. The soil is moderately well suited to campgrounds and playgrounds. The main limitation is flooding.

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

To—Tioga loam, frequently flooded

This is a deep, well drained, nearly level soil on

Figure 12.—Flooding is a hazard on Stendal silt loam, occasionally flooded.

flood plains. Slope ranges from 0 to 3 percent. Areas range from 5 to 40 acres in size. Most are circular or long and narrow.

Typically, the surface layer is brown, friable loam about 10 inches thick. The subsoil is dark brown, friable loam 25 inches thick. The substratum to a depth of about 60 inches is dark brown, friable sandy loam. In some areas the substratum has more clay or less sand. In a few areas the subsoil is more acid.

Included with this soil are small areas of Cuba and Stendal soils. Cuba soils have more silt in the subsoil. They are in slightly higher positions on the landscape than the Tioga soil. Stendal soils are somewhat poorly drained. They are in small depressions on flood plains. Included soils make up about 10 percent of the unit.

Permeability of the Tioga soil is moderate or moderately rapid. Available water capacity is moderate. Runoff is slow. The surface layer can be easily tilled throughout a fairly wide range in moisture content. A seasonal high water table is at depth of 3.0 to 6.0 feet during extended wet periods.

Most areas of this soil are used as cropland and hayland. A few small areas are in native hardwoods.

This soil is well suited to corn and soybeans. In some years small grain, such as winter wheat, can be severely damaged by flooding in winter and spring. In some years flooding in spring delays planting. Returning crop residue to the soil and regularly adding other organic material improve fertility, reduce crusting, and increase water infiltration. Tilling within the optimum moisture range reduces surface compaction, maintains soil structure, and improves tilth.

This soil is well suited to hay and pasture.

Overgrazing or grazing when the soil is wet causes surface compaction, increased runoff, and reduced forage yields. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species.

This soil is well suited to trees. Spraying, cutting, or girdling undesirable trees and vines helps to reduce plant competition. Trees can be harvested or planted when the soil is not flooded.

This soil is generally unsuited as a site for dwellings and septic tank absorption fields. The main limitation is flooding. It is well suited to picnic areas, paths, and trails. The soil is moderately well suited to campgrounds and playgrounds. The main limitation is flooding.

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

UgC—Upshur-Gilpin complex, 8 to 15 percent slopes

These are well drained, strongly sloping soils on ridgetops on uplands. The soils are so intermingled because the bedrock is stratified. The Upshur soil is deep. It is commonly on concave slopes and in saddles. The Gilpin soil is moderately deep. It is on knolls and uneven slopes. Most areas of these soils are long and narrow or irregularly shaped and follow the contour of the ridgetop. Areas range from 5 to 100 acres in size. Most areas are about 50 percent Upshur silty clay loam and 25 percent Gilpin silt loam. The soils are in areas so intricately mixed or so small in size that separating them in mapping was not practical.

Typically, the Upshur soil has a brown, firm silty clay loam surface layer about 5 inches thick. The subsoil is about 39 inches thick. In the upper part it is yellowish red, firm silty clay. In the lower part it is reddish brown and dark red, firm clay and silty clay. The substratum is red, firm silty clay loam. Soft, red shale is at a depth of about 55 inches. In some areas bedrock is moderately deep. In some areas the surface layer is silt loam. In some places the subsoil is not as red. In some areas the lower part of the subsoil has gray mottles.

Typically, the Gilpin soil has a brown, friable silt loam surface layer about 2 inches thick. The subsurface layer is yellowish brown, friable silt loam about 5 inches thick. The subsoil is yellowish brown and strong brown, friable silt loam about 18 inches thick. Siltstone is at a depth of about 25 inches. In places the lower part of the subsoil has gray mottles. In some areas bedrock is more than 40 inches deep. In some areas the subsoil has more sand. In places bedrock is less than 20 inches deep.

Included with these soils in mapping are small areas of Rarden, Steinsburg, and Woodsfield soils. Rarden soils are moderately well drained and are on the higher parts of ridgetops and on shoulder slopes. Steinsburg soils have more sand in the subsoil than the Upshur and Gilpin soils and are on narrow ridges. Woodsfield soils have more silt in the upper part of the subsoil than the Upshur and Gilpin soils and are on the broader ridges. Included soils are less than 10 acres in size and make up about 25 percent of the unit.

Permeability is slow on the Upshur soil and moderate on the Gilpin soil. The root zone in the Upshur soil is deep but restricted by high clay content. The root zone in the Gilpin soil is moderately deep. The available water capacity is low or moderate in the Upshur soil and low in the Gilpin soil. Runoff is rapid. The shrink-swell potential is high in the subsoil of the Upshur soil and low in the Gilpin soil.

Most areas of these soils are used for pasture and woodland. Some areas are used for cropland.

The Upshur and Gilpin soils are poorly suited to row crops and small grain. Controlling erosion is a major management concern. The surface layer of these soils crust after hard rains. A conservation tillage system, including no-till, that leaves crop residue on the soil surface, grassed waterways, contour stripcropping, meadow crops in the cropping system, cover crops, and returning crop residue to the soil help to control erosion, to reduce crusting, and to improve infiltration.

The Upshur and Gilpin soils are moderately well suited to pasture and hay. If these soils are overgrazed or plowed for seedbed preparation, erosion is a severe hazard. No-till, winter cover crops, or companion crops helps to control erosion. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage plants. Controlling grazing in winter and other wet periods helps to prevent surface compaction.

The Upshur soil is moderately well suited and the Gilpin soil is well suited to trees. On the Upshur soil planting techniques that spread the roots of seedlings and increase soil-root contact reduce the seedling mortality rate. On the Upshur soil the windthrow hazard can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced. The surface layer of the Upshur soil is sticky when wet. Applying gravel or crushed stone on haul roads and log landings improves soil strength and traction. Cutting and filling to a more desirable slope improve sites for log landings. On the sticky Upshur soil logging, tilling, and planting can be done during dry periods. Compaction wheels on planters are needed to firm the soil around the roots of seedlings.

These soils are generally unsuited to septic tank absorption fields and poorly suited to buildings. The clay content in the subsoil of the Gilpin soil is lower, and so it is better suited to buildings than the Upshur soil. Cutting and filling increase the hazard of slippage. Draining surface water away from buildings helps to reduce damage from shrinking and swelling of the soil. The bedrock underlying these soils is generally rippable with heavy construction equipment. On the Upshur soil backfilling along foundation walls with a suitable material helps to reduce shrinking and swelling. On the Upshur soil drains at the base of footings intercept the lateral movement of water and reduce the hazard of slippage. Maintaining as much cover as possible on the construction site helps to control erosion. On the Upshur soil most local roads require considerable excavation and are subject to slippage. Providing a suitable base material reduces the damage to local roads caused by frost action on both soils and by shrinking and swelling and low strength on the Upshur soil.

The land capability classification is IVe. The woodland ordination symbol for Upshur soil is 3C. Gilpin soil is 4A. The pasture and hayland suitability group is F-5 for Upshur soil and F-1 for Gilpin soil.

UgD—Upshur-Gilpin complex, 15 to 25 percent slopes

These are well drained, moderately steep soils on ridgetops and shoulder slopes on uplands. The soils are so intermingled because the bedrock is stratified. The Upshur soil is deep. It is commonly on concave slopes and in saddles. The Gilpin soil is moderately deep. It is on knolls and uneven slopes. Most areas of these soils are long and narrow or irregularly shaped and follow the contour of the ridgetop. Areas range from 10 to 100 acres in size. Most are 50 percent Upshur silty clay loam and 25 percent Gilpin silt loam. The soils are in areas so intricately mixed or so small in size that separating them in mapping was not practical.

Typically, the Upshur soil has a brown, firm silty clay loam surface layer about 5 inches thick. The subsoil is yellowish red and red, firm silty clay 45 inches thick. The substratum is red, firm silty clay loam. Soft, red shale is at a depth of about 55 inches. In some areas the soil is moderately deep to bedrock. In some areas the surface layer is silt loam. In some places the subsoil is not as red. In some areas the lower part of the subsoil has gray mottles. In places the subsoil has more coarse fragments.

Typically, the Gilpin soil has a brown, friable silt loam surface layer about 4 inches thick. The subsoil is about 19 inches thick. It is yellowish brown, friable silt loam. Fractured sandstone and siltstone are at a depth of 23 inches. In some areas depth to bedrock is more than 40 inches. In places it is less than 20 inches. In some areas the subsoil has more sand. In places the lower part of the subsoil has gray mottles. In some areas the subsoil has more coarse fragments.

Included with this soil in mapping are small areas of Rarden and Steinsburg soils. Rarden soils are moderately well drained. They are on the higher parts of ridgetops and on shoulder slopes. Steinsburg soils have more sand in the subsoil. They are on narrow ridges. Included soils are less than 10 acres in size.

Permeability is slow in the Upshur soil and moderate in the Gilpin soil. Available water capacity is low or moderate on the Upshur soil and low on the Gilpin soil. Runoff is very rapid on both soils. The shrink-swell potential is high in the subsoil of the Upshur soil. It is low in the Gilpin soil.

Most areas are used for woodland (fig. 13). Some areas are used for cropland and pasture.

The Upshur and Gilpin soils are poorly suited to row crops and small grain. These soils can be cropped successfully, but the cropping system should include a high proportion of long-term hay or pasture. Controlling erosion is a major management concern. The surface layer of these soils is crusted after hard rains. A conservation tillage system, including no-till, that leaves crop residue on the soil surface, cover crops, tillage at the proper moisture content, and grassed waterways help to control erosion, to improve tilth, and to maintain the organic matter content.

The Upshur and Gilpin soils are poorly suited to hay and pasture. If these soils are overgrazed or plowed for seedbed preparation, erosion is a severe hazard. During pasture seeding, cover crops, companion crops, or no-till helps to control erosion. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species. Controlling grazing in winter and other wet periods helps to prevent surface compaction.

The Upshur and Gilpin soils are moderately well suited to trees. North- and east-facing slopes and coves are better sites for woodland than south- and west-facing slopes because of less evapotranspiration and cooler temperatures. Laying out logging roads and skid trails on or near the contour, installing water bars, and a maintaining a vegetative cover help to control erosion. Planting seedlings that have been transplanted once will reduce the seedling mortality rate. On the Upshur soil planting techniques that spread the roots of seedlings and increase soil-root contact will reduce the seedling mortality rate. The surface layer of the Upshur soil is sticky when wet. On the Upshur soil harvesting without leaving the remaining trees widely spaced or isolated will reduce the windthrow hazard. Applying gravel or crushed stone on haul roads and log landings improves soil strength and traction. Laying out haul roads and log landings apart from active slips helps to stabilize the road base and to prevent soil slippage. Building haul roads and skid trails on the contour facilitates the use of equipment. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting. On the sticky Upshur soil logging, tilling, and planting can be done when the soil is dry. Compaction wheels on planters are needed to firm the soil around the roots of seedlings.

The Upshur and Gilpin soils are generally unsuited to septic tank absorption fields. The main limitations are slope on both soils, bedrock between depths of 20 and 40 inches on the Gilpin soil, and slow permeability and the slippage hazard on the Upshur soil.

These soils are poorly suited to buildings. The Gilpin soil has a lower clay content in the subsoil than the Upshur soil. Thus, it is better suited to buildings than the Upshur soil. On the Upshur soil extending foundations of buildings to bedrock helps to overcome the slippage hazard. On the Upshur soil installing drains at the base of footings intercepts the lateral movement of water. On the Upshur soil backfilling excavations around foundations with a low shrink-swell material helps to overcome shrinking and swelling. On the Upshur soil cutting and filling increases the hazard of slippage. Maintaining as much cover as possible helps to control erosion. On the Upshur soil most local roads require considerable excavation and are subject to slippage. Laying out local roads on the Gilpin soil will avoid soil problems on the Upshur soil. Providing a suitable base material reduces the damage to local roads caused by frost action on both soils and by shrinking and swelling on the Upshur soil.

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

UgE—Upshur-Gilpin complex, 25 to 40 percent slopes

These are well drained, steep soils on shoulders and side slopes on uplands. The Upshur soil is deep. It is commonly on midslope benches, shoulder slopes, and lower side slopes. Hillside slips are common on the Upshur soil. The Gilpin soil is moderately deep. It is commonly on upper and middle side slopes and on shoulder slopes. Slopes, either smooth or benched, are dominantly 25 to 40 percent. Most areas range from 20 to several hundred acres in size. Areas generally are about 55 percent Upshur silty clay loam and 25 percent Gilpin silt loam. These soils occur in areas so intricately mixed or so small in size that separating them in mapping was not practical.

Typically, the Upshur soil has a surface layer of dark brown, friable silty clay loam about 2 inches thick. The subsoil is about 46 inches thick. In the upper part it is yellowish red, friable silty clay loam. In the lower part it is dark reddish brown and dark red, firm silty clay. The substratum is dark reddish brown, firm silty clay loam. Soft, dark red siltstone is at a depth of about 58 inches. In places bedrock is at depths of 20 to 40

Figure 13.—A good stand of white oak in an area of Upshur-Gilpin complex, 15 to 25 percent slopes.

inches. In places the subsoil is not as red. In some areas the subsoil has more coarse fragments.

Typically, the Gilpin soil has a surface layer of brown, friable silt loam about 3 inches thick. The subsoil is about 29 inches thick. It is yellowish brown and strong brown, friable silt loam, channery silt loam, and very channery silt loam. Brown siltstone is at a depth of about 32 inches. In places the lower part of the subsoil has gray mottles. In some areas bedrock is deeper. In places the subsoil has more sand.

Included with these soils in mapping are small areas of Latham and Rarden soils. Latham and Rarden soils are moderately well drained. They are in random patterns on benches and on lower side slopes. Included soils make up about 20 percent of the complex.

Permeability is slow in the Upshur soil and moderate in the Gilpin soil. The available water capacity is low or moderate in the Upshur soil and low in the Gilpin soil. Runoff is very rapid. The shrink-swell potential is high in the subsoil of the Upshur soil. It is low in the Gilpin soil.

In most areas these soils are woodland.

The Upshur and Gilpin soils are generally unsuited to row crops, hay, and pasture. The main limitation is steep slope and the severe erosion hazard on both soils, bedrock between depths of 20 to 40 inches on the Gilpin soil, and the high clay content in the subsoil on the Upshur soil.

The Upshur and Gilpin soils are moderately well suited to trees and well suited to habitat for woodland wildlife. North- and east-facing slopes and coves are better sites for woodland than south- and west-facing slopes because of less evapotranspiration and cooler temperatures. Laying out logging roads and skid trails on or near the contour, installing water bars, and maintaining a vegetative cover help to control erosion. Planting seedlings that have been transplanted once reduces the seedling mortality rate on south-facing slopes. On the Upshur soil planting techniques that spread the roots of seedlings and increase soil-root contact reduce the seedling mortality rate. On the Upshur soil harvesting practices that do not leave the remaining trees widely spaced or isolated will reduce the windthrow hazard. Applying gravel or crushed stone on haul roads and log landings improves soil strength and traction. Laying out haul roads and log landings apart from active slips helps to stabilize the road base and to prevent soil slippage. Building haul roads and skid trails on the contour facilitates the use of equipment. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting.

The Upshur and Gilpin soils are generally unsuited to septic tank absorption fields and buildings. The main limitations are steep slope on both soils, bedrock between depths of 20 and 40 inches on the Gilpin soil, and slow permeability, high shrinking and swelling, and hillside slippage on the Upshur soil. Erosion is a severe hazard if the vegetative cover is removed. Establishing trails in recreation areas across the slope, if possible, and protecting them helps to control erosion.

The land capability classification is VIIe. The woodland ordination symbol for the Upshur soil is 4R on the north aspect, 3R on the south aspect; for the Gilpin soil it is 4R on both aspects. The pasture and hayland suitability group is F-6 for the Upshur soil and F-2 for the Gilpin soil.

UgF—Upshur-Gilpin complex, 40 to 70 percent slopes

These are well drained, very steep soils on shoulder slopes and side slopes on uplands. The Upshur soil is deep. It is commonly on midslope benches, on lower side slopes, and on shoulder slopes. Hillside slips are common on the Upshur soil. The Gilpin soil is moderately deep. It is commonly on upper and middle side slopes and on shoulder slopes. Slopes are either smooth or benched. Most areas of these soils range from 40 to several hundred acres in size. Areas generally are about 55 percent Upshur soil and 25 percent Gilpin soil. These soils are in areas so intricately mixed or so small in size that separating them in mapping was not practical.

Typically, Upshur soil has a surface layer of brown, friable silt loam about 2 inches thick. The subsoil is about 36 inches thick. In the upper part it is strong brown, friable silty clay loam. In the lower part it is reddish brown and dark reddish brown, firm silty clay. The substratum is dusky red, firm silty clay loam. Soft, dark reddish brown shale is at a depth of about 45 inches. In places bedrock is at a depth of 20 to 40 inches. In places the subsoil is not as red. In some areas the subsoil has more coarse fragments.

Typically, the Gilpin soil has a surface layer of brown, friable channery silt loam about 3 inches thick. The subsoil is about 27 inches thick. It is strong brown, friable channery silt loam. Fractured siltstone is at a depth of 30 inches. In places the lower part of the subsoil has gray mottles. In some areas the soil is more than 40 inches or less than 20 inches deep. In places the subsoil has more sand. In some areas the subsoil has more coarse fragments.

Included with these soils in mapping are small areas of Latham, Rarden, and Vandalia soils. Latham and Rarden soils are moderately well drained. They are in random patterns on benches and on the lower parts of slopes. Vandalia soils have more coarse fragments than the Upshur soil and have more clay in the subsoil than the Gilpin soil. They are on foot slopes. Also included are small areas of shallow soils that have more coarse fragments in the subsoil than the Gilpin soil and that are on shoulder slopes. Included soils are in areas of less than 20 acres. They make up about 20 percent of the complex.

Permeability is slow in the Upshur soil and moderate in the Gilpin soil. Available water capacity is low or moderate on the Upshur soil and low on the Gilpin soil. Runoff is very rapid. The shrink-swell potential is high in the subsoil of the Upshur soil. It is low in the Gilpin soil.

In most areas these soils are woodland.

The Upshur and Gilpin soils are moderately well suited to trees. North- and east-facing slopes and coves are better sites for woodland than south- and west-facing slopes because of less evapotranspiration and cooler temperatures. Laying out logging roads and skid trails on or near the contour, installing water bars, and a maintaining a vegetative cover help to control erosion. On the Upshur soil planting techniques that spread the roots of seedlings and increase soil-root contact reduce the seedling mortality rate. Planting seedlings that have been transplanted once will reduce the seedling mortality rate on south-facing slopes. On the Upshur soil harvesting without leaving the remaining trees widely spaced or isolated will reduce the windthrow hazard. Applying gravel or crushed stone on haul roads and log landings improves soil strength and traction. Laying out haul roads and log landings apart from active slips helps to stabilize the road base and to prevent soil slippage.

Building haul roads and skid trails on the contour facilitates the use of equipment. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting.

These soils are generally unsuited to row crops, hay, and pasture. The main limitations are steep slope and the severe erosion hazard on both soils, moderately deep bedrock on the Gilpin soil, and the high clay content in the subsoil of the Upshur soil (fig. 14).

These soils are generally unsuited to septic tank absorption fields and buildings. The main limitations are very steep slope on both soils, bedrock between depths of 20 and 40 inches on the Gilpin soil, and slow permeability, high shrinking and swelling, and hillside slippage on the Upshur soil. Erosion is a severe hazard if the vegetative cover is removed. In recreation areas laying out trails across the slope, if possible, and protecting them helps to control erosion.

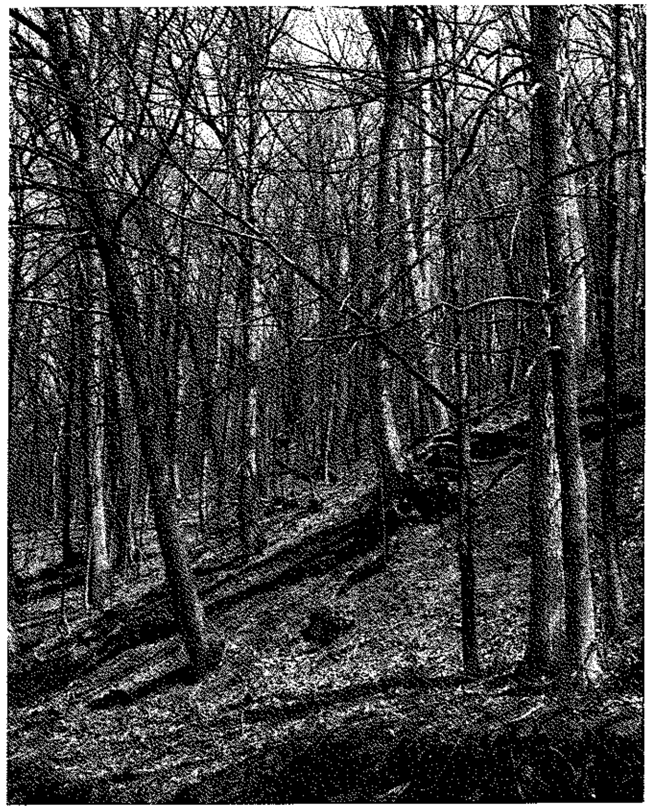


Figure 14.—Soil creep in an area of Upshur-Gilpin complex, 40 to 70 percent slopes. Note curvature at the base of trees.

The land capability classification is VIIe. The woodland ordination symbol for the Upshur soil is 4R on the north aspect, 3R on the south aspect; for the Gilpin soil it is 4R on both aspects. The pasture and hayland suitability group is H-1 for both soils.

UsE—Upshur-Gilpin-Steinsburg association, steep

This association consists of Upshur, Gilpin, and Steinsburg soils on shoulder slopes and side slopes on uplands. The Upshur, Gilpin, and Steinsburg soils are well drained. The Upshur soil is deep. It is commonly on midslopes and the lower side slopes. The Gilpin and Steinsburg soils are moderately deep. They are commonly on shoulder slopes and the upper side slopes. Most slopes are smooth and even, but some are benched and have sharp breaks at sandstone escarpments. Slope is dominantly 25 to 50 percent. Areas of these soils are irregularly shaped. They range from 10 to several hundred acres in size. Most areas are about 30 percent Upshur silt loam, 30 percent Gilpin silt loam, and 20 percent Steinsburg loam. Because of present and anticipated use of these soils, separating them in mapping was impractical or unnecessary.

Typically, the Upshur soil has a surface layer of brown, friable silt loam about 2 inches thick. The subsoil is about 39 inches thick. In the upper part it is yellowish brown, friable silt loam and silty clay loam. In the lower part it is red, dusky red, and reddish brown, firm silty clay. The substratum to a depth of about 46 inches is dark reddish brown, firm silty clay. Limestone is at a depth of about 46 inches. In places bedrock is at a depth of 20 to 40 inches. In places the subsoil is not as red. In some areas the subsoil has more coarse fragments.

Typically, the Gilpin soil has a surface layer of brown, friable silt loam about 3 inches thick. The subsurface layer is yellowish brown, friable silt loam about 3 inches thick. The subsoil is strong brown and dark brown, friable channery silt loam. Siltstone is at a depth of about 25 inches. In some areas it is at a depth of more than 40 inches or less than 20 inches. In some areas the subsoil has more sand. In some areas the lower part of subsoil has gray mottles. In places the subsoil has more coarse fragments.

Typically, the Steinsburg soil has a surface layer of brown, friable loam about 2 inches thick. The subsurface layer is yellowish brown, friable sandy loam 2 inches thick. The subsoil, to a depth of 25 inches, is yellowish brown, friable sandy loam. The substratum is yellowish brown, friable channery sandy loam. Weathered sandstone is at a depth of 33 inches. In places the bedrock is at a depth of more than 40 inches or less than 20 inches. In a few areas the subsoil has more coarse fragments. In places the subsoil has more clay.

Included with this association in mapping are small areas of Latham and Rarden soils. Latham and Rarden soils are moderately well drained and moderately deep. They are on shoulder slopes. Latham soils are also on lower side slopes. Also included are shallow soils that have more coarse fragments in the subsoil than the Upshur, Gilpin, and Steinsburg soils. These shallow soils and rock outcrops are on upper or lower side slopes. Individual areas of these soils and rock outcrops are less than 20 acres in size. Included areas make up about 20 percent of the association.

