United States Department of Agriculture

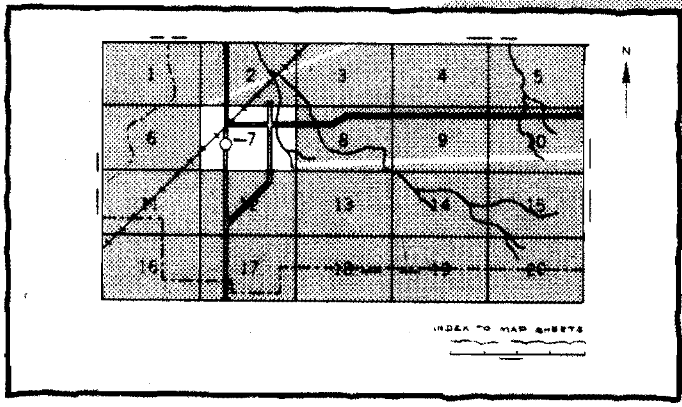
Soil Conservation Service

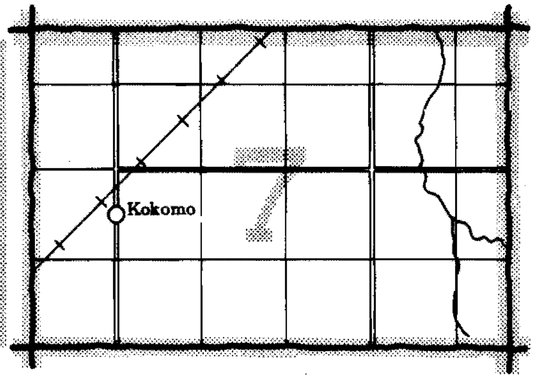
In cooperation with Ohio Department of Natural Resources, Division of Soil and Water Conservation, and Ohio Agricultural Research and Development Center

Soil Survey of Knox County, Ohio

HOW TO USE

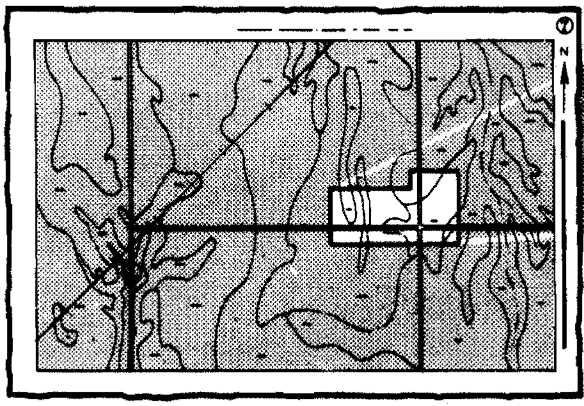
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

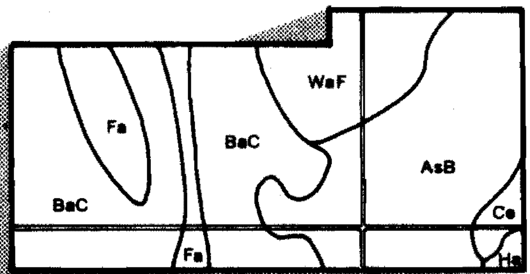




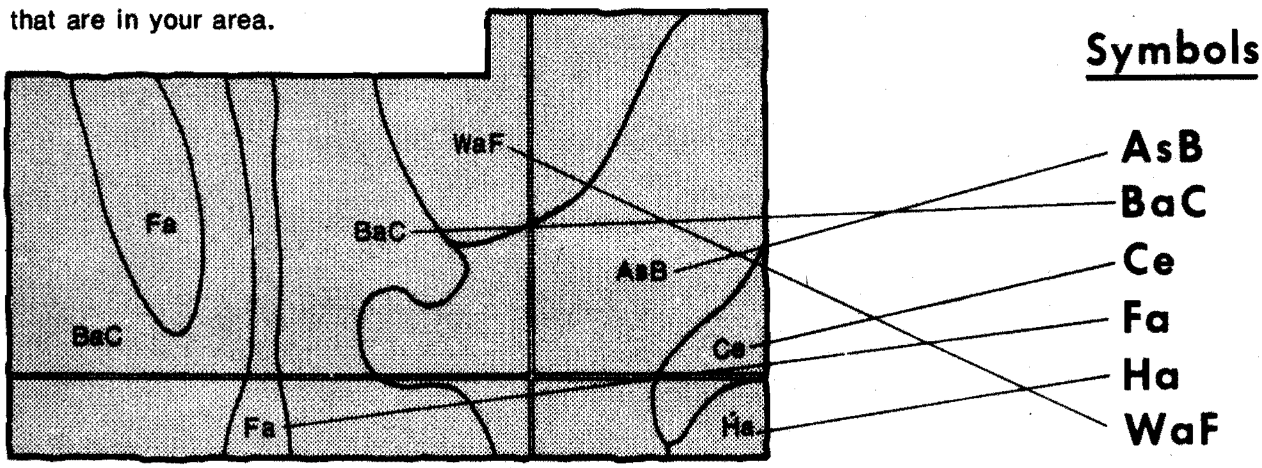
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