Permeability is slow in the Upshur soil, moderate in the Gilpin soil, and moderately rapid in the Steinsburg soil. Available water capacity is low or moderate on the Upshur soil and low on the Gilpin and Steinsburg soils. Runoff is very rapid. The shrink-swell potential is low in the Gilpin and Steinsburg soils and high in the Upshur soil.

Most areas of these soils are woodland. A few areas are in permanent pasture.

These soils are moderately well suited to trees. North- and east-facing slopes and coves are better sites for woodland than south- and west-facing slopes because of less evapotranspiration and cooler temperatures. Laying out logging roads and skid trails on or near the contour, installing water bars, and maintaining a vegetative cover help to control erosion. Planting seedlings that have been transplanted once and mulching around seedlings will reduce the seedling mortality rate. On the Upshur and Steinsburg soils harvesting without leaving the remaining trees widely spaced or isolated will reduce the windthrow hazard. Applying gravel or crushed stone on haul roads and log landings improves soil strength and traction. Laying out haul roads and log landings apart from active slips helps to stabilize the road base and to prevent soil slippage. Building haul roads and skid trails on the contour facilitates the use of equipment. Cutting and filling to a more desirable slope improves sites for log landings. Special equipment is needed for site preparation and planting.

These soils are generally unsuited to cultivated crops, hay, and pasture. The main limitations are steep slope and the severe erosion hazard on all three soils, the moderately deep bedrock on the Steinsburg and Gilpin soils, and the high clay content in the subsoil on the Upshur soil.

These soils are generally unsuited to septic tank absorption fields and buildings. The main limitations are steep slope on all three soils, bedrock at a depth of 20 to 40 inches on the Gilpin and Steinsburg soils, and the slow permeability, high shrinking and swelling, and hillside slippage on the Upshur soil. Erosion is a severe hazard if the vegetative cover is removed. Laying out trails in recreation areas across the slope, if possible, and protecting them help to control erosion.

The land capability classification is VIIe. The woodland ordination symbol is 4R for the Upshur and Steinsburg soils on the north aspect, 3R on the south aspect; for the Gilpin soil it is 4R on both aspects. The pasture and hayland suitability group is F-6 for the Upshur soil and F-2 for Gilpin and Steinsburg soils.

UtF—Upshur-Rock outcrop association, very steep

This map unit consists of the Upshur soil and Rock outcrop on uplands. The Upshur soil is deep and well drained. It is on benches, side slopes, and foot slopes. Hillside slips are common on the Upshur soil. Rock outcrop consists of bedrock escarpments on upper and lower side slopes. Below the rock outcrop are boulders. Slope ranges from 35 to 70 percent. Most areas are irregularly shaped and range from 10 to 1,000 acres in size. Most areas consist of about 60 percent Upshur soil and 20 percent Rock outcrop. Because of present and anticipated use of this soil and rock outcrop, separating them in mapping was impractical or unnecessary.

Typically, the Upshur soil has a surface layer of brown, friable silt loam about 5 inches thick. The subsoil is about 35 inches thick. It is yellowish red and dark red, firm silty clay. The substratum is reddish brown, firm channery silty clay loam. Soft, dark reddish brown shale is at a depth of 45 inches. In places the subsoil is not as red. In some areas the subsoil has more coarse fragments. In places bedrock is at a depth of 20 to 40 inches.

Rock outcrop is on vertical cliffs and ledges. The cliffs are about 40 to 80 feet in height. In places rock outcrop makes up more than 20 percent of the complex.

Included in this association in mapping are small areas of Gilpin, Rarden, and Steinsburg soils. Gilpin, Rarden, and Steinsburg soils are moderately deep. They are on the upper and lower side slopes. Included areas are less than 20 acres in size. Included soils make up about 20 percent of the complex.

Permeability is slow in the Upshur soil. The available water capacity is low or moderate. Runoff is very rapid. The shrink-swell potential is high.

Most areas of the Upshur soil are woodland and brushland. Some areas are pasture.

The Upshur soil is moderately well suited to trees. The Rock outcrop is generally unsuited to this use. On the Upshur soil north- and east-facing slopes and coves are better sites for woodland than south- and west-facing slopes because of less evapotranspiration and cooler temperatures. In some areas the problems large boulders can cause generally can be avoided. Laying out logging roads and skid trails on or near the contour, installing water bars, and maintaining a vegetative cover help to control erosion. Planting techniques that spread the roots of seedlings and increase soil-root contact reduce the seedling mortality rate. Harvesting methods that do not leave the remaining trees widely spaced or isolated will reduce the windthrow hazard. Laying out haul roads, log landings, and skid trails around rock outcrops is needed. Rock outcrops interfere with site preparation and planting. Boulders interfere with the use of equipment. Building haul roads and skid trails on the contour facilitates the use of equipment. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting. The surface layer of the Upshur soil is sticky when wet; hence, logging is feasible when the soil is frozen or dry. Applying gravel or crushed stone on haul roads and log landings improves soil strength and traction. Laying out haul roads and log landings apart from active slips helps to stabilize the road base and to prevent soil slippage.

The Upshur soil is generally unsuited to crops, hay, and pasture. The main limitation is very steep slope, the severe erosion hazard, rock outcrop, and boulders.

The Upshur soil is generally unsuited to sanitary facilities and buildings. The main limitations are steep and very steep slope, slow permeability, high shrinking and swelling, and hillside slippage on the Upshur soil and the large boulders and the hazard of rockfalls in areas of Rock outcrop. Construction for recreation and urban uses is very difficult. Erosion is a severe hazard if the vegetative cover is removed. Laying out trails in recreation areas across the slope, if possible, and protecting them help to control erosion. If roads are constructed on this Upshur soil and Rock outcrop, following the contour reduces the need for cut and borrow areas and helps to control erosion. Seeding and mulching road ditches help to prevent the formation of gullies.

The land capability classification is VIIe. The woodland ordination symbol for the Upshur soil is 4R on the north aspect and 3R on the south aspect. Rock outcrop is not assigned a woodland ordination symbol. The pasture and hayland suitability group is H-1 for both aspects of the Upshur soil.

VaD3—Vandalia silty clay loam, 15 to 25 percent slopes, severely eroded

This is a deep, well drained, moderately steep soil on colluvial foot slopes. Erosion has removed most of the original surface layer. The present surface layer consists of a mixture of the original surface layer and the subsoil. This soil is subject to hillside slippage. Most areas are commonly long and narrow, dissected by small drainageways, and range from 5 to 40 acres in size.

Typically, the Vandalia soil has a surface layer of reddish brown, friable silty clay loam about 3 inches thick. The subsoil is about 39 inches thick. It is yellowish red and reddish brown, firm silty clay and reddish brown, firm channery silty clay. The substratum to a depth of about 60 inches is yellowish red, brown, and light olive brown, firm very channery silty clay loam. In places the bedrock is moderately deep.

Included with this soil in mapping are small areas of Gilpin and Kanawha soils. These soils have less clay in the subsoil. Gilpin soils are on side slopes and ridgetops. Kanawha soils are on fans along valley walls. Included soils make up about 10 percent of the unit.

Permeability of the Vandalia soil is moderately slow or slow. Available water capacity is moderate. Runoff is very rapid. The shrink-swell potential is high in the subsoil of the Vandalia soil. A perched seasonal high water table is between depths of 4.0 and 6.0 feet during extended wet periods.

Most areas of this soil are used for hay or pasture. Some areas are woodland.

This soil is generally unsuited to row crops and small grain. The main limitations are moderately steep slope and the severe erosion hazard.

This soil is poorly suited to hay and pasture. The main limitations are moderately steep, uneven slopes and the severe erosion hazard. The erosion hazard is severe if this soil is plowed for seedbed preparation, cultivated, or overgrazed. Maintaining a permanent plant cover helps to control erosion. During seeding, cover crops, companion crops, and no-till help to control erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and reduced forage yields. Proper stocking rates, pasture rotation, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species.

This soil is moderately well suited to trees. North- and east-facing slopes and coves are better sites for woodland than south- and west-facing slopes because of less evapotranspiration and cooler temperatures. Laying out logging roads and skid trails on or near the contour, installing water bars, and maintaining a vegetative cover help to control erosion. Mulching around seedlings reduce the seedling mortality rate on south-facing slopes. The surface layer is sticky when wet. Applying gravel or crushed stone on haul roads and log landings improves soil strength and traction. Laying out haul roads and log landings apart from active slips helps to stabilize the road base and to prevent soil slippage. Building haul roads and skid trails on the contour facilitates the use of equipment. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting. Compaction wheels on planters are needed to firm the soil around the roots of seedlings. On the sticky Vandalia soil logging, tilling, and planting is possible when the soil is dry.

This soil is generally unsuited to septic tank absorption fields and buildings (fig. 15). The main limitations are slope, hillside slippage, slow permeability, and high shrinking and swelling. Site preparation for urban and recreation uses is very difficult.

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

WaB—Watertown sandy loam, 1 to 8 percent slopes

This is a deep, well drained, nearly level and gently sloping soil on stream terraces. Most areas are long and narrow or irregularly shaped. Areas range from 5 to 100 acres in size.

Typically, the surface layer is brown, friable sandy loam about 10 inches thick. The subsoil is yellowish brown, friable coarse sandy loam and sandy loam about 18 inches thick. The substratum to a depth of about 80 inches is strong brown, loose, stratified coarse sand and gravelly coarse sand. In some areas the substratum has more clay. In places the subsoil has less sand.

Included with this soil in mapping are narrow strips of Elkinsville, Lakin, Weinbach, and Wheeling soils. Elkinsville and Wheeling soils have less sand in the subsoil and are in slightly lower positions than the Watertown soil. Lakin soils have less clay in the subsoil and are in slightly steeper positions than the Watertown soil. Weinbach soils are somewhat poorly drained and are along drainageways. Included soils make up about 10 percent of the unit.

Permeability of the Watertown soil is moderately rapid in the subsoil and rapid in the substratum. Available water capacity is low. Runoff is slow. The surface layer can be easily tilled throughout a fairly wide range in moisture content.

Most of the acreage of this soil is cropland. Some areas are used for homesites. A few small areas are in native hardwoods.

This soil is well suited to corn, soybeans, tobacco, and small grain. If the soil is cultivated, erosion is a hazard. Cultivated crops can be grown every year but erosion control and improved management are needed. Conservation measures that maintain tilth and the organic matter content are also needed. A conservation tillage system that leaves crop residue on the surface, a cropping sequence that includes grasses and legumes, incorporating crop residue into the plow layer, contour farming or contour stripcropping, and grassed waterways help to maintain tilth, to reduce runoff, and to control erosion. Tilling within the optimum moisture range reduces surface compaction.

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

This soil is well suited to trees. Species that tolerate droughtiness are preferred for planting.

This soil is well suited to dwellings and septic tank absorption fields. Because of rapid permeability in the subsoil, the effluent in septic tank absorption fields is not adequately filtered and can pollute the ground water. Installing the absorption field in suitable fill material reduces the hazard of ground water pollution. In some areas an aeration sewage disposal system is needed. Providing a suitable base material reduces the damage to local roads and streets caused by frost action and low strength.

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

WeA—Weinbach silt loam, 0 to 2 percent slopes

This is a deep, somewhat poorly drained, nearly level soil on stream terraces. Most areas are long and broad or irregularly shaped and range from 5 to 80 acres in size.

Typically, the surface layer is brown, friable silt loam about 10 inches thick. The subsoil is 60 inches thick. In the upper part it is light brownish gray and pale brown,

Figure 15.—Cutting and filling caused hillside slippage in this area of Vandalia silty clay loam, 15 to 25 percent slopes, severely eroded.

mottled, friable and firm silt loam. In the middle part it is a fragipan of light brownish gray and yellowish brown, mottled, very firm and brittle silt loam. In the lower part it is yellowish brown, mottled, friable silt loam. In some areas the fragipan is deeper. In a few areas the fragipan is not as dense. In some areas the subsoil has more sand.

Included with this soil in mapping are small areas of Sciotoville and Peoga soils. Sciotoville soils are moderately well drained and on slight rises. Peoga soils are poorly drained and are in depressions. Also included are areas of soils that are subject to rare flooding. Included soils make up about 15 percent of the unit.

Permeability of the Weinbach soil is moderate above the fragipan and very slow within. The root zone is 20 to 36 inches deep above the fragipan. The fragipan has a low available water capacity. Runoff is slow. The surface layer can be easily tilled throughout a fairly wide range in moisture content. A perched seasonal high water table is at a depth of 1.0 to 3.0 feet during extended wet periods.

Most areas of this soil are cropland.

In drained areas this soil is well suited to corn, soybeans, and small grain. In undrained areas it is moderately well suited or poorly suited. The seasonal high water table and the dense, very slowly permeable fragipan are major limitations. Surface and subsurface drains can remove excess water in areas where adequate outlets are available. Subsurface drains are more effective if installed on or above the very slowly permeable fragipan. Returning crop residue to the soil and regularly adding other organic material improve fertility, reduce crusting, and increase the rate of water infiltration. Tilling within the optimum moisture range reduces surface compaction, maintains soil structure, and improves tilth.

In drained areas this soil is well suited to grasses and legumes for hay and pasture. It is poorly suited to grazing early in spring. In undrained areas it is moderately well suited. Surface and subsurface drains can remove excess water where adequate outlets are available. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture in good condition. Forage species that tolerate the seasonal high water table are preferred for planting.

This soil is moderately well suited to trees. Logging can be done when the soil is dry or frozen. Site preparation and planting can be done during dry periods. The windthrow hazard can be reduced by harvesting methods that do not isolate the remaining trees or leave them widely spaced.

This soil is poorly suited to septic tank absorption fields. The main limitations are the seasonal high water table and very slow permeability. Increasing the size of the absorption field helps to overcome the restricted permeability. Installing perimeter drains around the absorption field helps to lower the seasonal high water table. In some areas an aeration sewage disposal system is needed.

This soil is poorly suited to dwellings and local roads. The main limitations are the seasonal high water table, low strength, and frost action. Because of the seasonal high water table it is better suited to houses without basements. Laying out properly landscaped building sites helps to keep surface water away from foundations. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Installing a roadside drainage system and providing suitable base material reduce the damage to local roads caused by frost action and low strength. The included areas subject to rare flooding are generally unsuited to buildings.

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

WmB—Wheeling silt loam, 1 to 6 percent slopes

This is a deep, well drained, gently sloping soil on stream terraces. Areas generally are long and narrow or irregularly shaped. They range from 5 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is dark brown and dark yellowish brown, friable silt loam and loam 46 inches thick. The substratum to a depth of 80 inches is brown, friable gravelly loamy sand that has lenses of sandy loam. In some areas the subsoil has more clay. In places the subsoil has less sand.

Included with this soil in mapping are narrow strips of Elkinsville, Sciotoville, and Weinbach soils. Elkinsville soils are well drained. They have less sand in the subsoil and are in landscape positions similar to those of the Wheeling soil. Sciotoville soils are moderately well drained. They are in slightly lower areas than the Wheeling soil. Weinbach soils are somewhat poorly drained. They are along drainageways. Also included are areas of soils that are subject to rare flooding. Included soils make up about 10 percent of the unit.

Permeability of the Wheeling soil is moderate in the subsoil and rapid in the substratum. Available water capacity is moderate. Runoff is medium. The surface layer can be easily tilled throughout a fairly wide range in moisture content.

Most of the acreage of this soil is cropland. A few small areas are in native hardwoods.

This soil is well suited to corn, soybeans, tobacco, and small grain. If the soil is cultivated, erosion is a hazard. Cultivated crops can be grown every year but erosion control and improved management are needed. Conservation measures that maintain tilth and the organic matter content are needed. A conservation tillage system that leaves crop residue on the surface, a cropping sequence that includes grasses and legumes, incorporating crop residue into the plow layer, contour farming or contour stripcropping, and grassed waterways help to maintain tilth, to reduce runoff, and to control erosion. Tilling within the optimum moisture range reduces surface compaction.

This soil is well suited to hay and pasture. Pastures can be grazed early in spring. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species.

This soil is well suited to trees. Removing vines and the less desirable trees and shrubs helps to reduce plant competition.

This soil is well suited to dwellings and septic tank absorption fields. Because of rapid permeability in the substratum, the effluent in septic tank absorption fields is not adequately filtered and can cause ground water pollution. Installing the absorption field in suitable fill material reduces the hazard of ground water pollution. In some areas an aeration sewage disposal system is needed. Providing a suitable base material reduces the damage to local roads and streets caused by frost action and low strength. The included soils that are subject to rare flooding are generally unsuitable to building site development.

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

WmC2—Wheeling silt loam, 6 to 15 percent slopes, eroded

This is a deep, well drained, strongly sloping soil on loamy stream terraces along major streams. Erosion has removed part of the original surface layer. The present surface layer consists of a mixture of the original surface layer and the subsoil. Most areas of this soil are long and narrow and range from 2 to 20 acres in size.

Typically, the surface layer is dark yellowish brown, friable silt loam about 6 inches thick. The subsoil extends to a depth of 47 inches. In the upper part it is yellowish brown and brown, friable silt loam and brown, firm silt loam and loam. In the lower part it is brown, friable loam and yellowish brown, very friable sandy loam. The substratum to a depth of about 80 inches is strong brown, loose stratified gravelly sandy loam, very gravelly loamy sand, gravelly loamy sand, and gravelly sand. In some areas the subsoil has less sand. In places the subsoil has less clay.

Included with this soil in mapping are small areas of Elkinsville and Sciotoville soils. Elkinsville soils have less sand and gravel in the subsoil than the Wheeling soil. They are in positions on the landscape similar to those of the Wheeling soil. Sciotoville soils are moderately well drained. They are in the less sloping areas of the unit. Also included are areas of soils that are subject to rare flooding. Included soils make up about 15 percent of the unit.

Permeability of the Wheeling soil is moderate in the subsoil and rapid in the substratum. Available water capacity is moderate. Runoff is rapid. The surface layer can be easily tilled throughout a fairly wide range in moisture content.

This soil is used mostly for cultivated crops and forage crops.

This soil is moderately well suited to corn, soybeans, tobacco, and small grain. It can be cropped successfully if the cropping sequence includes a high proportion of long-term hay or pasture. If cultivated or the protective cover is removed, the erosion hazard is severe. A conservation tillage system that leaves crop residue on the surface, a cropping sequence that includes grasses and legumes, no-till, incorporating crop residue into the plow layer, contour farming or contour stripcropping, and grassed waterways help to maintain tilth, to reduce runoff, and to control erosion. Tilling within the optimum moisture range reduces surface compaction.

This soil is well suited to hay and pasture. Overgrazing and grazing when the soil is wet causes surface compaction, excessive runoff, and reduced forage yields. When reseeding, pasture renovation using companion crops or cover crops or using trash mulch or no-till help to control erosion. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species.

This soil is well suited to trees. Removing vines and the less desirable trees and shrubs helps to reduce plant competition. Cutting and filling to a more desirable slope improves sites for log landings. Laying out logging roads and skid trails on or near the contour, installing water bars, and maintaining a vegetative cover help to control erosion.

This soil is moderately well suited to septic tank absorption fields and buildings. Slope is the main limitation. Some included areas on lower terrace levels are subject to rare flooding and are generally unsuited to septic tank absorption fields and buildings. Placing distribution lines in absorption fields across the slope reduces the seepage of effluent to the surface. Because of the rapid permeability in the substratum, the effluent from sanitary facilities is not adequately filtered and can cause ground water contamination. In some areas an aeration sewage disposal system is needed. Designing buildings to conform to the natural slope of the land reduces the need for cutting, filling, and land shaping in most areas and reduces the hazard of hillside slippage. Laying out local roads on the contour reduces the need for cut and borrow areas. Providing artificial drainage and a suitable base material reduces the damage to local roads caused by frost action. Maintaining as much cover as possible on the construction site helps to control erosion. This soil is a probable source of sand and gravel for use in commerce and construction.

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

WoB—Woodsfield silt loam, 3 to 8 percent slopes

This is a deep, well drained, gently sloping soil on wide ridgetops. Most areas are rounded or long and narrow and range from 10 to 100 acres in size.

Typically, the surface layer is yellowish brown, friable silt loam about 10 inches thick. The subsoil is about 44 inches thick. In the upper part it is strong brown, friable silty clay loam. In the lower part it is red and dusky red, firm clay and silty clay loam. The substratum is dusky red, firm silty clay loam. Soft siltstone is at a depth of about 62 inches. In some areas the subsoil has less clay. In a few areas a clayey texture is closer to the surface. In some areas the soil is moderately well drained. In places slope is less than 3 percent.

Included with this soil in mapping are small areas of Gilpin and Upshur soils. Gilpin soils are moderately deep and are on the highest part of the landscape. Upshur soils are in more sloping, eroded areas where some of the silt mantle has been removed. They are on ridgetops and side slopes. Included soils make up about 10 percent of most areas.

Permeability of the Woodsfield soil is moderate in the upper part of the subsoil and slow in the lower part. Available water capacity is moderate. Runoff is medium. The shrink-swell potential in the subsoil is high.

In most areas this soil is used for cultivated crops, hay, and pasture. In some areas it is used for woodland.

This soil is well suited to row crops and small grain. If cultivated crops are grown, erosion is a hazard. Crops can be grown year after year with erosion control and improved management. Maintaining tilth and organic matter content is a management concern. A conservation tillage system that leaves crop residue on the surface, a cropping sequence that incorporates crop residue into the plow layer, contour tillage or contour stripcropping, and grassed waterways help to maintain tilth, to reduce runoff, and to control erosion. Tilling within the optimum moisture range reduces surface compaction.

This soil is well suited to hay and pasture. Overgrazing or grazing when the soil is wet and fertility levels are management concerns. Limiting grazing in winter and other wet periods helps to prevent surface compaction. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a maximum stand of key forage species. Trash mulch or no-till with cover crops or companion crops helps to control erosion.

This soil is well suited to trees. Harvesting without leaving the remaining trees widely spaced or isolated will reduce the windthrow hazard. Applying gravel or crushed stone on haul roads and log landings improves soil strength. Removing vines and the less desirable trees and shrubs helps to reduce plant competition. Planting seedlings that have been transplanted once reduces the seedling mortality rate.

This soil is poorly suited to septic tank absorption fields. The main limitation is slow permeability in the subsoil. Installing proper leach lines, using adequate fill, and backfilling with a suitable material improve the filtration of effluent. In some areas an aeration sewage disposal system is needed.

Increasing the size of the absorption field helps to overcome the slow permeability.

This soil is moderately well suited to buildings. The main limitation is high shrinking and swelling. It is better suited to houses without basements than to houses with basements. Laying out properly landscaped building sites helps to keep surface water away from foundations. Foundations and footings should be designed to prevent structural damage from shrinking and swelling. Backfilling along foundation walls with a suitable material helps to reduce shrinking and swelling. Providing a suitable base material reduces the damage to local roads caused by high shrinking and swelling and low strength. Maintaining as much cover as possible on the construction site helps to control erosion.

The land capability classification is IIe. The woodland ordination symbol is 4C. 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 land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forest land or other land, but it is not urban or built-up land or water areas. The soil qualities, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. It is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

About 31,200 acres in the survey area, or nearly 11 percent of the total acreage, meets the soil requirements for prime farmland. This land is scattered throughout the county, but most of it is in valleys, mainly in associations 7, 8, and 9, described under the heading "General Soil Map Units." Most of this prime farmland is used for crops, mainly corn, soybeans, and tobacco.

A recent trend in land use in some parts of the survey area 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, less productive, and not 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. On some soils included in the list, measures that overcome a hazard or limitation, such as flooding, wetness, and droughtiness, are needed. Onsite evaluation is needed to determine whether or not the hazard or limitation has been overcome by corrective measures. 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."

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, the seasonal high water table, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The soils in the survey area are assigned to various interpretative groups at the end of each map unit description and in some of the tables. The groups for each map unit also are shown in the section "Interpretive Groups", which follows the tables at the back of this survey.

Crops and Pasture

This section suggests general management needed for crops and pasture. It lists for each soil the estimated yields of the main crops and pasture plants. And, it explains the system of land capability classification used by the Natural Resources Conservation Service.

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 Natural Resources Conservation Service or the Ohio State University Extension.

Crops

Mark Hatfield and Ned Dooley, district conservationists, Natural Resources Conservation Service, helped to prepare this section.

General management needed for crops is suggested in this section. The crops 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 Natural Resources Conservation Service is explained; and the estimated yields of the main crops and hay plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Ohio State University Extension.

In 1981, about 10,838 acres in Lawrence County was used for row crops, mainly corn; 7,500 acres was used for hay; and 400 acres was used for tobacco. In 1982, about 18,337 acres was used for pasture (*27*). Soybeans and wheat are grown on a small scale in the county because equipment use is limited. The market value of each product causes yearly fluctuations in the acreage of each crop. Rising prices for livestock have increased the amount of cropland used as pasture and hayland. Orchard crops are produced in Lawrence

County on a much smaller scale than in the past. The sale of vegetables and other truck crops produced in the county provides significant income for local farmers. The rich soils on flood plains, the county's southern location, and the influence of the Ohio River on climate in Lawrence County are well suited to vegetable crops (fig. 16).

The potential for increased food production in the county is good. Production can be increased by extending the latest crop production technology to all of the cropland in the county. This survey can greatly facilitate the application of such technology. The measures needed on cropland are those that control erosion, improve drainage, and improve or help to maintain fertility and tilth.

Erosion is a hazard on all the gently sloping to very steep soils in the county. It reduces soil productivity and deteriorates tilth. It also increases the amount of sediment, herbicides, and pesticides that enter waterways and streams. The erodibility of a particular soil depends in part on the physical properties of the soil. For example, Omulga soils, which have a higher content of silt in the surface layer, are more susceptible to erosion than Wheeling soils on comparable slopes and with a similar vegetative cover. On all soils, the hazard of erosion increases with the percentage of slope. In eroded areas preparing a seedbed and tillage are difficult because erosion has removed part of the original, friable surface layer. Some common examples are the eroded Licking and Vandalia soils.

A protective plant cover increases the rate of water infiltration, reduces runoff, and helps to control erosion. Keeping a plant cover on the soil for extended

Figure 16.—Kanawha silt loam, 2 to 6 percent slopes, is well suited to no-till corn. In the background is Upshur-Gilpin complex, 40 to 70 percent slopes.

periods can hold soil losses to an amount that will not reduce soil productivity. Including grasses and legumes in the cropping sequence helps to control erosion, increases the supply of nitrogen, and improves tilth.

Tillage methods that leave all the crop residue on the surface throughout the year or that incorporate part of the residue into the soil also help to control erosion. Together with use of these methods, a high level of management is needed to control weeds and insects. These methods are best suited to well drained or moderately well drained soils. On somewhat poorly drained to very poorly drained soils, if no-till or another system of conservation tillage that leaves crop residue on the surface is used, a drainage system is needed.

Other erosion control measures include grassed waterways, contour farming or contour stripcropping, and diversions. Grassed waterways are natural or constructed surface drains protected by a cover of grasses. Natural drainageways are the best sites for these waterways because they commonly require a minimum of shaping. The waterways should be wide and flat so farm machinery can cross them with ease. On foot slopes contour farming and contour stripcropping, for example, are used on some areas of Shelocta and Vandalia soils and on the steeper areas of Omulga and Licking soils. Diversions reduce the length of slopes and thus help to reduce runoff and to control erosion. They are most practical on deep, well drained soils on smooth slopes (*17*).

Information on the design of erosion control practices for each kind of soil in Lawrence County is available at the local office of the Natural Resources Conservation Service.

Drainage is a major management concern on cropland on McGary, Peoga, Piopolis, Orrville, Stendal, and Weinbach soils. On naturally wet soils the production of common crops generally requires both surface and subsurface drains. In many areas of Peoga and Piopolis soils, however, adequate outlets for subsurface drainage systems are difficult to find.

Protection from flooding is needed on Chagrin, Cuba, and Tioga soils. These soils are on flood plains. In some areas of these soils levees have been built to prevent streambank overflow.

Soil fertility is naturally low or medium in many soils on uplands in Lawrence County. But it is naturally higher, for example, in Chagrin and Nolin soils on flood plains along the Indian Guyan Creek and Ohio River. These soils are slightly acid to moderately alkaline in the root zone.

Many soils on uplands are naturally acid in the surface layer. Applications of ground limestone are needed to raise the pH level sufficiently for good production of alfalfa and other crops that grow well on nearly neutral soils. Available phosphorus and potassium are naturally low in most of these soils. On all soils additions of lime and fertilizer need to be based on the results of soil tests, the needs of the crop, and the expected level of yields. Assistance in determining the kinds and amounts of lime and fertilizer to be applied can be obtained from the Ohio State University Extension.

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

Most soils used for crops in Lawrence County have a light-colored surface layer of silt loam. This surface layer is moderate or moderately low in content of organic matter. Generally, the structure of these soils is weak. A surface crust forms during periods of heavy rainfall where conventional tillage methods are used. The crust is hard when dry and nearly impervious to water. As a result, it reduces the rate of water infiltration and increases runoff. Use of no-till or grass-legumes in a crop rotation can improve water infiltration. Regular additions of crop residue, barnyard manure, or other organic material can improve soil structure and minimize crusting.

Fall plowing generally will not improve tilth on soils that have a light-colored surface layer. If these soils are plowed in fall, a crust forms on these soils in winter and spring. Many soils that are plowed in fall are nearly as dense and hard at planting time as they were before they were plowed.

Fall plowing is common on Nolin, Elkinsville, Wheeling, Weinbach, and Sciotoville soils on bottom lands and terraces along the Ohio River. On soils on slopes greater than 3 percent, erosion is a hazard and fall plowing is not recommended. Soil blowing is a hazard in all areas that are plowed in fall, including nearly level areas.

Some soils in the county do not dry out quickly enough for plowing early in spring. Often, the fields are plowed in spring before moisture conditions are optimum. Untimely plowing results in hard clods in the surface layer and zones of compacted soil in the subsurface layer.

Special Crops

Burley tobacco is the major specialty crop grown in the county. In 1985 the quota was 828,661 pounds. Tobacco is mainly grown on Cuba, Elkinsville, and Kanawha soils. In tobacco production the erosion hazard is increased because a fine seedbed and intensive cultivation are required. Cover crops, contour tillage, and crop rotation with grasses and legumes help to control erosion. The best soils on a farm are planted to tobacco for its high value. For additional information on tobacco production, contact the Ohio State University Extension or the Natural Resources Conservation Service.

Other special crops are sweet corn, strawberries, melons, and tomatoes. These special crops are grown dominantly on Chagrin, Elkinsville, Kanawha, and Wheeling soils. Information on specific management, fertilization rates, and seed varieties can be obtained from local offices of the Ohio State University Extension or the Natural Resources Conservation Service.

Orchard crops are important special crops in Lawrence County. Apples, pears, and peaches are commercial produce. Lawrence County was the leading producer of apples in Ohio, but insects and disease caused a decrease in the amount of orchard produce. The result was increased use of disease- and insect-resistant varieties and improved pesticides and herbicides. Upshur and Gilpin soils on ridgetops and Elkinsville and Wheeling soils on terraces are suited to orchard crops. Planting orchard crops on hillsides, where air circulation is better, benefits fruit production. On the sloping Upshur and Gilpin soils, maintaining a thick vegetative cover helps to control erosion. In traffic tracks planting trees on the contour also helps to control erosion. For more information on orchard crops contact the Ohio State University Extension.

Pasture

Mark Hatfield and Ned Dooley, district conservationists, Natural Resources Conservation Service, helped to prepare this section.

About 12 percent of Lawrence County is used for pasture and hayland. About 2 percent of the county is idle pasture and hayland reverting to brushland with young trees. Most pasture and hayland is on ridgetops, benches, and foot slopes. The soils are derived from the underlying shale, limestone, siltstone, and sandstone. Erosion is a hazard on these soils if the vegetation is removed. Pasture and hayland consist mainly of tall fescue and orchardgrass. Many unimproved pastures need renovation and brush control (fig. 17).

Overgrazing has damaged some pastures and meadows. They are weedy, have low forage production, and are subject to accelerated erosion because of a sparse vegetative cover. The soils in these overgrazed fields commonly are acid and low in phosphorus and potassium. Suitable management practices can restore the fields and make them more productive. They include liming, fertilizing, controlling weeds and brush, rotation grazing, and developing springs.

To establish forage crops, quality seed must be selected of species and varieties adapted to both the area and the soils. Reseeding requires proper seedbed preparation, proper seeding methods and times, and use of recommended applications of lime and fertilizer. Forage renovation requires the killing or suppression of existing grass and weeds before reseeding a desired species (*16*). Killing and leaving existing sod on or near the surface as dead mulch helps to control erosion. Nearly level pastures can be plowed. But on gently sloping and strongly sloping soils, vegetation needs to be killed or suppressed. Tillage and seeding on the contour is needed. Herbicides and trash mulching reduce the tillage needed to kill existing vegetation.

No-till on pasture is suitable on some soils if poor drainage or excessive slope is not a limitation. In no-till, grazing and herbicides are used to suppress vegetation.

April and August are generally best for forage seedings. Small grain can establish forages harvested for hay. Allowing small grain to reach maturity generally results in increased plant competition and reduced stands.

Seeding mixtures based on soil type and the desired pasture management system are needed. Legumes increase the nutrient value of forage and provide nitrogen for grass growth. Soils with good drainage can be seeded to alfalfa and red clover. The wetter soils can be seeded to ladino and alsike clovers.

Liming and fertilizing according to soil tests insure good productivity and long stand life. Mowing, clipping, and spraying weeds continue high production. Weeds need to be mowed before going to seed. In some areas control of such insects as alfalfa weevil and potato leaf hopper is needed. When herbicides are used label restrictions must be followed.

Hay, silage, or pasture harvested at the proper stage of maturity will provide the maximum quality feed for animals. The current Agronomy Guide (*16*) gives the proper management practices needed for forage species. As a rule, hay and pasture are managed for quality, not for quantity.

Multiflora rose has infested many pastures. It limits forage production and use of pasture. It is a problem widespread in southeastern Ohio and, unless treated, will completely overtake a field.

At the end of each description under the heading "Detailed Soil Map Units," the soils in the county are assigned a pasture and hayland suitability group

Figure 17.—Kanawha soils are suitable for homesites, pasture, and cropland. Upshur-Rock outcrop association, very steep, is an important source of spring water for livestock.

symbol. Soils that are assigned the same group symbol require the same general management and have about the same potential productivity. The pasture and hayland suitability groups are based on soil characteristics and limitations.

Group A soils have few limitations for management and growth of climatically adapted plants. Pasture and hayland suitability group A-1 consists of deep, well drained and moderately well drained soils. The surface textures are loam, fine sandy loam, and silt loam. Available water capacity is moderate or high. The slope range is 0 to 18 percent.

Group A-2 consists of deep, well drained and moderately well drained soils. The surface textures are clay loam, fine sandy loam, loam, and silt loam. Available water capacity is medium. Average slopes range from 18 to 25 percent. Group A-3 consists of deep, well drained and moderately well drained soils. Surface textures range from moderately coarse to fine. Available water capacity ranges from moderate to very high. The slope range is 25 to 40 percent. Group A-5 consists of deep, well drained and moderately well drained soils on flood plains. They are subject to frequent or occasional flooding. Surface textures are loam or silt loam. Available water capacity is low to very high. The slope range is 0 to 3 percent. Group A-6 consists of deep, well drained and moderately well drained soils that are subject to frost action. Surface textures range from moderately coarse to moderately fine. Available water capacity ranges from low to very high. The slopes range is 0 to 18 percent.

Group B soils are droughty and are limited in growth and production. Pasture and hayland suitability group B-1 consists of deep, well drained soils. The surface textures are gravelly loam and loam. Available water capacity is low. The substratum of these soils is sandy or skeletal. The slope range is 0 to 12 percent.

Group C soils have a high water table and are normally wet or saturated during the growing season. Pasture and hayland suitability group C-2 consists of deep, somewhat poorly and poorly drained soils. The surface texture is silt loam. Available water capacity is moderate or high. Subsurface drainage is generally limited by the permeability of the subsoil or the position on the landscape. The slope range is 0 to 4 percent. Group C-3 consists of deep, somewhat poorly drained and poorly drained soils on flood plains. These soils are subject to frequent or occasional flooding. The surface texture is silt loam. Available water capacity ranges from moderate to very high. Subsurface drainage is limited by the position on the landscape.

Group E soils are shallow and restrict root growth to a depth of less than 20 inches. Pasture and hayland suitability group E-3 consists of well drained soils that restrict root growth to a depth of 20 inches or less because of low pH in the underlying material. The surface texture is medium or moderately fine. Available water capacity is low or very low because of coarse fragments. The slope range is 0 to 25 percent.

In Group F soils, root growth of climatically adapted plants is restricted to a depth of 20 to 40 inches. Group F-1 consists of moderately deep, well drained and moderately well drained soils. The surface texture is channery silt loam or silt loam. Available water capacity is very low and low. The slope range is 3 to 25 percent. Group F-2 consists of moderately deep, well drained and moderately well drained soils. The surface texture is silt loam. Available water capacity is low. The slope range is 25 to 40 percent. Group F-3 consists of deep, moderately well drained soils that are moderately deep to a fragipan. The surface texture is silt loam. Available water capacity is moderate or low in the root zone. The slope range is 0 to 15 percent. Group F-5 consists of soils where a high clay content in the subsoil restricts the depth of the root zone. These soils are deep and moderately well drained and well drained. The surface texture is silty clay loam. Available water capacity is moderate. The slope range is 3 to 25 percent. Group F-6 consists of soils where a high bulk density, high clay content, or other properties in the subsoil restrict the depth of the root zone. These soils are moderately well drained or well drained. The surface texture ranges from medium to fine. Available water capacity is moderate or low in the root zone. The slope range is 25 to 40 percent.

Group G soils have unfavorable chemical properties for many adapted plants. Group G-1 consists of well drained soils that are shallow or moderately deep to toxic spoil from surface mine operations. The surface textures range from coarse to moderately fine. Available water capacity is low or very low in the root zone. The slope range is 0 to 25 percent.

Group H soils are not suitable to adapted plants. Group H-1 consists of soils that are toxic or that are on slopes of more than 40 percent and so are not suitable to adapted plants.

Yields per Acre

The average yields per acre that can be expected of the principal irrigated 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 Natural Resources Conservation Service or of the Ohio State University Extension 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 (*23*). 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 landscaping 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. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by 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 very cold or very dry climate.

Class I does not have 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."

Woodland Management and Productivity

Lionel Lemery, district ranger, U.S. Forest Service, Wayne National Forest, helped to prepare this section.

About 70 percent of Lawrence County is wooded (*14,17*). About 147,068 acres of woodland is privately owned; 57,924 acres is on public lands, including Dean State Forest and Wayne National Forest.

Most woodland is on steep or very steep soils formed in material weathered from underlying siltstone, sandstone, limestone, and shale. Such soils are extensive in the Upshur-Gilpin general map unit, described in the section "General Soil Map Units." In recent years, the wooded acreage has increased, particularly in steep and very steep areas. In these areas the soils are not suited to cultivated crops or hay and are reverting to woodland.

Most forests consist of mixed hardwoods, dominantly oaks. The county comprises several major forest types: oak-hickory, pitch pine-oak, shortleaf pine-Virginia pine-oak, and eastern redcedar on dry sites and oak-hickory, northern red oak, yellow-poplar, northern hardwood-hemlock, and bottomland hardwood on moist sites (*19*). The dry sites are mainly on southern aspects, on ridgetops, and in abandoned fields. The wet sites are mainly on northern aspects, on benches, and in coves and small drainageways. Bottomland hardwoods are along the major rivers and streams.

The oak-hickory group consists of post oak-black oak and scarlet oak cover types. In areas of the post oak-black oak cover type, the dominant species is black oak. Other species are post oak, blackjack oak, white oak, scarlet oak, and hickory. Scarlet oak and black oak are the dominant species in areas of the scarlet oak cover type. Other species include chestnut oak, white oak, post oak, hickory, and pine.

The pitch pine-oak group consists of the chestnut oak cover type and, to a minor extent, the pitch pine cover type. Other common species in areas of the chestnut oak cover type are scarlet oak, white oak, black oak, post oak, pitch pine, blackjack oak, blackgum, and red maple. Less common are red oak, Virginia pine, shortleaf pine, sourwood, and sassafras.

The shortleaf pine-Virginia pine-oak group consists of the shortleaf pine-oak and shortleaf pine-Virginia pine cover types and, to a lesser extent, the shortleaf pine and Virginia pine cover types. The shortleaf pine-oak cover type is dominated by shortleaf pine. It has more oaks than the shortleaf pine-Virginia pine cover type. Some are white, scarlet, blackjack, black, post, and chestnut oaks. In some areas the stand includes hickories, blackgum, Virginia pine, and pitch pine. The shortleaf pine-Virginia pine cover type is dominantly pines. The other species are oak and hickory.

The eastern redcedar type is of minor extent in the county. The eastern redcedar-pine-hardwood cover type also is of minor extent. It includes eastern redcedar, shortleaf and Virginia pines, and red and black oaks.

Some of the understory species in areas of the cover types on dry sites are dogwood, sassafras, serviceberry, and some beech and red maple. The ground cover consists of greenbrier and poison ivy.

The oak-hickory group consists of the white oak-red oak-hickory and white oak cover types. The white oak-red oak-hickory cover type is dominated by white oak, black oak, and hickory. Other common species are scarlet oak, red maple, sugar maple, and yellow-poplar. Less common are black cherry, butternut, basswood, beech, black walnut, and blackgum. Other species in areas of the white oak cover type are black oak, shagbark and butternut hickories, and yellow-poplar.

The northern red oak group consists of the northern red oak-basswood-white ash and the northern red oak-mockernut hickory-sweetgum cover types. These types are of minor extent in the county.

The yellow-poplar group consists of the yellow-poplar and yellow-poplar-white oak-northern red oak cover types and the yellow-poplar-hemlock type, which is of minor extent in the county. Other species in areas of the yellow-poplar cover type are red maple and northern red oak. Other species in areas of the yellow-poplar-white oak-northern red oak cover type include black oak, hemlock, and blackgum.

The northern hardwood-hemlock group consists of the beech-sugar maple cover type, which is of minor extent in the county. Other species in areas of this cover type include red maple, white oak, yellow-poplar, black cherry, and black walnut.

The bottom land hardwoods consist of the river birch-sycamore, cottonwood, and pin oak-sweetgum cover types.

Some of the understory species in areas of the cover types on wet sites are dogwood, redbud, and spicebush. The ground cover consists of many ferns, wild ginger, Solomons seal, Jack-in-the-pulpit, Virginia creeper, and poison ivy. Soils differ greatly in their productivity as woodland. The factors that influence the growth of trees are almost the same as those that influence the production of annual crops and pasture. The major difference is that tree roots extend deeper into the soil, especially around rock fragments in the lower part of the soil. The direction of exposure, or aspect, and the position of the soil on the landscape also are important. Other properties to be considered are slope, extent of erosion, soil reaction, thickness of the surface layer, and fertility level.

The best sites for woodland are generally on the lower parts of slopes and in coves. The poorer sites are generally on the upper parts of slopes and on ridges. Further, sites mainly on north- and east-facing slopes are better for woodland than those mainly on south- and west-facing slopes (*7*).

Aspect, the direction in which a slope faces, influences site quality. Differences associated with aspect are slight in areas where slopes are gentle. In steep areas, however, site-index values are much higher on northeast-facing slopes than on southwest-facing slopes. Trees grow better on the lower slopes than on northeast-facing aspects, which have more available water and cooler temperatures. Temperatures are cool because of less surface exposure to the prevailing wind and to direct sunlight. On south and west aspects, a higher soil temperature, a high evaporation rate, earlier snowmelt, and a greater degree of freezing and thawing limit available water during the growing season (*7*).

On southwest-facing slopes, site-index values decrease as slope increases. The differences in site-index values associated with gradient are less pronounced on southeast and northwest aspects. On northeast-facing slopes, the value even increases slightly as the slope increases.

Moisture available for tree growth depends on the position of the soil on the landscape. It generally increases with elevation, partly because of downslope seepage. Also, the soils on the lower parts of the slopes are generally deeper than those on the upper parts. They lose less moisture through evaporation. And they have somewhat lower temperatures. Concave sites are better than convex areas for woodland. Surface water runs off convex areas more rapidly. Ridges and the upper slopes generally are convex, whereas the lower slopes and foot slopes are commonly concave.

Slope is an important factor in woodland management. Steep or very steep slopes are a severe limitation to use of equipment. As slope increases, the rate of water infiltration decreases, runoff increases, and the hazard of erosion becomes severe.

Many wooded areas in the county are clearcut because selective cutting is generally not feasible.

Erosion control is needed during and after the harvest, especially in steep and very steep areas.

Erosion reduces the volume of soil available for water storage. Severe erosion removes the surface layer and exposes the subsoil. The subsoil is commonly less porous; hence, runoff increases and the rate of water intake and available water capacity decrease. Severe erosion reduces both tree growth and natural reseeding. Erosion is generally a severe hazard on logging trails through the forest. On logging trails constructing effective water bars on logging trails and reseeding the trails helps to control erosion (fig. 18).

The thickness of the surface layer affects tree height more significantly than any other single soil or topographic feature. Landscape position, aspect, and shape and steepness of slopes affect thickness of the surface layer and texture of the subsoil (*7*).

Soil reaction and fertility influence tree growth and the suitability of the soils for different kinds of trees. Trees grow more slowly on all the less fertile soils. But fertility has a major effect on tree production only in areas where critical nutrients are deficient (*7*).

Many soils in the county can produce larger and better quality wood crops than currently produced. Improved woodland management is a common need (fig. 19).

Christmas trees are grown in some areas of the county. They grow well on many soils, in spite of some adverse factors. The combination of soil conditions, topographic factors, climatic factors, and biotic agencies prevailing in an area constitute the site factors for an area. The combined site factors and the ecological requirements of a species must be carefully considered to ensure successful establishment, survival, and growth of a species (*5*).

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops.

Figure 18.—Erosion is a hazard on log roads on Steinsburg-Shelocta association, very steep.

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 the first indicator tree species listed under common trees. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce in a pure stand under natural conditions. The number 1 indicates low potential productivity; 2 or 3, moderate; 4 or 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 *L,* low strength. 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 L.

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, 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.

Plant competition ratings indicate the degree to which undesirable species are expected to invade and grow when openings are made in the tree canopy. The main factors that affect plant competition are depth to the water table and the available water capacity. A rating of *slight* indicates that competition from undesirable plants is not likely to prevent natural regeneration or suppress the more desirable species. Planted seedlings can become established without undue competition. A rating of *moderate* indicates that competition may delay the establishment of desirable species. Competition may hamper stand development, but it will not prevent the eventual development of fully stocked stands. A rating of *severe* indicates that competition can be expected to prevent regeneration unless precautionary measures are applied.

Figure 19.—Christmas tree plantation in an area of Upshur-Gilpin complex, 15 to 25 percent slopes.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *productivity class*. 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. Black oak can be considered a general indicator of site index for other uplands hardwoods on similar sites. These hardwoods include red oak, white oak, white ash, yellow-poplar, and black walnut (*8*).

The *productivity class*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic meters per hectare 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.

Woodland Harvesting and Regeneration Activities

Table 9 gives the degree and kinds of limitations that affect the operation of equipment for harvesting and regeneration of woodlands. These activities are haul roads, log landings, skid trails and landing areas, and site preparation and planting. The limitations are considered slight if the physical site characteristics impose little or no limitations on kinds of equipment or time of operation. They are considered moderate if physical site characteristics impose some limitations on kind of equipment, time of operation, or both. They are considered severe if physical site conditions are such that special equipment or techniques are needed, that time of efficient operation is very limited, or both.

Haul roads are access roads leading from log landings to primary or surfaced roads. Generally, these are unpaved roads and not graveled. The ratings are based on soil properties, site features, and observed performances of the soils. Wetness, rockiness, depth to hard bedrock, stoniness, soil strength, slope, soil texture, and flooding are soil properties and hazards that should be considered in selecting a route for haul roads. Wetness and flooding affect the duration of use. Rock outcrops, stones, and boulders, which are difficult to move, hinder the construction when cutting and filling are needed. The soil strength is inferred from the AASHTO group index. The AASHTO group is a measure of the traffic support capacity of the soil. Slope affects the equipment use and the cutting and filling requirements.