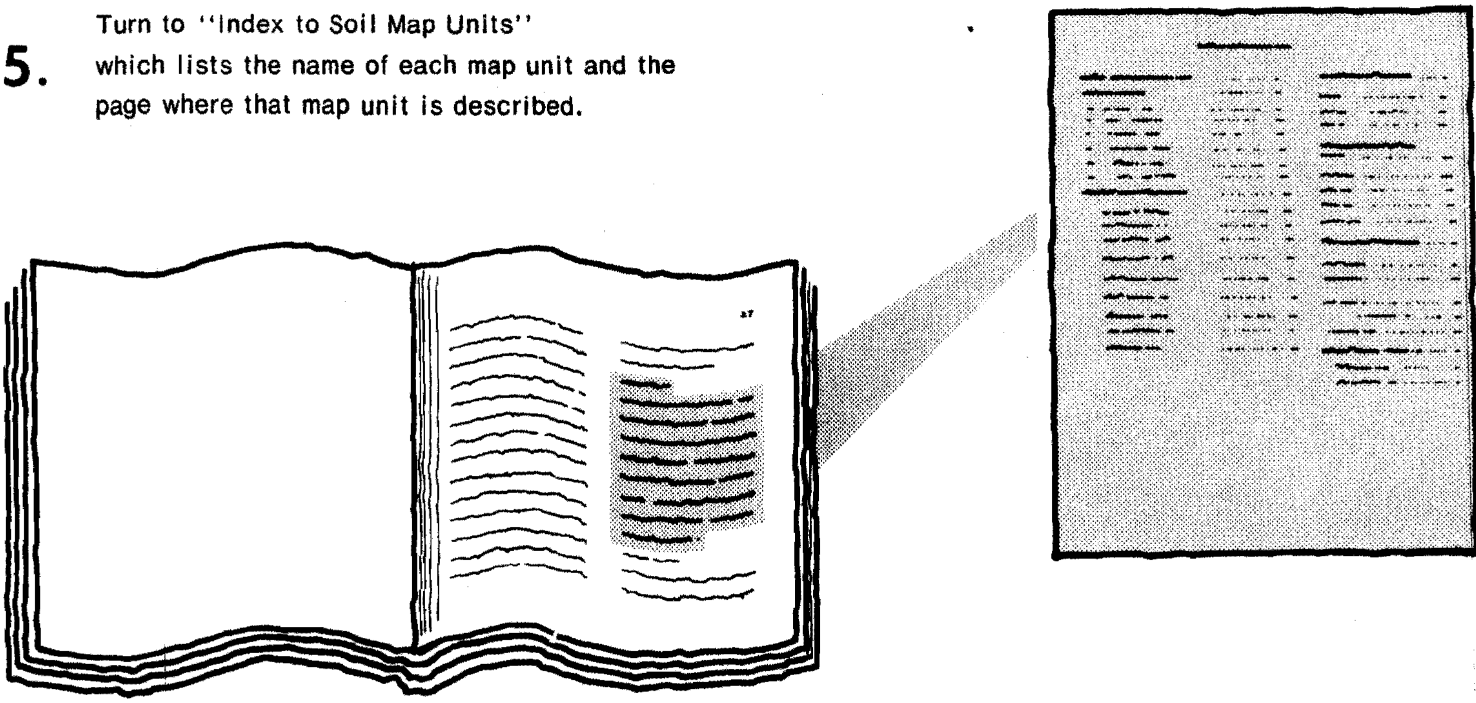


4. List the map unit symbols that are in your area.

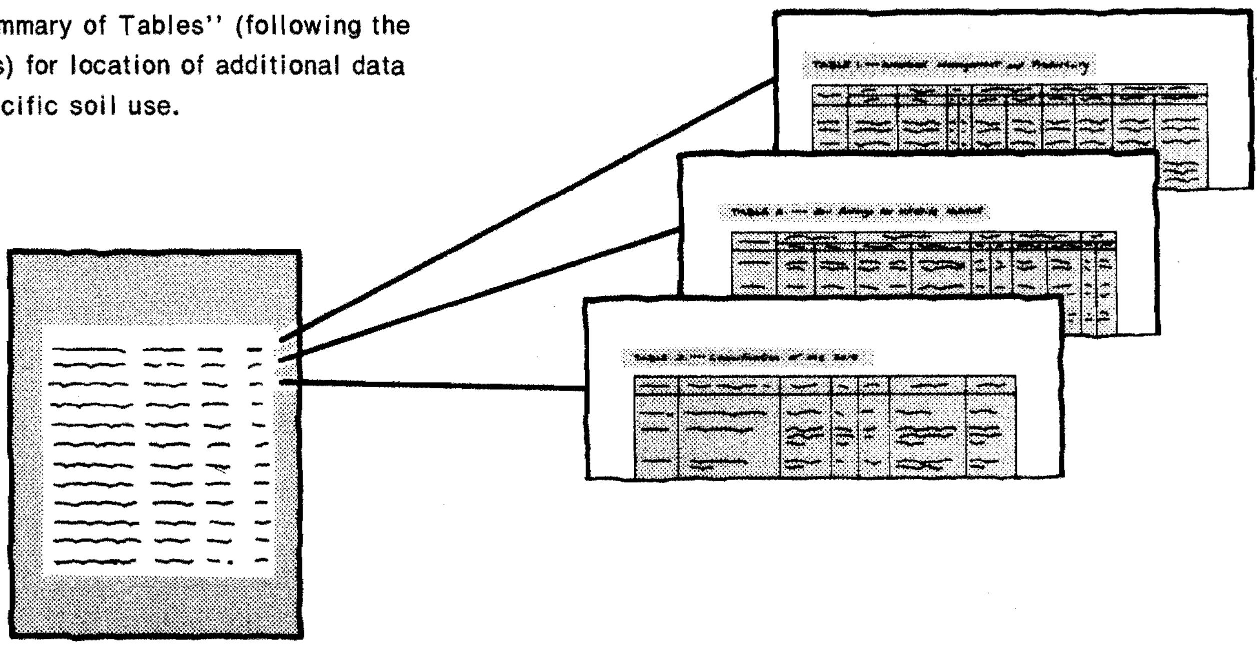


THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was completed in 1982. Soil names and descriptions were approved in 1983. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1983. This survey was made cooperatively by the Soil Conservation Service; the Ohio Department of Natural Resources, Division of Soil and Water Conservation; and the Ohio Agricultural Research and Development Center. It is part of the technical assistance furnished to the Knox Soil and Water Conservation District. Some of the work was subsidized by the Knox County Board of Commissioners.

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

Cover: Contour stripcropping on Brownsville channery silt loam, 12 to 18 percent slopes. This conservation practice is widely used on soils that have uniform slopes.

Contents

Soil Series

Issued November 1986

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Summary of Tables

Foreword

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

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

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

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

Harry W. Oneth
State Conservationist
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Soil Survey of Knox County, Ohio

By C. E. Redmond and T. E. Graham, Soil Conservation Service

Fieldwork by C. E. Redmond, D. L. Brown, and T. E. Graham, Soil Conservation Service

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

General Nature of the County

Knox County is northeast of the center of Ohio (fig. 1). The total area is 339,904 acres, or 531 square miles. Centerburg, the geographic center of the state, is in the southwest corner of the county. Mt. Vernon, the county seat and only city, is located in the west-central part of the county, about 45 miles northeast of Columbus. In 1980, it had a population of 14,612.

Knox County is an agricultural area. About 73 percent of the county is farmland, and only about 6 percent is urban and built-up land (*8, 13*). Mt. Vernon is an agricultural trade center. Other trade centers are Fredericktown, in the northwest; Danville, in the northeast; Centerburg, in the southwest; and Martinsburg, in the southeast.