Log landings are areas where logs are assembled for transportation. Areas that require little or no surface preparation of cutting or filling are desired. Considerable soil compaction on these areas can be expected. The ratings are based on the soil properties, site features, and observed performance of soils. Wetness, flooding, rockiness, stoniness, slope, depth to hard bedrock, soil strength, soil texture, and coarse fragments are soil properties and hazards that should be considered in selecting sites for log landings. Wetness and flooding affect the duration of use. Rock outcrops, stones, and boulders, which are difficult to move, affect equipment operability and configuration and location of landings. Depth to hard bedrock presents problems where cutting and filling are required. Slope affects the equipment use and the cutting and filling requirements of the site. Soil textures affect the trafficability. The soil strength, as inferred from the AASHTO group index and AASHTO group, is a measure of the traffic supporting capacity of the soil.

Skid trails and logging areas are areas that are being partly or completely logged. It includes the logging operations from stump to log landing areas with rubber-tired equipment. Other types of log-moving equipment can sometimes be utilized to reduce or overcome the site limitations. The ratings are based on soil properties, site features, and observed performance of soils. Wetness, flooding, rockiness, stoniness, texture, and slope are soil and topographic features that affect equipment use in logging operations. Periods when the soil is saturated at or near the surface should be avoided to minimize environmental damage. In addition, special equipment is usually required in these periods. Soils with a hazard of flooding for long duration should be avoided to prevent damage to equipment, the environment, or both. Surface stones and boulders and rock outcrops are problems for efficient and safe equipment operation. As slope gradients increase, traction problems increase. Clayey and sandy textures have special traction problems. Clayey soils have reduced traction when wet, and sandy soils have reduced traction when dry. Severe environmental damage occurs when rubber-tired or track-type equipment is used on organic soils, unless frozen.

Site preparation and planting are the mechanized operations for site preparation, planting, row seeding, or all three. The ratings are based on both limitations to efficient equipment operation and hazards to the site from the operation of equipment. It is assumed that operating techniques are used that do not displace or remove topsoil from the site or create channels to concentrate storm runoff. Wetness, flooding, rockiness, stoniness, coarse fragments, depth to hard bedrock, texture, and slope are soil and topographic features that affect equipment use in site preparation and planting operations. Periods when the soil is saturated at or near the surface should be avoided to minimize environmental damage. In addition, special equipment is usually required in these periods. Soils with flooding hazards of long duration should be avoided to prevent damage to equipment, the environment, or both. Surface stones and boulders and rock outcrops are problems for efficient and safe operation. Coarse fragments and hard bedrock at very shallow depths can interfere with equipment used in site preparation and planting. As slope gradients increase, traction problems increase. Clayey and sandy soils have special traction problems. Clayey soils have reduced traction when wet; and sandy soils have reduced traction when dry. Severe environmental damage occurs when rubber-tired or track-type equipment is used on organic soils, unless frozen.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens and provide habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

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

Table 10 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 10 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from the local office of the Natural Resources Conservation Service or of the Ohio State University Extension, from a commercial nursery, or from the Ohio Department of Natural Resources, Division of Forestry.

Recreation

Gerald S. Greenwood, forester, U.S. Forest Service, Ironton Ranger District, Wayne National Forest, helped to prepare this section.

Lawrence County comprises the 55,224-acre Wayne National Forest and the 2,745-acre Dean State Forest. Both forests are open to the public for fishing, hunting, hiking, berry picking, mushroom gathering, pleasure driving, and many other recreation activities.

The Lake Vesuvius Recreation Area is in the Wayne Forest. It provides a 143-acre lake, a boat dock, a bathing beach, campgrounds, picnic grounds, and hiking trails.

Wayne National and Dean State Forests together have more than 26 miles of hiking trails and more than 50 miles of horseback riding trails.

Symmes Creek has been developed for canoeing. It is the locale of an annual canoe race from Arabia to Linville.

Throughout the county numerous farm ponds and strip mine ponds provide opportunities for fishing. Fishing is also available on Symmes Creek, Pine Creek, Storms Creek, Ice Creek, and some of the smaller streams that run year around. Fishing and boating are available on the Ohio River, which borders the south part of the county. Public boat ramps on the Ohio River are located in Ironton, Chesapeake, and Fairland.

A private, 9-hole golf course, a swimming pool, and tennis courts are available at the Ironton Country Club. The club is located in the west part of the county.

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation 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 11, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or a combination of these measures.

The information in table 11 can be supplemented by other information in this survey. Consult, for example, interpretations for septic tank absorption fields in table 14 and interpretations for dwellings without basements and for local roads and streets in table 13.

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

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

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry.

If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

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

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Lawrence County has a wide variety of wildlife. Some of the more common birds that inhabit the county are bobwhite quail, wild turkey, mourning dove, ruffed grouse, common crow, pileated woodpecker, red-tailed hawk, great horned owl, meadowlark, bobolink, and many other species of songbirds. Mammalian wildlife species include cottontail rabbit, gray and fox squirrel, gray and red fox, whitetail deer, raccoon, woodchuck, mink, and beaver.

The diverse species of wildlife inhabit a wide variety of wildlife habitats, including openland, woodland, and riparian (areas along rivers and streams).

Upland wildlife habitat consists of both openland and woodland. The major soils in the area of upland wildlife habitat are Gilpin, Latham, Shelocta, Steinsburg, and Upshur soils. Including grasses and legumes in the cropping sequence, applying a system of conservation tillage, constructing ponds, and planting trees and shrubs can improve the habitat for openland wildlife. Applying measures that improve timber stands, excluding livestock from wooded areas, and planting trees and shrubs can improve the habitat for woodland wildlife.

The major riparian areas in the county are along the Ohio River, Indian Guyan Creek, Pine Creek, and Symmes Creek. The dominant soils in these areas include Chagrin, Cuba, Nolin, and Tioga soils. Stabilizing streambanks, erecting nest boxes for wood ducks, and planting trees and shrubs can improve the riparian 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 12, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife (*1*). This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

Elements of Wildlife Habitat

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, wheat, oats, and soybeans.

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 foxtail, ragweed, goldenrod, beggarweed, Johnson grass, and ferns.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and sumac. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are honeysuckle, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, cedar, and juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, and soil moisture. Examples of shrubs are spicebush, sumac, blackberry, and greenbrier.

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, slope, and surface stoniness. Examples of wetland plants are cordgrass, 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 ponds.

Habitat for Various Kinds of Wildlife

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, groundhog, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and bear.

Habitat for wetland wildlife consists of open, marshy, or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. 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 kinds 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 13 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and 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 steep and very steep soils in the county have small included areas that are subject to hillside slippage. Buildings and local roads can be damaged from this slippage.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 14 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 14 also shows the suitability of the soils for use as daily cover for 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. Unsaturated soil material must be beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 14 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage 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 14 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench 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 wind erosion.

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 the final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 15 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help 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, and 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 15, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble 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.

Soil Material for Reconstruction of Strip-mined Land

Table 16 gives information about the soils as a source of material for reclaiming areas drastically disturbed by surface mining.

The surface layer, subsoil, and substratum of the soils are rated good, fair, and poor according to their erodibility and stability and to their suitability as a medium for plant growth. The ratings only apply to that part of the soil within a depth of about 6 feet.

The intepretations in table 16 cannot be used for quarry, pit, dredge, and surface mine operations that require an offsite source of soil reconstruction material. The interpretations for daily cover for sanitary landfill in table 14 should be used to evaluate the material used in restoration of these operations.

A rating of "good" in table 16 means vegetation is relatively easy to establish and maintain, the surface is stable and resists erosion, and the reconstructed soil has good potential productivity. Material rated "fair" can be vegetated and stabilized by modifying one or more properties. Topdressing with better material or application of soil amendments may be necessary to establish and maintain vegetation.

Soil texture and coarse fragments influence soil structure and consistence, water intake rate, runoff, fertility, workability, and trafficability. They also influence the available water capacity of a soil and its erodibility by wind or water. Loamy and silty soils that are free of coarse fragments are the best reconstruction material. Clayey soils are sticky or cloddy and are difficult to spread. Sandy soils are droughty and subject to soil blowing.

Rock fragments influence the ease of excavation, stockpiling, respreading, and suitability for final use of land. A certain amount of rock fragments can be tolerated, depending upon the size of the fragments and the intended use of the reclaimed area. If the size of rock fragments exceeds 10 inches, the problems are more severe.

Vegetation is difficult to establish on soils that are extremely acid or alkaline. Materials that are extremely acid upon oxidation are difficult and expensive to vegetate and they contribute to poor water, both in runoff or in ground water. Materials high in pyrite and marcasite without offsetting bases have high potential acidity. Laboratory tests may be needed to properly identify those materials.

Excessive amounts of substances that restrict plant growth, such as sodium, salt, sulfur, copper, and nickel create problems in establishing vegetation and thereby influence erosion and the stability of the surface. Other substances, such as selenium, boron, and arsenic, get into the food chain and are toxic to animals that eat vegetation. Of all these substances, only sodium and salt were considered in the ratings. Soil horizons relatively high in toxic substances are rated poor. Laboratory tests are needed to properly identify toxic substances.

The interpretations in table 16 do not cover all soil features required in planning soil reconstruction, for example, slope, thickness of material, ease of excavation, potential slippage hazard, and soil moisture regime. Slope of the original soil may influence the method of stripping and stockpiling of reconstruction material but may have little effect on final contour and, therefore, on the stability and productivity of the reconstructed soil. Therefore, slope was not a criterion in making the interpretations.

The thickness of material suitable for reconstruction and the ease of excavation are important criteria in planning soil reconstruction operations. However, they are so dependent on the method of mining operations that they were not used as criteria in developing the interpretations. Potential slippage hazard is related to soil texture, slope, differential permeability between layers, rainfall, and other factors that were not considered. Soil moisture regime, climate, and weather influence the choice of plants and the rate of vegetative growth. They were not used as criteria because the relative rating does not change with variable moisture regimes; that is, the best soil in a moist environment. Furthermore, the soil may be irrigated to establish vegetation.

Water Management

Table 17 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. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, and sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to 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 wind erosion 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 wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts and sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 21.

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.

Engineering Index Properties

Table 18 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 the heading "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. 20). "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

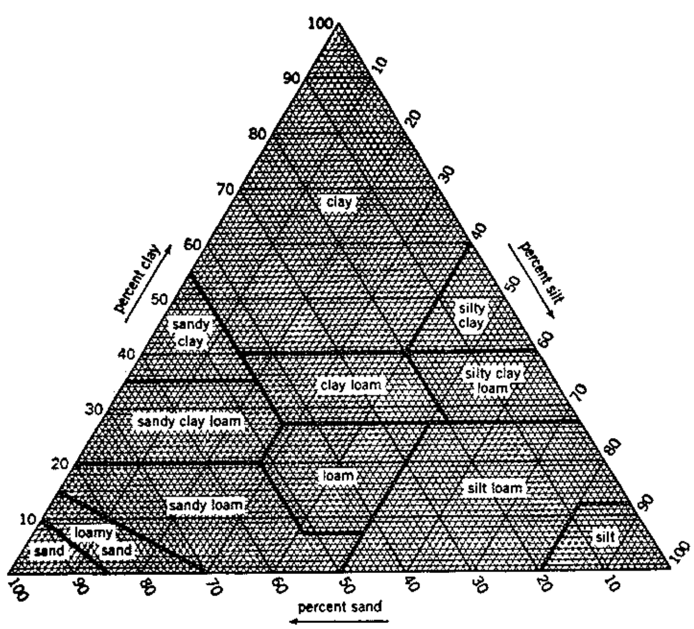


Figure 20.—Percentage of clay, silt, and sand in the basic USDA soil textural classes.

those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested is given in table 21.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40 and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 19 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 1/3-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

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; *high*, more than 6 percent; and *very high*, greater than 9 percent.

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 0.02 to 0.64. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility to soil blowing. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are as follows:

1. Coarse sands, sands, fine sands, and very fine sands.
2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, ash material, and sapric soil material.
3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay.
5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material.
6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay.
7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material.
8. Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 19, 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 20 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, 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 high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 20, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Table 20 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, on the average, once or less in 2 years (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of flooding is more than 50 percent in any year). *Common* is used when the occasional and frequent classes are grouped for certain purposes. 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 observations of the water table at selected sites and on the evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. Indicated in table 20 are the depth to the seasonal high water table; the kind of water table—that is, perched, apparent, or artesian; 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 20.

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. An *artesian* water table is under hydrostatic head, generally below an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Two numbers in the column showing depth to the water table indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

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 results in a severe hazard of corrosion. 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 Analysis of Selected Soils

Many of the soils in Lawrence County were analyzed by the Soil Characterization Laboratory, Department of Agronomy, the Ohio State University, Columbus, Ohio. The physical and chemical data obtained from most of the samples include particle size distribution, reaction, organic matter content, calcium carbonate equivalent, and extractable cations.

These data were used in classifying and correlating the soils and evaluating their behavior under various land uses. One pedon was selected as representative of its respective series and is described under the heading “Soil Series and Their Morphology”. This series and its laboratory identification number is Pinegrove series (LW-3).

In addition to the data from Lawrence County, laboratory data are available from nearby counties in southern Ohio, which have many of the same soils. Data from these counties and from Lawrence County are on file at the Department of Agronomy, the Ohio State University; the Ohio Department of Natural Resources, Division of Soil and Water Conservation; and the Natural Resources Conservation Service, State Office, Columbus, Ohio.

Engineering Index Test Data

Table 21 shows laboratory test data for one pedon sampled at a carefully selected site in the survey area. The pedon is representative of a series described in the section “Soil Series and Their Morphology.” The soil samples were tested by the Ohio Department of Transportation, Division of Highways, Bureau of Testing, Soils and Foundation Section.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 4248 (ASTM); and Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*24*). 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 22 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 Ultisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udult (*Ud*, meaning humid, plus *Ult*, from Ultisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludults (*Hapl*, meaning minimal horizonation, plus *Udults*, the suborder of the Ultisols that has a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup 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 taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludults.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle size, mineral content, soil temperature regime, soil depth, and reaction. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Hapludults.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each 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" (*26*). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (*24*) and in "Keys to Soil Taxonomy" (*25*). Unless otherwise indicated, 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."

Bethesda Series

The Bethesda series consists of deep, well drained soils in surface-mined areas. These soils formed in partly weathered, fine earth material mixed with fragments of shale, sandstone, and siltstone. Permeability is moderately slow. Slope ranges from 8 to 70 percent.

Bethesda soils are commonly adjacent to Gilpin, Latham, and Rarden soils and are similar to Fairpoint and Morristown soils. All these soils are in similar landscape positions. Fairpoint soils derived from mine spoil less acid than that from which Bethesda soils derived. Morristown soils derived from calcareous mine spoil. Gilpin, Latham, and Rarden soils are in unmined areas. They have fewer coarse fragments throughout than Bethesda soils.

Typical pedon of Bethesda channery silty clay loam, 25 to 70 percent slopes, about 1.5 miles north-northeast of Glendale in Hamilton Township, 1,600 feet south and 100 feet east of the northwest corner of sec. 2, T. 1 N., R. 19 W.

Oe—1 to 0 inch; partly decomposed leaf litter.

A—0 to 2 inches; brown (10YR 5/3) channery silty clay loam, light gray (10YR 7/2) dry; weak medium and fine granular structure; friable; many fine and medium roots; 20 percent coarse fragments; very strongly acid; abrupt smooth boundary.

C1—2 to 25 inches; variegated yellowish brown (10YR 5/6) (70 percent) and pale brown (10YR 6/3) (30 percent) very channery loam; massive; firm; few fine and medium roots; 40 percent coarse fragments; very strongly acid; clear smooth boundary.

C2—25 to 54 inches; variegated strong brown (7.5YR 5/6) (70 percent) and yellowish brown (10YR 5/4) (30 percent) very channery clay loam; massive; firm; few fine roots; 40 percent coarse fragments; very strongly acid; clear smooth boundary.

C3—54 to 80 inches; variegated strong brown (7.5YR 5/6) (70 percent) and light brownish gray (2.5Y 6/2) (30 percent) very channery silty clay loam; massive; firm; few fine roots; 50 percent coarse fragments; very strongly acid.

Depth to bedrock is more than 80 inches. The content of rock fragments between depths of 10 to 40 inches is typically 35 to 55 percent; however, in individual subhorizons it ranges from 20 to 70 percent. The rock fragments commonly are less than 10 inches across, but some are stones, flagstones, and boulders.

The A and C horizons have hue of 7.5YR to 5Y, value of 3 to 6, and chroma of 1 to 8. In the fine earth fraction the C horizon is clay loam, silty clay loam, silt loam, or loam.

Chagrin Series

The Chagrin series consists of deep, well drained soils on flood plains. These soils formed in recent loamy alluvium. Permeability is moderate. Slope ranges from 0 to 3 percent.

Chagrin soils are commonly adjacent to Kanawha, Nolin, Orrville, and Vandalia soils and are similar to Nolin and Tioga soils. Kanawha soils typically have more coarse fragments throughout than Chagrin soils. They are on terraces and alluvial fans. Nolin soils have less sand in the subsoil than Chagrin soils. Orrville soils are somewhat poorly drained. Nolin and Orrville soils are in positions similar to those of Chagrin soils. Vandalia soils have more clay in the subsoil than Chagrin soils. They are on foot slopes. Tioga soils have less clay in the subsoil than Chagrin soils and are in similar landscape positions.

Typical pedon of Chagrin loam, frequently flooded, about 0.5 mile north-northeast of Scottown in Windsor Township, 700 feet south and 800 feet west of the northeast corner of sec. 14, T. 2 N., R. 16 W.

Ap—0 to 10 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

Bw1—10 to 15 inches; yellowish brown (10YR 5/4) loam; weak fine and medium subangular blocky structure; friable; few fine roots; few faint dark brown (7.5YR 4/4) silt coatings on faces of peds; slightly acid; clear smooth boundary.

Bw2—15 to 33 inches; dark yellowish brown (10YR 4/4) loam; weak fine and medium subangular blocky structure; friable; few fine roots; medium acid; clear smooth boundary.

Bw3—33 to 42 inches; dark yellowish brown (10YR 4/4) silt loam; few fine prominent strong brown (7.5YR 5/6) and few fine faint brown (10YR 5/3) mottles; weak fine and medium subangular blocky structure; friable; medium acid; clear smooth boundary.

C1—42 to 68 inches; dark yellowish brown (10YR 4/4) silt loam; massive; friable; medium acid; abrupt smooth boundary.

C2—68 to 80 inches; yellowish brown (10YR 5/4) sandy loam; common medium distinct light brownish gray (10YR 6/2) mottles; massive; friable; many fine and medium strong brown (7.5YR 5/6) stains (iron and manganese oxides); medium acid.

The solum ranges from 24 to 48 inches in thickness.

Typically, the Ap horizon is loam but is silt loam in some pedons. The Bw horizon is silt loam or loam and less commonly sandy loam. The C horizon is silt loam, loam, or sandy loam.

Clymer Series

The Clymer series consists of deep, well drained soils on uplands. These soils formed in residuum and colluvium from sandstone. Permeability is moderate. Slope ranges from 25 to 40 percent.

Clymer soils are commonly adjacent to Rarden, Latham, Lily, and Steinsburg soils and are similar to Gilpin and Shelocta soils. Gilpin, Latham, Lily, Rarden, and Steinsburg soils are moderately deep. Shelocta soils have less sand in the solum than Clymer soils. Latham and Steinsburg soils are on ridgetops and shoulder slopes.

Typical pedon of Clymer loam, in an area of Steinsburg-Clymer association, steep, about 1 mile east of Blackfork in Washington Township, about 2,500 feet north and 300 feet west of the southeast corner of sec. 1, T. 4 N., R. 18 W.

Oe—1 inch to 0; partly decomposed leaf litter.

A—0 to 4 inches; brown (10YR 4/3) loam, light brownish gray (10YR 6/2) dry; weak fine and medium granular structure; friable; many fine and medium roots; 5 percent coarse fragments; very strongly acid; gradual wavy boundary.

BE—4 to 12 inches; yellowish brown (10YR 5/6) loam; weak fine and medium subangular blocky structure; friable; common fine, medium, and coarse roots; few faint yellowish brown (10YR 5/6) silt coatings on faces of peds; common brown (10YR 4/3) organic coatings on faces of peds; 5 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt1—12 to 17 inches; yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; friable; few fine and medium roots; common faint yellowish brown (10YR 5/6) clay films on faces of peds; few faint yellowish brown (10YR 5/4) silt coatings on faces of peds; 5 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt2—17 to 25 inches; strong brown (7.5YR 5/6) loam; moderate medium subangular and angular blocky structure; friable; few fine roots; common faint strong brown (7.5YR 5/6) and few faint yellowish brown (10YR 5/6) clay films on faces of peds; few distinct light yellowish brown (10YR 6/4) silt coatings on faces of peds; 5 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt3—25 to 31 inches; strong brown (7.5YR 5/6) clay loam; moderate medium subangular and angular blocky structure; friable; few fine roots; common faint strong brown (7.5YR 5/6) and few faint yellowish brown (10YR 5/6) clay films on faces of peds; few distinct light yellowish brown (10YR 6/4) silt coatings on faces of peds; 5 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt4—31 to 37 inches; strong brown (7.5YR 5/6) sandy loam; weak medium subangular blocky structure; friable; few fine roots; common faint strong brown (7.5YR 5/6) clay films on faces of peds; 5 percent coarse fragments; very strongly acid; clear smooth boundary.

C—37 to 50 inches; brownish yellow (10YR 6/6) sandy loam; massive; friable; few fine roots; 10 percent coarse fragments; very strongly acid; clear smooth boundary.

Cr—50 to 55 inches; brownish yellow (10YR 6/6) weathered sandstone.

The solum ranges from 24 to 40 inches in thickness. Depth to bedrock ranges from 40 to 60 inches. Rock fragments range from 5 to 50 percent in the Bt horizon and from 10 to 85 percent in the C horizon.

The A horizon is dominantly loam but is silt loam in some pedons. The Bt horizon has chroma of 4 to 6. Fine earth textures are loam, sandy loam, sandy clay loam, and clay loam. The C horizon has hue of 5YR, 7.5YR, or 10YR and value of 4 to 6. In the fine earth fraction it is loam or sandy loam.

Coolville Series

The Coolville series consists of deep, moderately well drained soils on uplands. These soils formed in loess and in the underlying residuum mainly from shale. In some areas, in the lower part they also formed in siltstone. Permeability is moderate in the upper part of the solum and slow in the lower part. Slope ranges from 2 to 6 percent.

Coolville soils are commonly adjacent to Latham, Rarden, Tilsit, and Upshur soils and are similar to Woodsfield soils. Latham and Rarden soils are moderately deep to bedrock. Rarden soils are on shoulder slopes and the narrower ridgetops. Latham soils are on the narrower ridgetops, on side slopes, and on shoulder slopes. Tilsit soils have a fragipan. They are on the flatter parts of ridgetops. Upshur and Woodsfield soils are well drained. Upshur soils are on ridgetops and side slopes. Like Coolville soils, Woodsville soils are on uplands.

Typical pedon of Coolville silt loam, in an area of Coolville-Tilsit silt loams, 2 to 6 percent slopes, about 1.6 miles northeast of Center Station in Decatur Township, about 1,250 feet north and 1,850 feet west of the southeast corner of sec. 27, T. 3 N., R. 18 W.

Oe—1 inch to 0; partly decomposed leaf litter.

A—0 to 3 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine and medium granular structure; friable;

common fine and medium roots; slightly acid; abrupt wavy boundary.

E—3 to 6 inches; yellowish brown (10YR 5/4) silt loam; weak fine and medium subangular blocky structure; friable; common fine and medium roots; common faint light yellowish brown (10YR 6/4) silt coatings on faces of peds; strongly acid; clear smooth boundary.

BE—6 to 12 inches; strong brown (7.5YR 5/6) silt loam; moderate fine and medium subangular blocky structure; friable; common fine and medium roots; common faint strong brown (7.5YR 5/6 and 5/8) silt coatings on faces of peds; very strongly acid; clear smooth boundary.

Bt1—12 to 16 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; few fine and medium roots; common faint strong brown (7.5YR 5/6) clay films on faces of peds; few faint yellowish brown (10YR 5/4) silt coatings on faces of peds; very strongly acid; clear smooth boundary.

2Bt2—16 to 21 inches; red (2.5YR 4/8) silty clay; common medium prominent light gray (10YR 7/2) and common fine prominent light brownish gray (2.5Y 6/2) mottles; moderate medium subangular blocky structure; firm; few fine and medium roots; common faint reddish brown (2.5YR 4/4) clay films on faces of peds; few distinct yellowish brown (10YR 5/4) silt coatings on faces of peds; strongly acid; clear smooth boundary.

2Bt3—21 to 34 inches; red (2.5YR 4/6) silty clay; common medium prominent light brownish gray (2.5Y 6/2) and common medium distinct yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine and medium roots; common faint red (2.5YR 4/6) clay films on faces of peds; strongly acid; clear smooth boundary.

2Bt4—34 to 42 inches; yellowish red (5YR 5/6) silty clay; common medium prominent light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; few fine roots; common faint yellowish red (5YR 5/6) and few distinct light gray (10YR 6/1) clay films on faces of peds; strongly acid; clear smooth boundary.

2BC—42 to 46 inches; yellowish red (5YR 5/6) silty clay; common medium prominent brown (10YR 5/3), light gray (2.5Y 7/2), and reddish gray (5YR 5/2) mottles; weak medium subangular blocky structure; firm; few fine roots; few faint gray (10YR 5/1) silt coatings on faces of peds; 5 percent coarse fragments and common soft siltstone fragments; very strongly acid; clear smooth boundary.

2Cr—46 to 51 inches; weathered interbedded shale and siltstone.

The solum ranges from 36 to 60 inches in thickness. Thickness of loess ranges from 14 to 26 inches. Depth to bedrock ranges from 40 to 60 inches. Coarse fragments range to as much as 5 percent in the Ap and Bt horizons, 15 percent in the 2Bt horizon, and 30 percent in the 2BC horizon, where present.

The A horizon has chroma of 2 or 3. The Bt horizon has hue of 7.5YR and 10YR. The 2Bt horizon has chroma of 6 to 8.

Cuba Series

The Cuba series consists of deep, well drained soils on flood plains. These soils formed in recent, acid alluvium. Permeability is moderate. Slope is 0 to 2 percent.

Cuba soils are commonly adjacent to Piopolis, Stendal, and Tioga soils and are similar to Nolin soils. Piopolis soils are poorly drained and very poorly drained. They are in depressions or in low-lying areas on flood plains. Stendal soils are somewhat poorly drained. They are in lower positions on flood plains. Tioga soils have more sand and less clay in the subsoil than Cuba soils and are in similar landscape positions. Nolin soils are not as acid in the subsoil as Cuba soils.

Typical pedon of Cuba silt loam, occasionally flooded, about 1.6 miles west-southwest of Olive Furnace in Decatur Township, 2,560 feet south and 800 feet east of the northwest corner of sec. 4, T. 3 N., R. 18 W.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; friable; many fine roots; few fine black (10YR 2/1) concretions (iron and manganese oxides); neutral; clear smooth boundary.

Bw1—8 to 20 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine and medium subangular blocky structure; common fine roots; common faint brown (10YR 4/3) coatings on faces of peds; common fine black (10YR 2/1) concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

Bw2—20 to 40 inches; yellowish brown (10YR 5/6) silt loam; common medium faint strong brown (7.5YR 5/6) and few medium distinct pale brown (10YR 6/3) mottles; weak medium subangular blocky structure; friable; few fine roots; common faint yellowish brown (10YR 5/4) coatings on faces of peds; few fine black (10YR 2/1) concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

C—40 to 80 inches; yellowish brown (10YR 5/6) silt loam; common medium distinct pale brown (10YR 6/3) and few fine faint strong brown (7.5YR 5/6) mottles; massive; friable; few fine roots; strongly acid.

The solum ranges from 20 to 40 inches in thickness.

The Ap horizon has chroma of 3 or 4. The C horizon has value of 4 or 5 and chroma of 4 to 6. It is silt loam or loam.

Elkinsville Series

The Elkinsville series consists of deep, well drained soils on stream terraces. These soils formed in old alluvium. Permeability is moderate. Slope ranges from 1 to 40 percent.

Elkinsville soils are commonly adjacent to Peoga, Sciotoville, Watertown, Weinbach, and Wheeling soils. Peoga soils are poorly drained. They are on flats and in depressions. Sciotoville soils are moderately well drained. They are in slightly lower positions. Weinbach soils are somewhat poorly drained. They are on flats and in low-lying areas. Wheeling and Watertown soils have more sand in the subsoil and substratum than Elkinsville soils and are in similar landscape positions.

Typical pedon of Elkinsville silt loam, 1 to 6 percent slopes, about 0.18 mile southeast of Glendale in Hamilton Township, 2,150 feet north and 2,600 feet west of the southeast corner of sec. 9, T. 1 N., R. 19 W.

Ap—0 to 12 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; friable; common fine roots; neutral; abrupt smooth boundary.

Bt1—12 to 20 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; firm; few fine roots; common distinct dark yellowish brown (10YR 4/4) and common faint strong brown (7.5YR 5/6) clay films on faces of peds; common distinct yellowish brown (10YR 5/6) silt coatings on faces of peds; slightly acid; clear smooth boundary.

Bt2—20 to 32 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular and angular blocky structure; firm; few fine roots; common faint strong brown (7.5YR 5/6) and common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common faint yellowish brown (10YR 5/4) silt coatings on faces of peds; slightly acid; clear smooth boundary.

Bt3—32 to 39 inches; brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure; friable; common faint yellowish brown (10YR 5/6) clay films on faces of peds; strongly acid; clear smooth boundary.

2Bt4—39 to 58 inches; brown (7.5YR 4/4) loam; weak medium subangular blocky structure; friable; few distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; abrupt smooth boundary.

2C—58 to 80 inches; brown (7.5YR 4/4) loam; massive; friable; thin strata of gravelly loamy sand; medium acid.

The solum ranges from 40 to 70 inches in thickness.

The Bt horizon has hue of 7.5YR or 10YR. It is silt loam or silty clay loam. The 2Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. The 2C horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay loam, loam, or sandy loam. Coarse fragments range from 0 to 5 percent.

Fairpoint Series

The Fairpoint series consists of deep, well drained soils in surface-mined areas. These soils formed in mixed, partly weathered fine earth material and fragments of shale, sandstone, and siltstone. Permeability is moderately slow. Slope ranges from 8 to 25 percent.

Fairpoint soils are commonly adjacent to Bethesda, Gilpin, Morristown, Rarden, and Upshur soils and are similar to Bethesda and Morristown soils. Bethesda soils are more acid throughout than Fairpoint soils. Morristown soils are mildly alkaline or moderately alkaline in the substratum. Gilpin, Rarden, and Upshur soils are in unmined areas. They have fewer coarse fragments throughout than Fairpoint soils.

Typical pedon of Fairpoint channery silty clay loam, 8 to 25 percent slopes, about 1.75 miles west of Blackfork in Washington Township, 2,000 feet north and 850 feet east of the southwest corner of sec. 3, T. 4 N., R. 18 W.

A—0 to 2 inches; brown (10YR 4/3) channery silty clay loam, very pale brown (10YR 7/3) dry; weak coarse granular structure; friable; common fine roots; 25 percent coarse fragments; strongly acid; abrupt smooth boundary.

C1—2 to 20 inches; variegated yellowish brown (10YR 5/6) (60 percent) and gray (10YR 6/1) (40 percent) very channery silty clay loam; weak fine subangular blocky structure; firm; few fine roots; 40 percent coarse fragments; medium acid; clear smooth boundary.

C2—20 to 50 inches; variegated yellowish brown (10YR 5/4) (80 percent) and gray (10YR 6/1) (20 percent) very channery silty clay loam; massive; firm; 45 percent coarse fragments; medium acid; clear smooth boundary.

C3—50 to 60 inches; variegated gray (10YR 6/1) (80 percent) and yellowish brown (10YR 5/4) (20 percent) very channery clay loam; massive; firm; 55 percent coarse fragments; neutral.

Depth to bedrock is more than 60 inches. Rock fragments, mainly shale and siltstone, range from 15 to 30 percent in the A horizon and from 20 to 55 percent in the C horizon. Rock fragments in the textural control section average more than 35 percent. Rock fragments commonly are less than 10 inches across, but some are stones, flagstones, or boulders.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 6. The C horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 1 to 6.

Gilpin Series

The Gilpin series consists of moderately deep, well drained soils on uplands. These soils formed in residuum derived from interbedded siltstone, shale, and sandstone. Permeability is moderate. Slope ranges from 8 to 70 percent.

Gilpin soils are commonly adjacent to Latham, Rarden, and Upshur soils and are similar to Clymer, Lily, and Shelocta soils. Clymer, Shelocta, and Upshur soils are deep to bedrock. Lily soils have a higher sand content in the subsoil. Latham and Rarden soils are moderately well drained. Rarden soils are on ridgetops and shoulder slopes. Latham and Upshur soils are on ridgetops, shoulder slopes, and side slopes.

Typical pedon of Gilpin silt loam, in an area of Upshur-Gilpin complex, 25 to 40 percent slopes, about 4.9 miles southwest of Sherritts, in Aid Township, 2,100 feet north and 240 feet east of the southwest corner of sec. 20, T. 4 N., R. 17 W.

Oe—1 inch to 0; partly decomposed leaf litter.

A—0 to 3 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; friable; common fine roots; about 5 percent coarse fragments; strongly acid; clear smooth boundary.

BE—3 to 7 inches; yellowish brown (10YR 5/6) silt loam; weak fine subangular blocky structure; friable; common fine and medium roots; common distinct brownish yellow (10YR 6/6) silt coatings on faces of peds; few black (10YR 2/1) concretions (iron and manganese oxides); common brown (10YR 4/3) organic stains; about 5 percent coarse fragments; strongly acid; clear smooth boundary.

Bt1—7 to 19 inches; strong brown (7.5YR 5/6) silt loam; moderate fine and medium subangular blocky structure; friable; common fine and medium roots; common distinct strong brown (7.5YR 5/6) clay films and common distinct yellowish brown (10YR 5/6) silt coatings on faces of peds; few black (10YR 2/1) concretions (iron and manganese oxides); about 10 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt2—19 to 25 inches; strong brown (7.5YR 5/6) channery silt loam; moderate medium subangular blocky structure; friable; common fine roots; common distinct strong brown (7.5YR 5/6) clay films on faces of peds; few black (10YR 2/1) concretions (iron and manganese oxides); about 25 percent coarse fragments; strongly acid; clear wavy boundary.

BC—25 to 32 inches; yellowish brown (10YR 5/6) very channery silt loam; weak fine subangular blocky structure; friable; few roots; about 40 percent coarse fragments; strongly acid; clear smooth boundary.

R—32 to 37 inches; fractured brown (10YR 5/3) siltstone.

The solum ranges from 18 to 36 inches in thickness. Depth to bedrock ranges from 20 to 40 inches. Coarse fragments range from 5 to 25 percent in the A horizon, from 5 to 35 percent in individual subhorizons of the B horizon, and from 30 to 90 percent in the C horizon.

The A horizon has value of 3 to 5 and chroma of 3 or 4. It is silt loam or channery silt loam. Some pedons have an E horizon. The Bt horizon has hue of 10YR or 7.5YR and chroma of 4 to 8. It is silt loam, silty clay loam, or their channery analog. Some pedons have a C horizon.

Kanawha Series

The Kanawha series consists of deep, well drained soils on terrace remnants and alluvial fans. Permeability is moderate. These soils formed in loamy alluvium. Slope ranges from 2 to 12 percent.

Kanawha soils are commonly adjacent to Chagrin, Cuba, Orrville, Stendal, and Vandalia soils and are similar to Shelocta soils. Chagrin, Cuba, Orrville, and Stendal soils do not have an argillic horizon. They are on flood plains. Vandalia soils have more clay in the subsoil. They are on foot slopes. Shelocta soils are more acid in the lower part of the soil than Kanawha soils. They are on side slopes, foot slopes, and colluvial fans.

Typical pedon of Kanawha silt loam, 2 to 6 percent slopes, about 1.25 miles west-northwest of Pine Grove in Elizabeth Township, 850 feet south and 2,500 feet west of the northeast corner of sec. 17, T. 2 N., R. 19 W.

Ap—0 to 11 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; friable; few fine and medium roots; 5 percent coarse fragments; slightly acid; abrupt smooth boundary.

Bt1—11 to 15 inches; yellowish brown (10YR 5/6) loam; weak fine and medium subangular blocky structure; friable; few fine roots; few faint strong brown (7.5YR 5/6) clay films and a few distinct brown (10YR 4/3) and yellowish brown (10YR 5/4) silt coatings on faces of peds; slightly acid; clear smooth boundary.

Bt2—15 to 23 inches; strong brown (7.5YR 5/6) loam; moderate medium subangular blocky structure; friable; few fine roots; few faint strong brown (7.5YR 5/6) clay films and few distinct yellowish brown (10YR 5/4) silt coatings on faces of peds; few distinct dark brown (7.5YR 3/2) concretions (iron and manganese oxides); 10 percent coarse fragments; slightly acid; clear smooth boundary.

Bt3—23 to 30 inches; yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; friable; few fine roots; common faint yellowish brown (10YR 5/6) clay films and few distinct yellowish brown (10YR 5/4) silt coatings on faces of peds; few distinct dark brown (7.5YR 3/2) concretions (iron and manganese oxides); 5 percent coarse fragments; slightly acid; clear smooth boundary.

Bt4—30 to 45 inches; yellowish brown (10YR 5/6) channery clay loam; weak medium subangular blocky structure; friable; common distinct yellowish brown (10YR 5/6) clay films on faces of peds; 20 percent coarse fragments; medium acid; clear smooth boundary.

C1—45 to 55 inches; yellowish brown (10YR 5/4) loam; massive; friable; 5 percent coarse fragments; medium acid; clear smooth boundary.

C2—55 to 80 inches; yellowish brown (10YR 5/4) channery loam; massive; friable; 30 percent coarse fragments; medium acid.

The solum ranges from 40 to 72 inches in thickness. Depth to bedrock is more than 6 feet. Coarse fragments range from 0 to 15 percent in the A horizon, from 0 to 20 percent in the B horizon, and from 0 to 30 percent in the C horizon.

The Bt horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 4 to 6. It is loam, silt loam, clay loam, sandy clay loam, fine sandy loam, or their channery analog. The C horizon has hue of 10YR or 7.5YR and chroma of 4 to 6. It is loam, sandy clay loam, and fine sandy loam, or their channery analog.

Kyger Series

The Kyger series consists of deep, very poorly drained soils on flood plains and alluvial fans. The flood plains are in watersheds affected by erosion from extensive areas of surface mine spoil. These soils consist of more than 40 inches of stratified sandy and loamy overwash underlain in places by a buried soil formed in silty or loamy alluvium. Permeability is moderate or moderately rapid. Slope ranges from 0 to 3 percent.

Kyger soils are commonly adjacent to Chagrin and Orrville soils. Chagrin and Orrville soils have a subsoil and have more clay between depths of 10 and 40 inches than Kyger soils. They are in landscape positions similar to those of Kyger soils.

Typical pedon of Kyger loamy sand, frequently flooded, about 0.5 mile southeast of Pedro in Elizabeth Township, 1,350 feet south and 1,500 feet west of northeast corner of sec. 21, T. 2 N., R. 18 W.

C1—0 to 12 inches; yellowish brown (10YR 5/4) loamy sand, very pale brown (10YR 7/3) dry; single grained; loose; 10 percent coarse fragments; very strongly acid; abrupt smooth boundary.

C2—12 to 24 inches; stratified brown (10YR 4/3) loamy sand and gray (10YR 6/1) loam; single grained and massive; loose and very friable; very strongly acid; clear smooth boundary.

Cg1—24 to 40 inches; gray (10YR 5/1) silt loam; massive; friable; strongly acid; clear smooth boundary.

Cg2—40 to 60 inches; grayish brown (2.5Y 5/2) silt loam; massive; friable; slightly acid.

The overwash ranges from 40 to 72 inches in thickness. Rock fragments consist of some coal but mainly of medium and coarse grained sandstone. They range from 0 to 15 percent in the C horizon to a depth of 10 inches and from 0 to 35 percent in the subhorizons below that depth.

The C horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 1 to 8. It is stratified sandy loam, loamy sand, loam, and silt loam, but strata of sand are in some pedons. The Cg horizon has hue of 10YR to 5Y. It is dominantly silt loam but consists of thin strata of silty clay loam in some pedons.

Lakin Series

The Lakin series consists of deep, excessively drained soils on terrace slope breaks and on the sides of valleys. These soils formed in sandy eolian and water-laid deposits on the leeward side of major streams. Permeability is rapid. Slope ranges from 8 to 25 percent.

Lakin soils are commonly adjacent to Elkinsville, Sciotoville, Watertown, Weinbach, and Wheeling soils. Elkinsville and Wheeling soils have more clay in the subsoil. Sciotoville soils are moderately well drained. Weinbach soils are somewhat poorly drained. Elkinsville, Wheeling, Sciotoville, and Weinbach soils are in lower landscape positions. Watertown soils have more coarse fragments in the subsoil than Lakin soils. They are on stream terraces.

Typical pedon of Lakin loamy fine sand, 8 to 25 percent slopes, about 1.6 miles north of South Point in Perry Township, 1,850 feet north and 1,400 feet west of the southeast corner of sec. 29, T. 2 N., R. 17 W.

Ap—0 to 11 inches; brown (10YR 4/3) loamy fine sand, pale brown (10YR 6/3) dry; weak fine and medium granular structure; very friable; few fine roots; very strongly acid; abrupt smooth boundary.

E—11 to 17 inches; yellowish brown (10YR 5/6) fine sand; single grained; loose; few fine roots; medium acid; gradual wavy boundary.

E and Bt1—17 to 33 inches; yellowish brown (10YR 5/6) fine sand that has dark brown (7.5YR 4/4) loamy fine sand lamellae and lumps (Bt1); single grained; loose; few fine roots; medium acid; clear smooth boundary.

E and Bt2—33 to 51 inches; yellowish brown (10YR 5/4) fine sand that has dark brown (7.5YR 4/4 loamy fine sand lamellae and lumps (Bt2); single grained; loose; medium acid; gradual wavy boundary.

C—51 to 80 inches; yellowish brown (10YR 5/4) fine sand; single grained; loose; few thin bands of dark brown (7.5YR 4/4) loamy fine sand; medium acid.

The solum is 40 to 80 inches or more in thickness. The sandy deposits range from 50 inches to more than 30 feet in thickness, but commonly are 10 feet or more in thickness. The uppermost lamellae is at a depth of 10 to 26 inches. Rock fragments range from 0 to 3 percent in the 10- to 40-inch control section.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. The E horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 8. It is loamy fine sand, loamy sand, fine sand, or sand. The E part of the E and Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. Its texture is loamy fine sand, loamy sand, fine sand, or sand. The Bt part (lamellae or lumps) of the E and Bt horizon has hue of 10YR to 5YR and value and chroma of 3 or 4. Its texture is loamy fine sand or loamy sand. The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is commonly loamy fine sand or fine sand.

Latham Series

The Latham series consists of moderately deep, moderately well drained soils on ridgetops and side slopes on uplands. These soils formed in residuum of shale and siltstone. Permeability is slow. Slope ranges from 8 to 40 percent.

Latham soils are commonly adjacent to Coolville, Gilpin, Lily, Shelocta, and Steinsburg soils and are similar to Rarden soils. Coolville and Shelocta soils are deep over bedrock. Gilpin, Lily, and Steinsburg soils have less clay in the subsoil than Latham soils. Coolville soils are on broader ridgetops. Gilpin and Steinsburg soils are on ridgetops and side slopes. Lily soils are on ridgetops and shoulder slopes. Shelocta soils are on side slopes and alluvial fans. Rarden soils have redder colors in the subsoil than Latham soils.

Typical pedon of Latham silt loam, in an area of Shelocta-Latham association, steep, about 1.8 miles south of Eifort, in Washington Township, 640 feet north and 520 feet east of the southwest corner of sec. 16, T. 4 N., R. 18 W.

Oe—2 inches to 0; partly decomposed leaf litter.

A—0 to 3 inches; brown (10YR 4/3) silt loam, light gray (10YR 7/2) dry; weak fine and medium granular structure; friable; common fine roots; 10 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt1—3 to 7 inches; yellowish brown (10YR 5/6) silty clay loam; few fine prominent strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; friable; common fine roots; common distinct yellowish brown (10YR 5/4) silt coatings on faces of peds; 10 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt2—7 to 12 inches; yellowish brown (10YR 5/6) silty clay; few fine distinct pale brown (10YR 6/3) mottles; moderate medium angular and subangular blocky structure; firm; few fine roots; common distinct yellowish brown (10YR 5/4) clay films and strong brown (7.5YR 5/6) silt coatings on faces of peds; 10 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt3—12 to 22 inches; light yellowish brown (2.5Y 6/4) silty clay; common medium prominent strong brown (7.5YR 5/6) and common medium distinct light brownish gray (2.5Y 6/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; common distinct strong brown (7.5YR 5/6) and light brownish gray (2.5Y 6/2) clay films on faces of peds; common distinct yellowish brown (10YR 5/4) silt coatings on faces of peds; 10 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt4—22 to 26 inches; light brownish gray (2.5Y 6/2) shaly silty clay; common medium prominent strong brown (7.5YR 5/6) and yellowish brown (10YR 5/4) mottles; moderate medium angular and subangular blocky structure; firm; few fine and medium roots; common distinct light brownish gray (2.5Y 6/2) clay films on faces of peds; 20 percent coarse fragments; very strongly acid; clear smooth boundary.

Cr—26 to 31 inches; weathered olive brown (2.5Y 4/4) siltstone and shale.

Thickness of the solum and depth to bedrock range from 20 to 40 inches. Rock fragments make up less than 15 percent of the A horizon and less than 20 percent of the Bt horizon. However, in some pedons they range to 30 percent in the lower part of the profile.

The A horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons have an E horizon. The Bt horizon has chroma of 2 to 8. Some pedons have a C horizon.

Licking Series

The Licking series consists of deep, moderately well drained soils on high terraces in valleys. These soils formed in loess and in the underlying lacustrine sediments. Permeability is slow. Slope ranges from 1 to 12 percent.

Licking soils are commonly adjacent to Elkinsville, Kanawha, McGary, Omulga, and Vandalia soils. Elkinsville and Kanawha soils have less clay in the subsoil. Elkinsville soils are on somewhat lower terraces. Kanawha soils are on terraces and alluvial fans. McGary soils are somewhat poorly drained. They are in depressions on landscapes similar to those of Licking soils. Omulga soils have a fragipan. They are on terrace remnants slightly higher than Licking soils. Vandalia soils contain more coarse fragments than Licking soils. They are on foot slopes.

Typical pedon of Licking silt loam, 1 to 6 percent slopes, about 1.4 miles southeast of Linnville, in Windsor Township, 2,300 feet north and 1,100 feet west of the southeast corner of sec. 19, T. 2 N., R. 16 W.

Ap—0 to 9 inches; brown (10YR 5/3) silt loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; friable; common fine roots; strongly acid; abrupt smooth boundary.

Bt1—9 to 13 inches; yellowish brown (10YR 5/6) silty clay loam; moderate fine and medium subangular blocky structure; friable; few fine roots; common faint yellowish brown (10YR 5/6) clay films on faces of peds; common faint strong brown (7.5YR 5/6) silt coatings on faces of peds; strongly acid; clear smooth boundary.

2Bt2—13 to 25 inches; yellowish brown (10YR 5/4) silty clay; common medium distinct light brownish gray (10YR 6/2) and common medium prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; common faint strong brown (7.5YR 5/6) and yellowish brown (10YR 5/4) clay films on faces of peds; strongly acid; clear smooth boundary.

2Bt3—25 to 38 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 angular blocky structure; firm; few fine roots; common faint yellowish brown (10YR 5/4) and common distinct gray (10YR 6/1) clay films on faces of peds; common pressure faces; strongly acid; clear smooth boundary.

2Bt4—38 to 56 inches; yellowish brown (10YR 5/4) silty clay; common medium distinct light brownish gray (10YR 6/2) and few medium distinct strong brown (7.5YR 5/6) mottles; coarse angular blocky structure; firm; common faint yellowish brown (10YR 5/4) and common distinct gray (10YR 6/1) clay films on faces of peds; common pressure faces; black (10YR 2/1) stains (iron and manganese oxides) on faces of peds; medium acid in the upper part and slightly acid in the lower part; clear smooth boundary.