Climate

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

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

Table 1 gives data on temperature and precipitation for the survey area as recorded at Fredericktown, Ohio, in the period 1951 to 1980. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

Figure 1.—Location of Knox County in Ohio.

In winter the average temperature is 26 degrees F, and the average daily minimum temperature is 17 degrees. The lowest temperature on record, which occurred at Fredericktown on February 8, 1977, is -25 degrees. In summer the average temperature is 70 degrees, and the average daily maximum temperature is 82 degrees. The highest recorded temperature, which occurred on June 26, 1952, is 99 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 38.50 inches. Of this, about 22 inches, or nearly 60 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 20 inches. The heaviest 1-day rainfall during the period of record was 4.82 inches at Fredericktown on September 14, 1979. Thunderstorms occur on about 40 days each year. Tornadoes and severe thunderstorms occur occasionally. They are local in extent and of short duration and cause damage in scattered areas.

The average seasonal snowfall is about 30 inches. The greatest snow depth at any one time during the period of record was 19 inches. On the average, 24 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 55 percent of the time possible in summer and 35 percent in winter. The prevailing wind is from the south-southwest. Average windspeed is highest, 13 miles per hour, in winter.

Physiography, Geology, and Drainage

Knox County is on the outer edge of an area that was covered by continental glaciers. Differences in the texture, thickness, and composition of glacial deposits and the method of deposition are responsible for many of the differences among the soils in the county. The latest of the glaciations, the Wisconsin, covered the western part of the county about 15,000 to 16,000 years ago. This glacier left thick deposits. Most of the relief in this part of the county is caused by the uneven surface of the glacial deposition and erosion of the glacial mantle.

Most of the eastern part of the county was covered by the earlier Illinoian glacier more than 100,000 years ago (*14*). This glaciation was not strong enough to level the existing bedrock hills. Rather, the ice flowed around and between the hills and left thick glacial deposits in some areas and almost none in others. The northeast and southeast corners of the county were not glaciated.

Most of the exposed bedrock in the county is fine grained sandstone and siltstone of Mississippian age. This rock typically shatters. As a result, the lower part of many soils that formed in residuum is channery. Two coarse grained sandstones are also exposed in the county. The Black Hand Sandstone of early Mississippian age is exposed on the sides of the major stream valleys. The Massillon Sandstone of Pennsylvanian age occurs as very high hogback ridges in the southeastern part of the county.

Several valleys in the county carried large volumes of glacial meltwater. Extensive gravel deposits laid down by this swiftly flowing water form the terraces along the sides of the valleys. Because some valleys were blocked by glaciers, the streams flowing through them changed directions. Lakebed sediments were deposited in the blocked valleys in many parts of the county.

The drainage pattern in the county is mainly postglacial. Most of the county is drained by the Kokosing, North Fork Licking, and Mohican Rivers and Wakatomika Creek and their tributaries. All of these streams are part of the Muskingum River watershed. A small area in western Hilliar Township is drained by Big Walnut Creek, a part of the Scioto River watershed.

The highest point in the county is 1,420 feet above sea level. It is in Liberty Township. The lowest point, where the Kokosing River leaves the county, is 840 feet above sea level. In general, relief is lowest in the southwestern part of the county and highest in the northeastern part. The steepest slopes are in the uplands adjacent to the Mohican River.

Settlement

The first recorded inhabitants of the area that is now Knox County were the mound builders (*10, 11*). Later, the area was inhabited by several other Indian tribes, especially the Delawares, Mingos, and Wyandots (*10*). The valley of the Kokosing River was used extensively as a trade route (*11*).

The first settler was Andrew Craig, whose cabin was near the area where Center Run flows into the Kokosing River. Mt. Vernon was laid out near his cabin in 1805. Craig, not liking the "crowding," moved on. As a result, Nathaniel Young, who settled in Wayne Township shortly after Craig, is sometimes considered the first permanent settler (*10, 11*).

The early settlers came primarily from the Eastern United States, especially from Pennsylvania. Some, however, came directly from England and Ireland. No one national or ethnic group was dominant (*11*).

In 1808, Knox County was formed from Fairfield County. Its present boundaries were established in 1848.

The county was named for Henry Knox, Revolutionary War general, who later became Secretary of War under President George Washington. It originally consisted of Clinton, Wayne, Morgan, and Union Townships. These four were later divided into 22 townships.