2C—56 to 80 inches; brown (10YR 5/3) silty clay; common medium faint light brownish gray (10YR 6/2) and common medium distinct strong brown (7.5YR 5/6) mottles; massive; common fine and medium pressure faces; firm; neutral in the upper part increasing to mildly alkaline in the lower part.

The solum ranges from 36 to 70 inches in thickness. Coarse fragments range from 0 to 2 percent in the upper part of the solum. The silt mantle ranges from 12 to 30 inches in thickness.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. It is silt loam or silty clay loam. The Bt and 2Bt horizons have hue of 10YR or 7.5YR and chroma of 4 to 6. The C horizon has chroma of 3 or 4.

Lily Series

The Lily series consists of moderately deep, well drained soils on uplands. These soils formed in residuum derived from sandstone. Permeability is moderately rapid. Slope ranges from 8 to 25 percent.

Lily soils are commonly adjacent to Gilpin, Latham, Rarden, Steinsburg, and Upshur soils and are similar to Gilpin soils. Gilpin soils have less sand in the subsoil and are on ridgetops and side slopes. Latham and Rarden soils are moderately well drained. Latham soils are on ridgetops and side slopes. Rarden soils are on ridgetops and shoulder slopes. Steinsburg soils have less clay in the subsoil. Upshur soils are deep. Steinsburg and Upshur soils are on ridgetops and side slopes.

Typical pedon of Lily loam, 8 to 15 percent slopes, about 1.3 miles south of Blackfork in Washington Township, 2,500 feet west and 100 feet south of the northeast corner of sec. 14, T. 4 N., R. 18 W.

Oe—1 inch to 0; partly decomposed leaf litter.

A—0 to 2 inches; brown (10YR 4/3) loam, light gray (10YR 7/2) dry; weak fine and medium granular structure; friable; common fine and medium roots; 5 percent coarse fragments; very strongly acid; abrupt smooth boundary.

E—2 to 8 inches; yellowish brown (10YR 5/4) loam; weak fine and medium subangular blocky structure; friable; few fine and medium roots; 5 percent coarse fragments; very strongly acid; clear smooth boundary.

BE—8 to 11 inches; yellowish brown (10YR 5/6) loam; weak medium subangular blocky structure; friable; few fine and medium roots; 5 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt1—11 to 18 inches; strong brown (7.5YR 5/6) loam; moderate medium subangular blocky structure; friable; few fine and medium roots; common faint strong brown (7.5YR 5/6) clay films on faces of peds; 5 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt2—18 to 24 inches; strong brown (7.5YR 5/6) sandy clay loam; moderate medium subangular blocky structure; friable; few fine and medium roots; common faint yellowish red (5YR 5/6) clay films on faces of peds; 5 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt3—24 to 30 inches; strong brown (7.5YR 5/6) loam; weak medium subangular blocky structure; friable; few fine and medium roots; few faint yellowish red (5YR 5/6) clay films on faces of peds; 5 percent coarse fragments; very strongly acid; abrupt smooth boundary.

R—30 to 35 inches; pale yellow (2.5Y 7/4) sandstone.

The thickness of the solum and depth to sandstone range from 20 to 40 inches. Coarse fragments range from 0 to 30 percent in the B horizon above a depth of 24 inches and from 0 to 35 percent below.

Some pedons do not have an E horizon. The Bt horizon has hue of 5YR to 10YR and chroma of 6 to 8. It is loam, clay loam, sandy clay loam, or their channery analog. Thin subhorizons of fine sandy loam and channery fine sandy loam are in the lower part of some pedons. Some pedons have a C horizon.

McGary Series

The McGary series consists of deep, somewhat poorly drained soils on high terraces in valleys. These soils formed in lacustrine sediments. Permeability is slow or very slow. Slope is 0 to 2 percent.

McGary soils are commonly adjacent to Kanawha, Licking, and Vandalia soils. Kanawha soils have less clay in the subsoil than McGary soils. They are on terraces and alluvial fans. Licking soils are moderately well drained. They are in slightly higher landscape positions than McGary soils. Vandalia soils are well drained. They are on foot slopes.

Typical pedon of McGary silt loam, 0 to 2 percent slopes, 1.3 miles southeast of Linnville in Windsor Township, 2,400 feet south and 1,750 feet west of the northeast corner of sec. 19, T. 2 N., R 16 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; weak fine and medium granular structure; friable; common fine and medium roots; common fine dark brown (7.5YR 3/2) concretions (iron and manganese oxides); neutral; abrupt smooth boundary.

Bt—8 to 13 inches; light yellowish brown (2.5Y 6/4) silty clay loam; common medium distinct light brownish gray (10YR 6/2) and common medium prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; few fine roots; common faint yellowish brown (10YR 5/4) clay films and many distinct light olive gray (5Y 6/2) and common distinct strong brown (7.5YR 5/6) silt coatings on faces of peds; common fine black (10YR 2/1) concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

Btg—13 to 30 inches; light brownish gray (10YR 6/2) silty clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; few fine roots; common faint light gray (10YR 7/2) clay films on faces of peds; few fine black (10YR 2/1) concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

B′t—30 to 44 inches; yellowish brown (10YR 5/6) silty clay; common medium prominent light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; common faint strong brown (7.5YR 5/6) and common distinct light brownish gray (10YR 6/2) clay films on faces of peds; few fine black (10YR 2/1) concretions (iron and manganese oxides); strongly acid; abrupt smooth boundary.

C1—44 to 70 inches; brown (10YR 5/3) silty clay loam; common medium faint light brownish gray (10YR 6/2) and common medium prominent strong brown (7.5YR 5/6) mottles; massive; friable; few fine dark brown (7.5YR 3/2) concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

C2—70 to 80 inches; brown (10YR 5/3) silty clay loam; common medium faint light brownish gray (10YR 6/2) and few fine prominent strong brown (7.5YR 5/6) mottles; massive; friable; few fine black (10YR 2/1) concretions (iron and manganese oxides); medium acid.

The solum is 24 to 48 inches in thickness.

The Ap horizon has value of 4 or 5 and chroma of 1 to 3. The Bt and the Btg horizons have value of 4 to 6 and chroma of 1 to 6. The C horizon has value of 4 to 6 and chroma of 1 to 6. It is clay, silty clay, or silty clay loam.

Melvin Series

The Melvin series consists of deep, poorly drained, moderately permeable soils on flood plains. This soil formed in recent alluvium. Slope is 0 to 1 percent.

Melvin soils are commonly adjacent to Cuba, Kanawha, and Stendal soils. Cuba and Kanawha soils are well drained. Stendal soils are somewhat poorly drained. Cuba and Stendal soils are on slightly higher flood plains. Kanawha soils are on terraces and alluvial fans.

Typical pedon of Melvin silt loam, ponded, about 2.5 miles south of Firebrick, in Washington Township, 350 feet south and 1,500 feet east of the northwest corner of sec. 21, T. 4 N., R. 18 W.

A—0 to 6 inches; dark grayish brown (2.5Y 4/2) silt loam, light gray (2.5Y 7/2) dry; common medium prominent strong brown (7.5YR 5/6) mottles; weak fine granular structure; friable; common fine roots; slightly acid; clear wavy boundary.

Cg1—6 to 18 inches; olive gray (5Y 5/2) silty clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; massive; friable; few fine roots; medium acid; clear wavy boundary.

Cg2—18 to 36 inches; olive gray (5Y 4/2) silt loam; common medium prominent strong brown (7.5YR 5/6) mottles; massive; friable; slightly acid; clear wavy boundary.

Cg3—36 to 46 inches; olive gray (5Y 5/2) silty clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; massive; friable; slightly acid; clear wavy boundary.

Cg4—46 to 60 inches; olive gray (5Y 4/2) silty clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; massive; friable; slightly acid.

Coarse fragments range to 5 percent to a depth of 30 inches and to 15 percent below.

The Ap has hue of 10YR to 5Y, value of 4 to 7, and chroma of 1 or 2. It is silty clay loam in some pedons but is typically silt loam. The C horizon has hue of 5Y to 10YR or is neutral, value of 4 to 7, and chroma of 0 to 2.

Morristown Series

The Morristown series consists of deep, well drained soils near surface mines. These soils formed in mixed, partly weathered fine earth material and fragments of shale, siltstone, and limestone. Permeability is moderately slow. Slope ranges from 0 to 70 percent.

Morristown soils are commonly adjacent to Bethesda, Fairpoint, and Pinegrove soils and are similar to Bethesda and Fairpoint soils. Bethesda, Fairpoint, and Pinegrove soils formed in mine spoil that is more acid than that in which Morristown soils formed. Pinegrove soils are sandier in the substratum than Morristown soils and are in similar landscape positions.

Typical pedon of Morristown channery silty clay loam, 8 to 25 percent slopes, about 1.9 miles north of Hanging Rock in Hamilton Township, 680 feet south and 2,200 feet west of the northeast corner of sec. 1, T. 1 N., R. 19 W.

Oe—1 inch to 0; partly decomposed leaf litter.

A—0 to 3 inches; light olive brown (2.5Y 5/4) channery silty clay loam, light gray (2.5Y 7/2) dry; massive; friable; common fine and medium roots; 15 percent coarse fragments; slight effervescence; mildly alkaline; clear smooth boundary.

C1—3 to 11 inches; variegated light olive brown (2.5Y 5/4) and gray (2.5Y 6/1) very channery silty clay loam; massive; friable; few medium roots; 35 percent coarse fragments; slight effervescence; mildly alkaline; gradual wavy boundary.

C2—11 to 22 inches; light olive brown (2.5Y 5/4) very channery silty clay loam; massive; friable; few fine roots; 45 percent coarse fragments; slight effervescence; mildly alkaline; gradual wavy boundary.

C3—22 to 29 inches; variegated light olive brown (2.5Y 5/4) and gray (N 5/0) channery silty clay loam; massive; friable; 25 percent coarse fragments; slight effervescence; mildly alkaline; clear smooth boundary.

C4—29 to 37 inches; variegated light olive brown (2.5Y 5/4) and gray (N 6/0) extremely channery silty clay loam; massive; friable; 70 percent coarse fragments; slight effervescence; mildly alkaline; gradual wavy boundary.

C5—37 to 60 inches; variegated light olive brown (2.5Y 5/4) and olive yellow (2.5Y 6/6) very channery silty clay loam; massive; friable; 55 percent coarse fragments; slight effervescence; mildly alkaline.

Depth to bedrock is more than 5 feet. The content of rock fragments ranges from 15 to 35 percent in the A horizon and from 20 to 80 percent in the C horizon. It averages about 40 percent throughout. Rock fragments commonly are less than 10 inches across, but some are stones, flagstones, and boulders.

The A horizon has hue of 5YR to 2.5Y, value of 4 or 5, and chroma of 3 to 8. The C horizon is neutral or has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 0 to 8.

Nolin Series

The Nolin series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slope ranges from 0 to 3 percent.

Nolin soils are commonly adjacent to Elkinsville soils and are similar to Chagrin and Cuba soils. Chagrin soils are sandier in the subsoil than Nolin soils. Cuba soils are more acid in the subsoil than Nolin soils. Elkinsville soils, on terraces, have an argillic horizon.

Typical pedon of Nolin silt loam, occasionally flooded, about 1.6 miles west of Glendale, in Hamilton Township, 400 feet north and 800 feet west of the southeast corner of sec. 7, T. 1 N., R. 19 W.

Ap—0 to 11 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; friable; common fine roots; medium acid; clear smooth boundary.

Bw1—11 to 22 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; few fine roots; common faint dark grayish brown (10YR 4/2) organic coatings on faces of peds; slightly acid; clear smooth boundary.

Bw2—22 to 28 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure; friable; few fine roots; common faint brown (10YR 4/3) coatings on faces of peds; slightly acid; clear smooth boundary.

Bw3—28 to 54 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine and medium subangular blocky structure; friable; common faint brown (10YR 4/3) coatings on faces of peds; medium acid; clear smooth boundary.

C—54 to 80 inches; dark brown (7.5YR 4/4) silt loam; massive; friable; strongly acid.

The solum is 40 inches or more in thickness. Coarse fragments, mostly pebbles, range to 5 percent in the solum and to 35 percent in the C horizon.

The Ap horizon has chroma of 2 or 3. The Bw horizon has hue of 10YR or 7.5YR. The C horizon has hue of 10YR or 7.5YR.

Omulga Series

The Omulga series consists of deep, moderately well drained soils on terrace remnants in the dissected parts of preglacial valleys. These soils formed in loess, colluvium, or old alluvium and in the underlying lacustrine sediments. They have a fragipan. Permeability is moderate above the fragipan and slow within. Slope ranges from 6 to 15 percent.

Omulga soils are commonly adjacent to Licking, Shelocta, Steinsburg, Upshur, and Vandalia soils and are similar to Sciotoville soils. Licking, Shelocta, Steinsburg, Upshur, and Vandalia soils do not have a fragipan. Licking soils are on slightly lower, lacustrine terraces. Shelocta, Steinsburg, and Upshur soils are on side slopes. Vandalia soils are on foot slopes. Sciotoville soils have low chroma mottles in the upper 10 inches of the argillic horizon.

Typical pedon of Omulga silt loam, 6 to 15 percent slopes, eroded, about 3.8 miles southwest of Superior, in Elizabeth Township, 2,500 feet north and 400 feet east of the southwest corner of sec. 7, T. 2 N., R. 19 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; weak fine and medium granular structure; friable; common fine and medium roots; specks of yellowish brown (10YR 5/6) subsoil material; neutral; abrupt smooth boundary.

Bt1—7 to 13 inches; yellowish brown (10YR 5/6) silt loam; weak fine and medium subangular blocky structure; friable; few fine roots; common faint yellowish brown (10YR 5/6) clay films on faces of peds; common distinct brown (10YR 4/3) organic coatings on faces of peds; common faint yellowish brown (10YR 5/6) silt coatings on faces of peds; neutral; clear smooth boundary.

Bt2—13 to 26 inches; strong brown (7.5YR 5/6) silt loam; common medium distinct light yellowish brown (10YR 6/4) mottles; moderate medium subangular blocky structure; friable; few fine roots; common faint strong brown (7.5YR 5/6) clay films and silt coatings on faces of peds; strongly acid; clear smooth boundary.

2B/E—26 to 30 inches; yellowish brown (10YR 5/6) silt loam (Bt); common medium prominent light brownish gray (10YR 6/2) mottles; weak very coarse prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; common distinct strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2) clay films on faces of peds; common faint yellowish brown (10YR 5/4) silt coatings on faces of peds (E); 5 percent coarse fragments; strongly acid; clear smooth boundary.

2Btx—30 to 42 inches; yellowish brown (10YR 5/6) silt loam; common medium prominent light gray (10YR 6/1) mottles; weak very coarse prismatic structure parting to moderate thick platy; very firm and brittle; common distinct strong brown (7.5YR 5/6) and grayish brown (10YR 5/2) clay films on faces of peds; common faint light yellowish brown (10YR 6/4) silt coatings on faces of peds; 5 percent sandstone fragments; strongly acid; clear smooth boundary.

2B´t—42 to 52 inches; yellowish brown (10YR 5/6) silty clay loam; common medium prominent light gray (10YR 6/1) mottles; weak coarse prismatic structure parting to weak medium platy; firm; common faint strong brown (7.5YR 5/6) clay films on faces of peds; 5 percent coarse fragments; strongly acid; abrupt smooth boundary.

3C1—52 to 72 inches; light brownish gray (10YR 6/2) silty clay; common medium prominent yellowish red (5YR 5/6) and strong brown (7.5YR 5/6) mottles; massive; firm; strongly acid; clear smooth boundary.

3C2—72 to 80 inches; light olive brown (2.5Y 5/6) silty clay loam; common medium prominent light brownish gray (10YR 6/2) mottles in seams; massive; firm; 5 percent coarse fragments; very strongly acid.

The solum ranges from 40 to 100 inches in thickness. Depth to the fragipan ranges from 18 to 36 inches. Coarse fragments, mainly waterworn gravel, range to 5 percent above the fragipan, 10 percent in the fragipan, and 15 percent in the lower part of the solum and in the substratum.

The Bt horizon has chroma of 6 to 8. The Btx horizon has hue of 10YR or 7.5YR and value of 5 or 6. The 2B´t and 3C horizons have hue of 10YR, 7.5YR, or 2.5Y, value of 4 to 6, and chroma of 2 to 6. They are silty clay loam, silty clay, clay loam, loam, silt loam, or sandy clay loam.

Orrville Series

The Orrville series consists of deep, somewhat poorly drained soils on flood plains. These soils formed in recent loamy alluvium. Permeability is moderate. Slope is 0 to 2 percent.

Orrville soils are commonly adjacent to Chagrin, Kanawha, and Vandalia soils and are similar to Stendal soils. Chagrin, Kanawha, and Vandalia soils are well drained. Chagrin soils are adjacent to stream channels. Kanawha soils are on terraces and alluvial fans. Vandalia soils are on foot slopes. Stendal soils have less sand in the subsoil than Orrville soils.

Typical pedon of Orrville silt loam, frequently flooded, about 3.6 miles north of Waterloo in Symmes Township, 1,750 feet south and 2,600 feet west of the northwest corner of sec. 11, T. 5 N., R. 17 W.

Ap—0 to 9 inches; dark grayish brown (2.5Y 4/2) silt loam, light gray (2.5Y 7/2) dry; weak fine and medium granular structure; friable; common fine roots; 5 percent coarse fragments; strongly acid; abrupt smooth boundary.

Bw—9 to 18 inches; brown (10YR 5/3) silt loam; common medium distinct light brownish gray (2.5Y 6/2) and few fine prominent yellowish red (5YR 5/6) mottles; weak fine and medium subangular blocky structure; friable; few fine roots; common distinct light brownish gray (2.5Y 6/2) silt coatings on faces of peds; common fine dark brown (7.5YR 3/2) concretions (iron and manganese oxides); 3 percent coarse fragments; strongly acid; clear smooth boundary.

Bg1—18 to 25 inches; grayish brown (2.5Y 5/2) loam; common medium prominent yellowish brown (10YR 5/4) mottles; weak fine and medium subangular blocky structure; friable; few fine roots; few distinct yellowish brown (10YR 5/4) silt coatings on faces of peds; common fine black

(10YR 2/1) concretions (iron and manganese oxides); 3 percent coarse fragments; strongly acid; clear smooth boundary.

Bg2—25 to 35 inches; grayish brown (2.5Y 5/2) silt loam; few prominent yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; friable; few fine roots; common distinct black (10YR 2/1) concretions (iron and manganese oxides); 5 percent coarse fragments; strongly acid; abrupt smooth boundary.

Cg—35 to 53 inches; dark gray (5Y 4/1) loam; massive; friable; few fine roots; medium acid; clear smooth boundary.

C—53 to 60 inches; yellowish brown (10YR 5/4) gravelly loam; massive; friable; 25 percent coarse fragments; medium acid.

The solum ranges from 24 to 50 inches in thickness. Content of coarse fragments is 0 to 5 percent in the Ap horizon, 0 to 15 percent in the B horizon, and 0 to 25 percent in the C horizon.

The Ap horizon has hue of 10YR or 2.5Y. The Bw horizon has value of 4 to 6 and chroma of 3 to 6. It is silt loam or loam. The Bg horizon has hue of 10YR or 2.5Y. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 7, and chroma of 1 to 6. It is silt loam, loam, sandy loam, or their gravelly analog.

Peoga Series

The Peoga series consists of deep, poorly drained soils on flats and in depressions on stream terraces. These soils formed in old alluvium. Permeability is slow. Slope is 0 to 2 percent.

Peoga soils are commonly adjacent to Elkinsville, Sciotoville, and Weinbach soils. These soils are in slightly higher positions than Peoga soils. Elkinsville soils are well drained. Sciotoville soils are moderately well drained. Weinbach soils are somewhat poorly drained.

Typical pedon of Peoga silt loam, rarely flooded, about 1.25 miles west-northwest of Glendale in Hamilton Township, 1,700 feet south and 1,100 feet east of the northwest corner of sec. 8, T. 1 N., R. 19 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; weak fine and medium granular structure; friable; common fine roots; common fine dark brown (7.5YR 4/4) stains (iron and manganese oxides); strongly acid; abrupt smooth boundary.

Btg1—9 to 20 inches; light brownish gray (10YR 6/2) silt loam; weak medium subangular blocky structure; friable; few fine roots; few faint light brownish gray (10YR 6/2) clay films on faces of peds; common faint pale brown (10YR 6/3) silt coatings on faces of peds; common fine dark brown (7.5YR 4/4) stains (iron and manganese oxides); very strongly acid; clear smooth boundary.

Btg2—20 to 40 inches; light brownish gray (2.5Y 6/2) silt loam; common medium prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; few faint light brownish gray (2.5Y 6/2) clay films on faces of peds; very strongly acid; clear smooth boundary.

BCg—40 to 50 inches; light brownish gray (10YR 6/2) silt loam; common medium prominent strong brown (7.5YR 5/6) and few medium faint light brownish gray (2.5Y 6/2) mottles; weak fine and medium subangular blocky structure; friable; few fine roots; very strongly acid; clear smooth boundary.

Cg—50 to 60 inches; light brownish gray (2.5Y 6/2) loam; few medium prominent yellowish brown (10YR 5/6) mottles; massive; friable; few fine roots; very strongly acid; abrupt smooth boundary.

C—60 to 80 inches; dark yellowish brown (10YR 4/4) loam; common medium prominent light brownish gray (2.5Y 6/2) and strong brown (7.5YR 5/6) and few medium distinct gray (10YR 6/1) mottles; massive; friable; common fine yellowish red (5YR 5/8) stains (iron and manganese oxides); very strongly acid.

The solum ranges from 40 to 80 inches in thickness.

The Ap horizon has value of 4 or 5 and chroma of 1 or 2. The Btg horizon has value of 4 to 6 and chroma of 1 or 2. It is silt loam or silty clay loam. The C horizon has value of 4 to 6 and chroma of 1 to 4. It is loam, silt loam, or silty clay loam.

Pinegrove Series

The Pinegrove series consists of deep, excessively drained soils near surface mines on uplands. These soils formed in mixed, partly weathered, sandy fine earth and fragments of sandstone. Permeability is rapid. Slope ranges from 8 to 70 percent.

Pinegrove soils are commonly adjacent to Gilpin, Lily, Shelocta, Steinsburg, and Upshur soils. Gilpin, Lily, and Steinsburg soils are moderately deep. Shelocta and Upshur soils have less sand than Pinegrove soils. Gilpin, Steinsburg, and Upshur soils are on ridgetops and side slopes. Lily soils are on ridgetops. Shelocta soils are on side slopes and alluvial fans.

Typical pedon of Pinegrove loamy coarse sand, 8 to 25 percent slopes, about 3.5 miles northwest of Pedro in Elizabeth Township, 1,520 feet north and 120 feet east of the southwest corner of sec. 9, T. 2 N., R. 19 W.

Oe—1 inch to 0; partly decomposed pine needles.

A—0 to 2 inches; olive yellow (2.5Y 6/6) loamy coarse sand very pale brown (10YR 8/4) dry; weak fine granular structure; loose; common fine roots; 5 percent coarse fragments; very strongly acid; clear wavy boundary.

C1—2 to 10 inches; olive yellow (2.5Y 6/8) loamy sand; single grained; loose; common fine roots; 5 percent coarse fragments; strongly acid; clear wavy boundary.

C2—10 to 40 inches; olive yellow (2.5Y 6/8) loamy coarse sand; single grained; loose; few fine roots; 5 percent coarse fragments; many soft sandstone fragments; strongly acid; clear wavy boundary.

C3—40 to 80 inches; olive yellow (2.5Y 6/8) channery loamy sand; single grained; loose; 5 percent coarse fragments; many soft sandstone fragments; very strongly acid.

Depth to bedrock is more than 60 inches. Rock fragments range to 35 percent between depths of 10 and 40 inches and to as much as 60 percent below a depth of 40 inches.

The A horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 to 6. It is sand, loamy sand, sandy loam, or coarse sandy loam in some pedons and loamy coarse sand in most pedons. In areas reclaimed with a blanket of topsoil, the Ap horizon, to a depth of as much as 10 inches, is silty clay loam in most pedons or silt loam or loam in some pedons. It has hue of 2.5YR to 5Y or is neutral, value of 4 to 6, and chroma of 0 to 8. The C horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 3 to 8. It is sand, loamy sand, or loamy coarse sand in the fine earth fraction.

Piopolis Series

The Piopolis series consists of deep, poorly drained and very poorly drained soils in depressions on flood plains. These soils formed in recent alluvium. Permeability is slow. Slope is 0 to 1 percent.

Piopolis soils are commonly adjacent to Cuba, Kanawha, and Stendal soils. Cuba and Kanawha soils are well drained. Cuba and Stendal soils are in slightly higher positions on flood plains. Stendal soils are somewhat poorly drained. Kanawha soils are on terraces and alluvial fans.

Typical pedon of Piopolis silty clay loam, frequently flooded, about 3.6 miles north of Waterloo in Symmes Township, 1,400 feet south and 200 feet west of the northeast corner of sec. 11, T. 5 N., R. 17 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silty clay loam, light gray (10YR 7/2) dry; weak fine and medium granular structure; friable; many fine roots; few distinct strong brown (7.5YR 5/6) stains (iron and manganese oxides) and black (10YR 2/1) concretions (iron and manganese oxides); strongly acid; abrupt smooth boundary.

Cg1—8 to 13 inches; light brownish gray (10YR 6/2) silty clay loam; few medium prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; few distinct black (10YR 2/1) concretions (iron and manganese oxide); very strongly acid; clear smooth boundary.

Cg2—13 to 30 inches; light brownish gray (10YR 6/2) silty clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; friable; few fine roots; few distinct dark brown (7.5YR 3/2) concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

Cg3—30 to 50 inches; gray (10YR 6/1) silty clay loam; common medium prominent strong brown (7.5YR 5/6) and light yellowish brown (2.5Y 6/4) mottles; massive; friable; common distinct dark brown (7.5YR 3/2) concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

Cg4—50 to 80 inches; gray (10YR 6/1) silty clay loam; many medium prominent strong brown (7.5YR 5/6) and common medium prominent light yellowish brown (2.5Y 6/4) mottles; massive; friable; common distinct black (10YR 2/1) stains (iron and manganese oxides); strongly acid.

The Ap horizon has value of 4 or 5 and chroma of 1 or 2. It is silt loam in some pedons and silty clay loam in most pedons. The Cg horizon has hue of 10YR or 2.5Y or is neutral, value of 5 or 6, and chroma of 0 to 2. It is typically silty clay loam; however, in some pedons, thin strata of silt loam are below a depth of 40 inches.

Rarden Series

The Rarden series consists of moderately deep, moderately well drained, slowly permeable soils on shoulder slopes and ridgetops on uplands. These soils formed in residuum of shale and, in some areas, thin beds of siltstone. Slope ranges from 8 to 25 percent.

Rarden soils are commonly adjacent to Coolville, Gilpin, Lily, Tilsit, and Upshur soils and are similar to

Latham soils. Coolville, Tilsit, and Upshur soils are deep to bedrock. Coolville and Tilsit soils are on the less sloping part of the ridgetop. Upshur soils are on ridgetops and side slopes. Gilpin and Lily soils are well drained. Like Rarden soils, they are on ridgetops. Latham soils are not as red in the subsoil as Rarden soils.

Typical pedon of Rarden silt loam, in an area of Rarden-Gilpin silt loams, 8 to 15 percent slopes, about 1.5 miles west of Blackfork, in Washington Township, 2,900 feet north and 2,700 feet west of the southeast corner of sec. 3, T. 4 N., R. 18 W.

Oe—1 inch to 0; partly decomposed leaf litter.

A—0 to 3 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; friable; common fine and medium roots; very strongly acid; abrupt smooth boundary.

E—3 to 6 inches; light yellowish brown (10YR 6/4) silt loam; weak fine and medium subangular blocky structure; friable; few fine and medium roots; very strongly acid; clear smooth boundary.

BE—6 to 10 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few fine and medium roots; common faint light yellowish brown (10YR 6/4) silt coatings on faces of peds; very strongly acid; clear smooth boundary.

Bt1—10 to 15 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; common faint strong brown (7.5YR 5/6) clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—15 to 24 inches; yellowish red (5YR 5/8) silty clay; common medium prominent light brownish gray (10YR 6/2) and common medium distinct strong brown (7.5YR 5/6) mottles; firm; few fine roots; common faint yellowish red (5YR 5/8) and common distinct light brownish gray (10YR 6/2) clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt3—24 to 30 inches; yellowish red (5YR 5/8) silty clay; common medium faint yellowish red (5YR 5/6) mottles; moderate medium angular blocky structure; firm; few fine roots; many distinct light brownish gray (10YR 6/2) clay films on faces of peds; 5 percent coarse fragments; very strongly acid; clear smooth boundary.

BC—30 to 37 inches; pale brown (10YR 6/3) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium angular blocky structure; firm; common distinct light brownish gray (2.5Y 6/2) and strong brown (7.5YR 5/6) clay films on faces of peds; very strongly acid; abrupt smooth boundary.

Cr—37 to 40 inches; weathered shale and thin beds of siltstone.

The thickness of the solum and depth to paralithic contact range from 20 to 40 inches. Coarse fragments range to 5 percent in the upper part of solum and to 20 percent in the lower part. Coarse fragments are dominantly shale or siltstone.

The E horizon has value of 5 or 6. The Bt horizon has dominant hue of 5YR, 2.5YR or 7.5YR and thin subhorizons of 10YR, value of 4 to 6, and chroma of 4 to 8. Some pedons have a C horizon.

Sciotoville Series

The Sciotoville series consists of deep, moderately well drained soils on stream terraces. These soils formed in old alluvium. They have a fragipan. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. Slope ranges from 1 to 6 percent.

Sciotoville soils are commonly adjacent to Elkinsville, Peoga, Weinbach, and Wheeling soils and are similar to Omulga soils. Elkinsville and Wheeling soils are well drained. They are in positions similar to those of Sciotoville soils. Peoga soils are poorly drained. They are on flats and in depressions. Weinbach soils are somewhat poorly drained. They are in slightly lower positions than Pinegrove soils. Unlike Omulga soils, Sciotoville soils have mottles of low chroma in the upper 10 inches of the argillic horizon.

Typical pedon of Sciotoville silt loam, 1 to 6 percent slopes, 800 feet south of Glendale in Hamilton Township, 1,500 feet north and 2,300 feet east of the southwest corner of sec. 14, T. 1 N., R. 19 W.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; friable; common fine roots; brown (10YR 4/3) silt coatings on faces of peds; few coarse fragments; strongly acid; abrupt smooth boundary.

Bt1—9 to 15 inches; yellowish brown (10YR 5/4) silt loam; common fine faint pale brown (10YR 6/3) and common medium distinct brown (7.5YR 4/4) mottles; weak fine and medium subangular blocky structure; friable; common fine roots; few distinct brown (7.5YR 5/4) clay films on faces of peds; few distinct yellowish brown (10YR 5/4) silt coatings on faces of peds; few black (10YR 2/1) stains and concretions (iron and manganese oxides);

common mica flakes; strongly acid; clear smooth boundary.

Bt2—15 to 24 inches; yellowish brown (10YR 5/4) silt loam; many medium distinct light gray (10YR 7/2) and common medium distinct brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; friable; common fine roots; common distinct brown (7.5YR 4/4) and light gray (10YR 7/2) clay films and silt coatings on faces of peds; common fine black (10YR 2/1) stains and concretions (iron and manganese oxides); common mica flakes; strongly acid; clear smooth boundary.

Btx1—24 to 31 inches; brown (7.5YR 4/4) silt loam; few fine distinct yellowish brown (10YR 5/4) and many medium prominent light gray (10YR 7/2) mottles; weak very coarse prismatic structure parting to weak fine and medium subangular blocky; firm and slightly brittle; few distinct light gray (10YR 7/2) and brown (7.5YR 4/4) clay films on vertical faces of peds; few distinct brown (7.5YR 4/4) silt coatings on faces of peds; few distinct black (10YR 2/1) stains and concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

Btx2—31 to 37 inches; brown (7.5YR 4/4) silt loam; common medium prominent gray (10YR 6/1) and few fine distinct yellowish brown (10YR 5/4) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; very firm and brittle; common distinct brown (10YR 5/3) and grayish brown (10YR 5/2) clay films and silt coatings on faces of peds; few distinct black (10YR 2/1) stains and concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

Btx3—37 to 57 inches; brown (7.5YR 4/4) silt loam; moderate very coarse prismatic structure parting to weak coarse subangular blocky; very firm and brittle; few distinct brown (7.5YR 5/4) clay films on horizontal faces of peds; few distinct brown (7.5YR 4/4) silt coatings on faces of peds; few distinct black (10YR 2/1) stains and concretions (iron and manganese oxides); very strongly acid; abrupt smooth boundary.

BC—57 to 80 inches; brown (7.5YR 4/4) loam; weak coarse prismatic structure parting to weak coarse subangular blocky; friable; few distinct brown (7.5YR 4/4) silt coatings on horizontal faces of peds; very few distinct black (10YR 2/1) stains and concretions (iron and manganese oxides); very strongly acid.

The solum ranges from 45 to 80 inches in thickness. Depth to the fragipan ranges from 18 to 38 inches. Coarse fragments range to 2 percent in the Ap horizon and to 5 percent in the Bt and Btx horizons. Coarse fragments are mainly waterworn sandstone or quartzite.

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 3 to 6. The Btx horizon has hue of 10YR or 7.5YR and value of 4 or 5.

Shelocta Series

The Shelocta series consists of deep, well drained soils. These soils formed in colluvium from siltstone, shale, and sandstone on side slopes and foot slopes on uplands. In a few areas they are on colluvial fans in narrow stream valleys and along valley walls. Permeability is moderate. Slope ranges from 2 to 60 percent.

Shelocta soils are commonly adjacent to Latham, Lily, and Steinsburg soils and are similar to Clymer and Kanawha soils. Latham, Lily, and Steinsburg soils are moderately deep over bedrock. Latham and Steinsburg soils are on ridgetops and side slopes. Lily soils are on ridgetops. Clymer soils are sandier than Shelocta soils. They are on side slopes. Kanawha soils are less acid in the lower part than Shelocta soils. They are on terraces and alluvial fans.

Typical pedon of Shelocta silt loam, in an area of Steinsburg-Shelocta association, very steep, about 3.75 miles northwest of Lisman, in Elizabeth Township, about 700 feet north and 1,600 feet east of the southwest corner of sec.2, T. 2 N., R. 19 W.

Oe—2 inches to 0; partly decomposed leaf litter.

A—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; many fine and medium roots; 10 percent coarse fragments; medium acid; clear smooth boundary.

BA—5 to 10 inches; dark yellowish brown (10YR 4/4) silt loam; weak very fine subangular blocky structure; friable; many fine and medium roots; few faint dark yellowish brown (10YR 4/4) organic coatings on faces of peds; 10 percent coarse fragments; strongly acid; clear smooth boundary.

Bt1—10 to 18 inches; yellowish brown (10YR 5/6) silt loam; weak fine and medium subangular blocky structure; friable; common fine roots; few distinct yellowish brown (10YR 5/4) clay films on vertical faces of peds; few faint yellowish brown (10YR 5/6) silt coatings on faces of peds; 10 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt2—18 to 24 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common fine roots; common distinct yellowish brown (10YR 5/4) clay films on faces of peds; 10 percent coarse fragments; very strongly acid; clear smooth boundary.
Bt3—24 to 33 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few fine roots; common distinct yellowish brown (10YR 5/4) clay films on faces of peds; 10 percent coarse fragments; strongly acid; clear wavy boundary.
Bt4—33 to 48 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few fine roots; few faint yellowish brown (10YR 5/6) clay films on faces of peds; 10 percent coarse fragments; strongly acid; clear wavy boundary.
BC—48 to 60 inches; yellowish brown (10YR 5/6) channery silt loam; weak fine and medium subangular blocky structure; friable; few fine roots; 20 percent coarse fragments; very strongly acid.
2Cr—60 to 65 inches; light olive brown (2.5Y 5/4) weathered siltstone and shale.

The solum ranges from 40 to 60 inches in thickness. Depth to bedrock is 60 inches or more. Coarse fragments range to 15 percent in the A horizon and from 5 to 35 percent in individual subhorizons of the Bt horizon.

The A horizon has chroma of 2 or 3. Some pedons have an E horizon. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is silt loam, silty clay loam, or their channery analog. Some pedons have subhorizons of loam or silty clay in the lower part. Some pedons have a C horizon. The 2Cr horizon is shale, siltstone, or sandstone.

Steinsburg Series

The Steinsburg series consists of moderately deep, well drained soils on ridgetops, shoulder slopes, and side slopes on uplands. These soils formed in residuum derived from sandstone or, in some areas, material weathered from conglomerate. Permeability is moderately rapid. Slope ranges from 15 to 70 percent.

Steinsburg soils are commonly adjacent to Clymer, Latham, Lily, and Shelocta soils. Latham soils are moderately well drained. They are on ridgetops and side slopes. Lily soils have more clay in the subsoil than Steinsburg soils. They are on ridgetops. Clymer and Shelocta soils are deep. Shelocta soils are on side slopes and colluvial fans. Clymer soils are on side slopes.

Typical pedon of Steinsburg loam, in an area of Steinsburg-Shelocta association, very steep, about 3.75 miles northwest of Lisman, in Elizabeth Township, 800 feet north and 1,960 feet east of the southwest corner of sec. 2, T. 2 N., R. 19 W.

Oe—1 inch to 0; partly decomposed leaf litter.
A—0 to 4 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; common fine and medium roots; very strongly acid; clear smooth boundary.
Bw1—4 to 8 inches; yellowish brown (10YR 5/4) loam; weak fine subangular blocky structure; friable; common fine and medium roots; 5 percent coarse fragments; very strongly acid; clear wavy boundary.
Bw2—8 to 16 inches; yellowish brown (10YR 5/6) sandy loam; weak medium subangular blocky structure; friable; few fine roots; few faint yellowish brown (10YR 5/6) silt coatings on vertical faces of peds; 5 percent coarse fragments; very strongly acid; clear wavy boundary.
Bw3—16 to 30 inches; yellowish brown (10YR 5/6) sandy loam; weak fine subangular blocky structure; friable; few fine roots; 10 percent coarse fragments; extremely acid; abrupt wavy boundary.
R—30 to 35 inches; brownish yellow (10YR 6/6) weakly cemented sandstone increasing in hardness with depth.

The solum ranges from 10 to 32 inches in thickness. Depth to bedrock ranges from 24 to 40 inches. Coarse fragments range from 0 to 20 percent in the Bw horizon.

The A horizon has chroma of 2 or 3. It is loam or sandy loam. The B horizon has hue of 7.5YR or 10YR and value of 5 or 6. It is loam, sandy loam, or channery sandy loam. In some pedons the C horizon is 15 to 60 percent, by volume, coarse fragments.

Stendal Series

The Stendal series consists of deep, somewhat poorly drained soils on flood plains. These soils formed in recent alluvium. Permeability is moderate. Slope ranges from 0 to 2 percent.

Stendal soils are commonly adjacent to Cuba, Kanawha, Piopolis, and Tioga soils and are similar to Orrville soils. Cuba, Kanawha, and Tioga soils are well drained. Cuba soils are near streams in higher positions than Stendal soils. Kanawha soils are on terraces and alluvial fans. Tioga soils are near streams. Orrville soils have more sand in the subsoil than Stendal soils. Piopolis soils are poorly drained and very poorly drained. They are in depressions on flood plains.

Typical pedon of Stendal silt loam, occasionally flooded, about 1.7 miles west southwest of Olive Furnace, in Decatur Township, 2,000 feet south and 720 feet east of the northwest corner of sec. 4, T. 3 N., R. 18 W.

Ap—0 to 10 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; friable; common fine roots; few fine black (10YR 2/1) and dark brown (7.5YR 3/2) concretions (iron and manganese oxides); strongly acid; abrupt smooth boundary.

C—10 to 15 inches; brown (10YR 5/3) silt loam; common medium and faint grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; few fine roots; common faint grayish brown (10YR 5/2) silt coatings on faces of peds; common medium dark brown (7.5YR 3/2) concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

Cg2—15 to 26 inches; gray (10YR 6/1) silt loam; many medium prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; few faint; yellowish brown (10YR 5/4) silt coatings on faces of peds; few medium dark brown (7.5YR 3/2) concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

Cg3—26 to 65 inches; gray (10YR 6/1) silt loam; many medium prominent strong brown (7.5YR 5/6) mottles; massive; friable; few fine roots; common medium black (10YR 2/1) stains (iron and manganese oxides); very strongly acid; clear smooth boundary.

C′—65 to 80 inches; brown (10YR 5/3) silt loam; common medium prominent strong brown (7.5YR 5/6) and gray (10YR 6/1) mottles; massive; friable; common medium black (10YR 2/1) stains (iron and manganese oxides); very strongly acid.

The Ap horizon has chroma of 2 or 3. The C horizon has chroma of 1 to 3. It is typically silt loam or silty clay loam. It has subhorizons of loam below a depth of 40 inches.

Tilsit Series

The Tilsit series consists of deep, moderately well drained soils on uplands. These soils formed in loess and in the underlying residuum derived from acid sandstone, shale, and siltstone. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. Slope ranges from 2 to 6 percent.

Tilsit soils are commonly adjacent to Coolville, Gilpin, Latham, Rarden, and Upshur soils. Coolville soils have more clay in the subsoil than Tilsit soils and are in similar landscape positions. Gilpin, Latham, and Rarden soils are moderately deep. Gilpin and Latham soils are on ridgetops and side slopes. Rarden soils are on ridgetops. Upshur soils have more clay in the subsoil than Tilsit soils. They are on ridgetops and side slopes.

Typical pedon of Tilsit silt loam, in an area of Coolville-Tilsit silt loams, 2 to 6 percent slopes, about 1.6 miles northeast of Center Station in Decatur Township, 2,000 feet north and 2,800 east of the southwest corner of sec. 27, T.3 N., R.18 W.

Ap—0 to 5 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; friable; common fine roots; medium acid; clear wavy boundary.

E—5 to 13 inches; yellowish brown (10YR 5/4) silt loam; weak fine and medium subangular blocky structure; friable; few fine roots; few faint light yellowish brown (10YR 6/4) and yellowish brown (10YR 5/4) silt coatings on faces of peds; few fine dark brown (7.5YR 3/2) stains (iron and manganese oxides); slightly acid; clear smooth boundary.

Bt1—13 to 28 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few fine roots; few faint yellowish brown (10YR 5/6) clay films on faces of peds; common fine dark brown (7.5YR 3/2) stains and concretions (iron and manganese oxides); slightly acid in the upper part and strongly acid in the lower part; clear smooth boundary.

Btx1—28 to 34 inches; yellowish brown (10YR 5/6) silt loam; few fine prominent gray (10YR 6/1) mottles; weak very coarse prismatic structure parting to moderate thin platy; firm; common faint yellowish brown (10YR 5/6) clay films on vertical faces of prisms; few distinct light yellowish brown (10YR 6/4) silt coatings on vertical faces of prisms; common fine dark brown (7.5YR 3/2) concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

Btx2—34 to 48 inches; strong brown (7.5YR 5/6) silt loam; few fine prominent gray (10YR 6/1) mottles; weak very coarse prismatic structure parting to moderate thin platy; very firm and brittle; common faint strong brown (7.5YR 5/6) clay films on vertical faces of prisms; common faint light yellowish brown (10YR 6/4) silt coatings on vertical faces of prisms; many fine and medium dark brown (7.5YR 3/2) concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

B´t—48 to 60 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; 2 percent coarse fragments; very strongly acid; abrupt smooth boundary.

2R—60 to 65 inches; strong brown (7.5YR 5/6) siltstone.

The solum ranges from 40 to 60 inches in thickness. Depth to bedrock ranges from 40 to 120 inches. Coarse fragments typically range from 0 to 10 percent in the solum. In some pedons coarse fragments make up as much as 40 percent of the lower part of the solum. The fragipan is at a depth of 18 to 28 inches.

The Bt horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. The Btx and 2B´t horizons have chroma of 4 to 6. They are silt loam or silty clay loam. Some pedons have a C horizon that is 10 to 50 percent, by volume, coarse fragments.

Tioga Series

The Tioga series consists of deep, well drained soils on flood plains. These soils formed in recent alluvium. Permeability is moderate or moderately rapid. Slope ranges from 0 to 3 percent.

Tioga soils are commonly adjacent to Cuba and Stendal soils and are similar to Chagrin soils. Cuba soils have less sand between depths of 10 and 40 inches than Tioga soils and are in similar landscape positions. Stendal soils are somewhat poorly drained. They are in depressions on flood plains. Chagrin soils have more clay in the subsoil than Tioga soils.

Typical pedon of Tioga loam, frequently flooded, about 2 miles south southeast of Linnville, in Windsor Township, 1,720 feet south and 2,200 feet west of the northeast corner of sec. 30, T. 3 N., R 16 W.

Ap—0 to 10 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; friable; common fine and medium roots; strongly acid; clear smooth boundary.

Bw1—10 to 18 inches; brown (7.5YR 4/4) loam; weak fine and medium subangular blocky structure; friable; few fine roots; strongly acid; clear wavy boundary.

Bw2—18 to 35 inches; brown (7.5YR 4/4) loam; weak medium subangular blocky structure; friable; few fine roots; medium acid; clear wavy boundary.

C—35 to 60 inches; brown (7.5YR 4/4) sandy loam; massive; friable; medium acid.

The solum ranges from 18 to 40 inches in thickness.

The Ap horizon typically is loam. In some pedons it is fine sandy loam to silt loam. The Bw horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. It is typically loam or fine sandy loam that, in some pedons, has subhorizons of loamy sand or sandy loam. The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. It is sandy loam, fine sandy loam, or loamy sand.

Upshur Series

The Upshur series consists of deep, well drained soils. These soils formed in colluvium and residuum derived from limestone and shale on uplands. Permeability is slow. Slope ranges from 8 to 70 percent.

Upshur soils are commonly adjacent to Gilpin, Lily, Steinsburg, Vandalia, and Woodsfield soils and are similar to Vandalia soils. Gilpin, Lily, and Steinsburg soils are moderately deep to bedrock. Lily soils are on ridgetops and shoulder slopes. Gilpin and Steinsburg soils are on ridgetops, shoulder slopes, and side slopes. Vandalia soils have more coarse fragments in the subsoil than Upshur soils. They are on foot slopes. Woodsfield soils have more silt in the upper part of the subsoil. They are on wide ridgetops.

Typical pedon of Upshur silty clay loam, in an area of Upshur-Gilpin complex, 8 to 15 percent slopes, about 3 miles north of Kitts Hill, in Aid Township, 1,600 feet east and 1,900 feet north of the southwest corner of sec. 29, T. 4 N., R. 17 W.

Oe—2 inches to 0; partly decomposed leaf litter.

A—0 to 5 inches; brown (10YR 4/3) silty clay loam, pale brown (10YR 6/3) dry; moderate fine and medium subangular blocky structure; firm; common fine and medium roots; few fine black (10YR 2/1) concretions (iron and manganese oxides); strongly acid; clear wavy boundary.

Bt1—5 to 13 inches; yellowish red (5YR 4/6) silty clay; strong medium subangular blocky structure; firm; common medium roots; strong brown (7.5YR 5/6) variegations; many distinct yellowish red (5YR 4/6) and few distinct reddish brown (5YR 5/3) clay films on faces of peds and few distinct pale brown (10YR 6/3) clay films in root channels; few fine black (10YR 2/1) concretions (iron and manganese oxides); medium acid; clear wavy boundary.

Bt2—13 to 25 inches; yellowish red (5YR 4/6) silty clay; moderate medium and coarse subangular blocky structure; firm; few medium roots; many distinct yellowish red (5YR 4/6) clay films on faces of peds; many very fine pinkish white (7.5YR 8/2) soft accumulations; 2 percent coarse fragments; slightly acid; clear wavy boundary.

Bt3—25 to 32 inches; reddish brown (5YR 4/4) clay; weak coarse angular and subangular blocky structure; firm; few fine and medium roots; common distinct reddish brown (5YR 4/4) clay films on faces of peds and few reddish brown (5YR 4/4) slickensides; few fine pinkish white (7.5YR 8/2) soft accumulations (calcium carbonate); few fine black (10YR 2/1) concretions (iron and manganese oxides); neutral; clear wavy boundary.