In 1840, the population of Knox County was just under 30,000. It then declined to between 27,000 and 29,000. It was more than 30,000 in 1910. Since then, it has continued to grow. It was 41,795 in 1970 (*11*) and 46,304 in 1980.

Natural Resources

Soil is the most valuable natural resource in Knox County. It supports a vigorous agriculture. The crops grown on the soil are marketed as grain or are fed to livestock.

The county has a good supply of ground water. A partly buried valley that extends from Fredericktown to Utica is an especially good ground water reservoir (*14*).

Oil and gas are also important natural resources in the county. Many oil and gas wells are in areas of moderately steep to very steep soils that are erosive.

Gravel and sand deposits are extensive in the county, especially in the major stream valleys. Large gravel pits are mined at Fredericktown, Mt. Vernon, Gambier, and Brinkhaven. At Millwood, Black Hand Sandstone is crushed into sand, which is used for industrial purposes. Small amounts of building stone have been quarried from Massillon Sandstone, but most of the quarries are now inactive.

Farming

Farming is an important source of income in Knox County (*6*). In addition to the direct farm income, many businesses in the county are heavily dependent on agriculture.

In 1981, the county had 1,430 farms, which averaged 173 acres in size (*8*). Farmland made up about 248,000 acres. The average amount paid for an acre of farmland increased substantially from 1972 to 1977 (*9*). The loss of farmland to other uses is not dramatic in Knox County. Most of the converted farmland is used as woodland or recreation areas. Farmland is converted to urban land primarily as individual homes are built along existing township roads, especially in the western part of the county.

The major types of farming in the county are cash grain, livestock, and dairy. Part-time farmers are involved in all three types. Cash-grain farming is concentrated in the western part of the county, on the more nearly level and generally more productive land. Most cash-grain farms include rented land in addition to the land owned by the farmer. General livestock farms are in all parts of the county. Typically, some of the grain produced on these farms is sold. Some is fed to the livestock. Dairy farms are also throughout the county but are more numerous on the gently sloping to moderately steep soils in the northern part. Forage crops grown on these farms have helped to control erosion, and barnyard manure has helped to maintain the organic matter content of the soils.

Corn is the major grain crop in the county (fig. 2). In 1981, about 61,700 acres, or one-fifth of the farmland, was planted to corn to be sold as grain (*8*). In addition, some of the acreage was planted to corn to be used as silage. In 1981, about 27,200 acres was planted to soybeans, 14,000 acres to wheat, and 4,400 acres to oats. About 24,000 acres was used for hay (*8*).

At the end of 1981, Knox County had about 14,400 head of sheep, the largest number in the state. Hogs and pigs numbered 27,000; milk cows and heifers that have calved numbered 8,800; and other cattle and calves, including young dairy replacement stock, numbered 29,200 (*8*).

Transportation and Industry

Knox County is served by a good system of highways. State Route 3 and U.S. Route 36 connect Mt. Vernon with Columbus and points to the east and northeast. State Route 13 crosses the western part of the county from north to south. U.S. Route 62 crosses the southeastern part of the county. The closest connection with the interstate highway system is by State Route 95, west of Fredericktown. A railroad serves Mt. Vernon and Fredericktown.

Most of the industry in the county is in Mt. Vernon. Energy equipment, windows, glass containers, and packaging materials are among the industrial products. A foundry and a sheet-metal factory are in Fredericktown. Industrial sand is produced at Millwood. Other communities in the county have facilities for handling grain.

How This Survey Was Made

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

Figure 2.—Harvesting corn on Homewood silt loam, 6 to 12 percent slopes. If well managed, this is a productive soil.

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

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

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

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

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

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

Map Unit Composition

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

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

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

Survey Procedures

The general procedures followed in making this survey are described in the National Soils Handbook of the Soil Conservation Service. The soil survey maps made for conservation planning on individual farms prior to the start of the project and a description of the geology of Knox County (*14*) were among the references used.

Before the actual fieldwork began, preliminary boundaries of slopes and landforms were plotted stereoscopically on aerial photographs, which were taken in 1975 at a scale of 1:38,000 and enlarged to a scale of 1:15,840. U.S. Geologic Survey topographic maps, at a scale of 1:24,000, helped the soil scientists to relate land and image features.