Bt4—32 to 44 inches; dark red (2.5YR 3/6) silty clay; weak coarse angular blocky structure; firm; few fine and medium roots; few distinct dark red (10R 3/6) clay films on faces of peds; few fine pinkish white (7.5YR 8/2) soft accumulations (calcium carbonate); few fine black (10YR 2/1) concretions (iron and manganese oxides); 2 percent coarse fragments; neutral; clear wavy boundary.

C—44 to 55 inches; red (2.5YR 4/6) silty clay loam; massive; firm; 10 percent coarse fragments; violent effervescence; moderately alkaline; clear smooth boundary.

Cr—55 to 60 inches; soft, calcareous red (2.5YR 4/6) shale.

The solum ranges from 26 to 50 inches in thickness. Depth to bedrock ranges from 40 to 72 inches or more. Coarse fragments range from 0 to 10 percent in the A horizon and in the upper part of the Bt horizon, from 0 to 25 percent in the lower part of the Bt horizon, and to 35 percent in the C horizon.

The A horizon has hue of 5YR to 10YR and value and chroma of 3 or 4. It is silt loam or silty clay loam. The Bt horizon has hue of 5YR to 10R and chroma of 3 to 6. The C horizon has hue of 5YR to 10R, value of 3 or 4, and chroma of 3 to 6. It is silty clay loam, silty clay, or their shaly analog. Typically, the Cr horizon is shale or limestone. Some pedons have thin strata of siltstone.

The C horizon has hue of 5YR to 10YR, value of 3 or 4, and chroma of 3 to 6. It is silty clay loam, silty clay, or their shaly analog. Typically, the Cr horizon is shale or limestone. Some pedons have thin strata of siltstone.

Vandalia Series

The Vandalia series consists of deep, well drained soils on uplands. These soils formed in colluvium from shale, siltstone, and sandstone on foot slopes. Permeability is moderately slow or slow in the subsoil. Slope ranges from 15 to 25 percent.

Vandalia soils are commonly adjacent to Gilpin, Kanawha, and Upshur soils and are similar to Upshur soils. Gilpin soils are moderately deep. They are on ridgetops and side slopes. Kanawha soils have less clay in the subsoil than Vandalia soils. They are on terraces and alluvial fans. Upshur soils have fewer coarse fragments in the subsoil than Vandalia soils. They are on ridgetops and side slopes.

Typical pedon of Vandalia silty clay loam, 15 to 25 percent slopes, severely eroded, about 0.5 mile north northeast of Scottown, in Windsor Township, 400 feet south and 1,100 feet west of the northeast corner of sec. 14, T. 2 N., R. 16 W.

Ap—0 to 3 inches; reddish brown (5YR 4/3) silty clay loam, light reddish brown (5YR 6/3) dry; moderate medium and coarse granular structure; friable; many fine roots; 10 percent coarse fragments; slightly acid; abrupt smooth boundary.

Bt1—3 to 10 inches; yellowish red (5YR 4/6) silty clay; moderate medium subangular blocky structure; firm; common fine roots; common faint yellowish red (5YR 4/6) clay films on faces of peds; 5 percent coarse fragments; medium acid; clear smooth boundary.

Bt2—10 to 19 inches; reddish brown (2.5YR 4/4) silty clay; moderate medium angular and subangular blocky structure; firm; few fine roots; common faint dark reddish brown (2.5YR 3/4) clay films on faces of peds; 5 percent coarse fragments; medium acid; clear smooth boundary.

Bt3—19 to 42 inches; reddish brown (2.5YR 4/4) channery silty clay; moderate medium subangular blocky structure; firm; few fine roots; common faint reddish brown (2.5YR 4/4) clay films on faces of peds; 30 percent coarse fragments; strongly acid; clear smooth boundary.

C1—42 to 54 inches; yellowish red (5YR 5/6) very channery silty clay loam; massive; firm; 50 percent coarse fragments; strongly acid; clear smooth boundary.

C2—54 to 60 inches; brown (7.5YR 5/4) and light olive brown (2.5Y 5/4) very channery silty clay loam; massive; firm; 35 percent coarse fragments; strongly acid.

The solum ranges from 40 to 80 inches in thickness. Depth to bedrock is generally more than 6 feet. Coarse fragments range from 5 to 15 percent in the A horizon, 5 to 40 percent in individual subhorizons of the B horizon, and 5 to 50 percent in the C horizon.

The Ap horizon has hue of 5YR to 10YR and chroma of 2 to 4. It is typically silty clay loam. In some pedons it is silt loam. In the upper part the Bt horizon has hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 4 to 6. In the lower part it has hue of 10R to 5YR, value of 3 or 4, and chroma of 4 to 6. The Bt horizon is silty clay loam, silty clay, or their channery analog. The C horizon has hue of 7.5YR to 2.5YR and value and chroma of 3 to 6. Some pedons have a 2C horizon that has hue of 10YR to 5Y. The C horizon is silty clay loam and channery or very channery silty clay loam.

Watertown Series

The Watertown series consists of deep, well drained soils on stratified glacial stream terraces. These soils formed in stratified sandy outwash. Permeability is moderately rapid. Slope ranges from 1 to 8 percent.

Watertown soils are commonly adjacent to Elkinsville, Lakin, and Wheeling soils. Elkinsville and Wheeling soils have less sand in the subsoil than Watertown soils and are in similar landscape positions. Lakin soils have fewer coarse fragments in the subsoil than Watertown soils. They are on slope breaks of terraces and on sides of valleys.

Typical pedon of Watertown sandy loam, 1 to 8 percent slopes, about 0.75 mile north of Proctorville, in Rome Township, 600 feet south and 450 feet east of the northwest corner of sec. 33, T. 1 N., R. 15 W.

Ap—0 to 10 inches; brown (10YR 4/3) sandy loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; friable; many fine roots; 5 percent fine gravel; strongly acid; abrupt smooth boundary.

Bt1—10 to 24 inches; yellowish brown (10YR 5/6) coarse sandy loam; weak medium subangular blocky structure; friable; few fine roots; few distinct brown (7.5YR 4/4) clay films bridging sand grains; 5 percent fine gravel; medium acid; clear wavy boundary.

Bt2—24 to 28 inches; brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; few distinct strong brown (7.5YR 4/6) clay films bridging sand grains; 10 percent fine gravel; medium acid; clear smooth boundary.

2C—28 to 80 inches; strong brown (7.5YR 5/6) stratified coarse sand and gravelly coarse sand; single grained; loose; 15 percent fine gravel; medium acid.

The solum ranges from 25 to 60 inches in thickness. Coarse fragments range to 15 percent in the A horizon, to 30 percent in individual subhorizons of the Bt and Bw horizons, and to 60 percent in the C horizon.

The A horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 to 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is sandy loam or coarse sandy loam in the upper part and sandy loam, coarse sandy loam, loamy sand, or their gravelly analog in the lower part. The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is sand, loamy sand, coarse sand, or their gravelly and very gravelly analogs.

Weinbach Series

The Weinbach series consists of deep, somewhat poorly drained soils on stream terraces. These soils formed in old alluvium. They have a fragipan. Permeability is moderate above the fragipan and very slow in the fragipan. Slope is 0 to 2 percent.

Weinbach soils are commonly adjacent to Elkinsville, Peoga, Sciotoville, and Wheeling soils. Elkinsville and Wheeling soils are well drained. They are in terrace positions higher than those of the Weinbach soils. Peoga soils are poorly drained. They are on flats and in depressions. Sciotoville soils are moderately well drained. They are on flats and in depressions. Sciotoville soils are moderately well drained. They are on terraces higher than those of Weinbach soils.

Typical pedon of Weinbach silt loam, 0 to 2 percent slopes, about 1.7 miles west of Glendale in Hamilton Township, 1,600 feet south and 1,040 feet west of the northeastern corner of sec. 7, T. 1 N., R. 19 W.

Ap—0 to 10 inches; brown (10YR 5/3) silt loam, light gray (10YR 7/2) dry; weak fine and medium granular structure; friable; common fine roots; many fine black (10YR 2/1) concretions (iron and manganese oxides); medium acid; abrupt smooth boundary.

BEg—10 to 22 inches; light brownish gray (2.5Y 6/2) silt loam; few fine faint light gray (10YR 7/2) and few fine prominent yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; friable; few fine roots; few distinct brown (10YR 5/3) and pale brown (10YR 6/3) silt coatings on faces of peds; many fine and medium black (10YR 2/1) concretions (iron and manganese oxides); strongly acid; clear wavy boundary.

Bt—22 to 28 inches; pale brown (10YR 6/3) silt loam; few fine faint light gray (10YR 7/2) and yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; common distinct pale brown (10YR 6/3) and few distinct light gray (10YR 7/2) clay films on faces of peds; many distinct brownish gray (10YR 5/2) coatings on faces of peds; many coarse black (10YR 2/1) concretions (iron and manganese oxides); very strongly acid; clear wavy boundary.

Btxg1—28 to 42 inches; light brownish gray (10YR 6/2) silt loam; common medium prominent yellowish brown (10YR 5/6) mottles; weak very coarse prismatic structure parting to moderate medium platy; very firm and brittle; common distinct pale brown (10YR 6/3) clay films on faces of peds; few distinct light gray (10YR 7/2) silt coatings on faces of peds; few mica flakes; many coarse black (10YR 2/1) and dark brown (7.5YR 3/2) concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

Btxg2—42 to 50 inches; light brownish gray (10YR 6/2) silt loam; common fine prominent yellowish brown (10YR 5/6) mottles; weak very coarse prismatic structure parting to moderate medium platy; very firm and brittle; common distinct pale brown (10YR 6/3) clay films on faces of peds; few distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; few mica flakes; many medium black (10YR 2/1) and dark brown (7.5YR 3/2) concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

Btx3—50 to 62 inches; yellowish brown (10YR 5/6) silt loam; few fine prominent light gray (10YR 7/2) mottles; weak very coarse prismatic structure parting to weak medium platy; very firm and brittle; few distinct yellowish brown (10YR 5/4) and pale brown (10YR 6/3) clay films on faces of peds; few distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; few mica flakes; common fine distinct black (10YR 2/1) and dark brown (7.5YR 3/2) concretions (iron and manganese oxides) very strongly acid; clear smooth boundary.

B´t—62 to 70 inches; yellowish brown (10YR 5/6) silt loam; few fine prominent light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; few distinct pale brown (10YR 6/3) clay films on faces of peds; few distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; common fine distinct black (10YR 2/1) and dark brown (7.5YR 3/2) concretions (iron and manganese oxides); strongly acid.

The solum ranges from 40 to 72 inches in thickness. Depth to the fragipan ranges from 20 to 36 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. The Bt horizon has value of 5 or 6 and chroma of 3 or 4. The Btx and Btxg horizons have hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 6. It is silt loam or silty clay loam.

Wheeling Series

The Wheeling series consists of deep, well drained soils on stream terraces. These soils formed in silty or loamy material and in the underlying glacial outwash. Permeability is moderate in the subsoil and rapid in the substratum. Slope ranges from 1 to 15 percent.

Wheeling soils are commonly adjacent to Elkinsville, Peoga, Sciotoville, Watertown, and Weinbach soils. Elkinsville and Sciotoville soils have less sand in the subsoil than Wheeling soils. Elkinsville soils are in landscape positions similar to those of Wheeling soils. Sciotoville soils are in slightly lower positions than those of Wheeling soils. Peoga soils are poorly drained. Weinbach soils are somewhat poorly drained. They are along drainageways and on flats on stream terraces. Watertown soils have less clay in the subsoil. They are on glacial stream terraces.

Typical pedon of Wheeling silt loam, 6 to 15 percent slopes, eroded, about 0.25 mile east-southeast of Glendale, in Hamilton Township, 1,600 feet north and 2,200 feet west of the southeast corner of sec. 9, T.1 N., R.19 W.

Ap—0 to 6 inches; dark yellowish brown (10YR 4/4) silt loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; friable; common fine roots; specks of yellowish brown (10YR 5/6) subsoil material; 3 percent coarse fragments; strongly acid; abrupt smooth boundary.

Bt1—6 to 10 inches; yellowish brown (10YR 5/6) silt loam; moderate subangular blocky structure; friable; common fine roots; common distinct light yellowish brown (10YR 6/4) silt coatings on the faces of peds; 5 percent coarse fragments; medium acid; clear smooth boundary.

Bt2—10 to 19 inches; brown (7.5YR 4/4) silt loam; moderate fine and medium angular blocky structure; firm; few fine roots; common distinct brown (7.5YR 5/4) clay films on faces of peds; 5 percent coarse fragments; strongly acid; clear smooth boundary.

Bt3—19 to 33 inches; brown (7.5YR 4/4) loam;

moderate medium angular blocky structure; firm; few fine roots; common faint brown (7.5YR 5/4) clay films on faces of peds; strongly acid; abrupt smooth boundary.

Bt4—33 to 40 inches; brown (7.5YR 4/4) loam; weak medium subangular blocky structure; friable; 3 percent coarse fragments; thin strata of fine sandy loam; strongly acid; clear smooth boundary.

2BC—40 to 47 inches; yellowish brown (10YR 5/4) sandy loam; weak coarse and medium subangular blocky structure; very friable; thin strata of loamy sand; strongly acid; abrupt smooth boundary.

2C1—47 to 67 inches; strong brown (7.5YR 5/6) stratified gravelly sandy loam and very gravelly loamy sand; single grained; loose; 20 to 50 percent coarse fragments; strongly acid; clear smooth boundary.

2C2—67 to 80 inches; strong brown (7.5YR 5/6) gravelly loamy sand and gravelly sand; single grained; loose; 20 percent coarse fragments; strongly acid.

The solum ranges from 40 to 60 inches in thickness. Coarse fragments range to 15 percent in the solum and from 15 to 60 percent in the C horizon.

The Ap horizon is typically silt loam. In some pedons it is loam. The Bt horizon has chroma of 4 to 6. The C horizon has hue of 10YR or 7.5YR, value 4 or 5, and chroma of 4 to 6.

Woodsfield Series

The Woodsfield series consists of deep, well drained soils on uplands. These soils formed in a silty mantle and in the underlying reddish clayey residuum derived from interbedded shale and siltstone. Permeability is moderate in the silty material and slow in the underlying material. Slope ranges from 3 to 8 percent.

Woodsfield soils are commonly adjacent to Gilpin and Upshur soils and are similar to Coolville soils. Gilpin soils are moderately deep. They are on ridgetops and side slopes. Upshur soils do not have as much silt in the upper part of the subsoil as Woodfield soils. They are on ridgetops and side slopes. Coolville soils are moderately well drained.

Typical pedon of Woodsfield silt loam, 3 to 8 percent slopes, about 1.9 miles north-northeast of Cannons Creek, in Decatur Township, 800 feet north and 1,600 feet east of the southwest corner of sec. 36, T.3 N., R.18 W.

Ap—0 to 10 inches; yellowish brown (10YR 5/4) silt loam, very pale brown (10YR 7/4) dry; fine and medium granular structure; friable; common fine roots; strongly acid; abrupt smooth boundary.

Bt1—10 to 20 inches; strong brown (7.5YR 5/6) silty clay loam; weak fine and medium subangular blocky structure; friable; few fine roots; common faint strong brown (7.5YR 5/6) clay films on faces of peds; common distinct yellowish brown (10YR 5/6) silt coatings on faces of peds; medium acid; abrupt smooth boundary.

2Bt2—20 to 40 inches; red (2.5YR 4/6) clay; moderate medium subangular blocky structure; firm; few fine roots; common distinct dusky red (10R 3/4) clay films on faces of peds; few distinct brownish yellow (10YR 6/6) silt coatings on faces of peds; medium acid; clear smooth boundary.

2Bt3—40 to 54 inches; dusky red (10R 3/4) silty clay loam; moderate medium angular and subangular blocky structure; firm; few fine roots; common faint dusky red (10R 3/4) clay films on faces of peds; common distinct olive yellow (5Y 6/6) silt coatings on faces of peds; 5 percent coarse fragments; medium acid in the upper part to neutral in the lower part; abrupt smooth boundary.

2C—54 to 62 inches; dusky red (10R 3/4) silty clay loam; massive; firm; 10 percent coarse fragments; mildly alkaline; slight effervescence; abrupt smooth boundary.

2Cr—62 to 67 inches; dusky red (10R 3/4) weathered interbedded shale and siltstone.

The thickness of the solum and depth to free carbonates range from 40 to 60 inches. The silt mantle ranges from 14 to 26 inches thick. Depth to soft bedrock is 40 to 72 inches. Coarse fragments range to 15 percent in the 2B and 2C horizons.

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 and chroma of 4 to 6. It is silt loam or silty clay loam. The 2Bt horizon has hue of 10R to 5YR, value of 3 to 5, and chroma of 4 to 6. Texture is silty clay loam, silty clay, and clay.

Formation of the Soils

This section describes the major factors of soil formation, tells how these factors have affected the soils of Lawrence County, and explains some of the processes of soil formation.

Factors of Soil Formation

Soils are the product of soil-forming processes acting on material deposited or accumulated by geologic forces (*18*). The major factors in soil formation are parent material, climate, relief, living organisms, and time.

Climate and living organisms, particularly vegetation, are the active forces in soil formation. Their effect on the parent material is modified by relief and by the length of time the parent material has been acted upon. The relative importance of each factor differs from place to place. In some places, one factor dominates and determines most of the soil properties, but normally the interaction of all five factors determines what kind of soil forms in any given place.

Parent Material

The soils of Lawrence County formed in several kinds of parent material: residuum, colluvium, loess, or a combination of these materials, eolian sand, lacustrine sediments, and alluvium.

Residuum from shale, sandstone, siltstone, and limestone is the most extensive parent material in the county. Shale residuum is fine textured. Latham, Rarden, Upshur, and other soils that formed in shale residuum have a fine textured subsoil. Residuum weathered from siltstone and fine grained sandstone is medium textured. Gilpin and Clymer soils formed in this material and have a medium textured or moderately coarse textured subsoil. Steinsburg soils formed in residuum derived from medium or coarse grained sandstone and have a medium or coarse textured subsoil.

In some areas, the upper part of the subsoil formed in loess. This silty, windblown material is as much as 60 inches deep over residuum. Coolville, Tilsit, and Woodsfield soils are examples of soils that are partly loess covered.

Colluvium consists of weathered residuum and soil material that has been moved downslope by gravity. The soils on the middle and lower parts of long hillsides show the effects of colluvial action. Downslope movement results from gravity, water action, animal activity, and frost action over long periods. Shelocta and Vandalia soils formed in colluvium. They are deep to bedrock and have rock fragments tilted at various angles.

Coal surface mine spoils consist of mixed, partly weathered fine earth and fragments of shale, siltstone, sandstone, and limestone that was piled up or graded in surface mining for coal. Bethesda, Fairpoint, Pinegrove, and Morristown soils formed in spoil from surface mining for coal. The spoil is dominantly fragments of rock and some sand, silt, and clay. A few areas of Pinegrove soils have been reclaimed with 1/2 to 1 foot of stockpiled soil material.

Areas of lacustrine sediments or old alluvium are on terraces along Symmes Creek and Indian Guyan Creek. Most of these soils are medium to fine textured in the subsoil. Licking, McGary, and Sciotoville soils are on terraces.

Alluvium, or floodwater deposits, is the youngest parent material in the county. Alluvium is still accumulating as fresh sediment to which more sediment is added by overflowing streams. The additions of sediment originate in the surface layer of higher lying soils. Chagrin, Cuba, Stendal, Nolin, and Tioga soils formed in alluvium.

A few areas of old alluvium covered by loess remain in deeply dissected pre-glacial valley fills. Omulga soils are medium textured in the subsoil and are at higher elevations.

Lakin soils formed in eolian or wind blown sand on the leeward side of major stream terraces.

Climate

The climate of Lawrence County was so uniform that it did not contribute greatly to differences among the soils. It has favored both physical change and chemical weathering.

Climate affects the physical, chemical, and biological relationships in the soils. It influences the kind and number of plants and animals on and in the soils, the weathering of rocks and minerals, the susceptibility of the soils to erosion, and the rate of soil formation.

The climate of Lawrence County is humid and temperate. The average annual precipitation is about 40 inches and the mean annual air temperature is about 57 degrees F. The soils are almost never dry and are subject to leaching throughout most of the year. Most of the soluble bases have been leached out of the solum, and clay minerals have been moved from the surface layer to the subsoil. As a result, most of the soils have a leached, acid surface layer that is coarser textured than the subsoil.

Plant and Animal Life

Plants and animals, but mainly plants, are active soil-forming factors. They modify the color and organic matter content of the soil. Plants transfer nutrients from the lower part of the solum to the upper soil layers. They produce channels through which air and water can move and can modify soil structure. Micro-organisms and animals mix and decompose organic matter, making nutrients available to plants, and generally improve the soil condition.

The native vegetation in the county was dominantly deciduous trees, mainly oaks, yellow-poplar, and hickories. Virginia pine, shortleaf pine, and pitch pine were common in areas of droughty soils on narrow ridgetops. Because of flooding, grasses replaced hardwoods as the dominant vegetation in some areas on bottomland along the major streams. Grass roots penetrate to a greater depth than tree roots. In some alluvial soils they increase the organic matter content and thickness of the dark surface soil.

Relief

Relief influences soils chiefly through its effects on drainage and erosion. It directly affects the microclimate. Slopes that face south or southwest are drier and less productive than those that face north or northeast. Aspect affects the degree of exposure to the prevailing wind and to direct sunlight and thus also affects evapotranspiration, the breakdown of organic matter, and the kind and growth rate of vegetation.

Some of the steeper soils in the county have been eroded and thus are moderately deep. Steinsburg soils are an example. Steep soils that formed partly in colluvium, such as Shelocta and Vandalia soils, have received material from uphill and thus are deep.

Relief generally determines the depth to the water table. The water table has important effects on the development of a soil profile. Soils that formed in similar kinds of parent material but in different topographic positions can have differences in internal drainage. From an equal amount of rainfall, sloping soils receive less water than and depressional soils receive more water than nearly level soils. The Licking and McGary soils, for example, both formed in lacustrine material. The moderately well drained Licking soils are in higher positions on terraces. The somewhat poorly drained McGary soils are on flats on terraces.

Time

Time is required for changes to take place in the parent material and for uniquely different kinds of soil to form. To some extent, the degree of soil development indicates the age of a soil. If the parent material weathers slowly, the profile forms more slowly. Shale weathers more rapidly than sandstone and siltstone. Soils that formed in shale residuum have a more strongly developed profile than soils that formed in siltstone or sandstone residuum.

Most of the soils in the county are old and have a strongly expressed profile. The youngest soils formed in strip mine spoil. They are Fairpoint and Morristown soils. On flood plains, deposits of fresh sediments periodically interrupt soil formation. As a result, Nolin and Melvin soils do not have a strongly expressed profile.

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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.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock control. Configuration and relief of a landform that is determined or strongly influenced by the underlying bedrock.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of 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.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Channery soil material. Soil material that is, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax plant community. 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.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Colluvium. Soil material or 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 or miscellaneous areas 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 or miscellaneous areas are somewhat similar in all areas.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

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. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cover type. The forest type now occupying the ground. No implication being conveyed as to whether it is temporary of permanent.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

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 to bedrock; moderately deep soils, 20 to 40 inches to bedrock; and shallow soils are 10 to 20 inches to bedrock.

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 wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained.* These classes are defined in the "Soil Survey Manual."

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, such as a fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

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.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

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 outwash. Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glaciofluvial deposits. Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

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 as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 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. 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. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil 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, a plowed surface horizon, most of which was originally part of a B horizon.

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 A horizon. The B horizon is in part a layer of transition from the overlying A 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) 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 soil material. 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.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it 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 potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

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.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, 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. 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 of 6.6 to 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. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it generally is low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Perimeter drain. Artificial drain placed around the perimeter of a septic tank absorption field to lower the water table, also called curtain drain.

Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

Extremely slow	0.0 to 0.01 inch
Very slow	0.01 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

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 or very 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.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

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:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill generally is 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. 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 (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

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. In this survey, classes for simple slopes are as follows:

Nearly level	0 to 2 percent
Gently sloping	2 to 6 percent
Strongly sloping	6 to 15 percent
Moderately steep	15 to 25 percent
Steep	25 to 40 percent
Very steep	40 percent and higher

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

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 material below the solum. 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 that provide vegetative barriers to wind erosion 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 wind erosion 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. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

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 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, considered collectively. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

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. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

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.

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.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland. 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 or 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 bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

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.