A reconnaissance was made by pickup truck before the soil scientists traversed the surface on foot, examining the soils. In areas of the Bennington-Centerburg-Pewamo association and other areas where the soil pattern is very complex, traverses were spaced as close as 200 yards. In areas of the Brownsville-Westmoreland-Gilpin association and other areas where the soil pattern is relatively simple, traverses were spaced about 0.25 mile apart.

As they traversed the surface, the soil scientists divided the landscape into segments based on the use and management of the soils. For example, a hillside would be separated from a swale or a gently sloping ridgetop from a very steep side slope. In most areas soil examinations along the traverses were made at points 100 to 800 yards apart, depending on the landscape and soil pattern (*12*).

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

At the beginning of the survey, sample areas were selected to represent the major landscapes in the county. These areas were then mapped. Extensive notes were taken on the composition of the map units in these preliminary study areas. These notes were modified as mapping progressed and a final assessment of the composition of the individual map units was made. Some transects were made to determine the composition of soil complexes, especially the Rigley-Coshocton and Brownsville-Westmoreland complexes in the unglaciated part of the county.

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

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

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

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

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

Soil Descriptions

Deep, Well Drained to Very Poorly Drained Soils Formed in Glacial Till

These soils make up about 24 percent of the county. They are nearly level to very steep soils that formed in medium textured and moderately fine textured Wisconsin glacial till. They are on till plains and moraines. The nearly level to sloping soils are used mainly as cropland. The steep and very steep soils are used mostly for pasture, hay, or woodland. The erosion hazard, seasonal wetness, ponding, slope, and moderately slow or slow permeability are the major management concerns.

1. Centerburg-Bennington-Amanda Association

Deep, nearly level to very steep, moderately well drained, somewhat poorly drained, and well drained soils on till plains and moraines

This association is on till plains and moraines that have moderate relief. The landscape consists of elongated, nearly level to sloping plains separated by narrow valleys that have moderately steep to very steep sides.

This association makes up about 14 percent of the county. It is about 50 percent Centerburg soils, 20 percent Bennington soils, 10 percent Amanda soils, and 20 percent soils of minor extent.

Centerburg soils are moderately well drained. They are gently sloping on convex hilltops and are sloping on side slopes in small valleys. Permeability is moderately slow. A seasonal high water table is at a depth of 18 to 36 inches. Typically, the surface layer is dark brown silt loam. The subsoil is yellowish brown silty clay loam and clay loam. It is mottled in the lower part. Many areas of these soils are eroded.

Bennington soils are somewhat poorly drained. They are nearly level and gently sloping and are on concave hilltops and in low spots at the head of drainageways. Permeability is slow. A seasonal high water table is at a depth of 12 to 30 inches. Typically, the surface layer is dark grayish brown silt loam. The subsoil is yellowish brown, mottled silty clay loam.

Amanda soils are well drained. They are moderately steep to very steep and are on side slopes in stream valleys and on the dissected parts of ground and end moraines. Permeability is moderately slow. A seasonal high water table is below a depth of 48 inches. Typically, the surface layer is dark brown silt loam. The subsoil is yellowish brown silty clay loam and clay loam. It is mottled in the lower part. These soils are significantly eroded.

Some of the minor soils in this association are Pewamo, Bogart, and Shoals soils. The very poorly drained Pewamo soils are on flats and in closed depressions. Bogart soils have more gravel and sand in the lower part than the major soils. They are on long, narrow terraces. Shoals soils formed in alluvium on narrow flood plains.

Most areas of this association are used as cropland. The steeper areas of the Amanda soils are used as pasture or woodland. Many nonfarm rural residences are along the major highways. Most farms are small, and many are part-time enterprises. Corn, soybeans, and small grain are the principal crops. The less sloping soils are well suited to hay, pasture, row crops, and woodland. They are moderately well suited or poorly suited to most urban uses. The steeper soils are poorly suited or generally unsuited to crops and urban uses.

The slope, the erosion hazard, and drainage are the main management concerns if these soils are used for cultivated crops. Most erosion-control practices are suitable. The seasonal wetness of the Bennington soils is a limitation. Subsurface drains are effective in removing excess water from these soils. The seasonal wetness and the slope are limitations on homesites. The moderately slow or slow permeability, the seasonal wetness, and the slope are limitations affecting septic tank absorption fields.

2. Bennington-Centerburg-Pewamo Association

Deep, nearly level to sloping, somewhat poorly drained, moderately well drained, and very poorly drained soils on till plains and moraines

This association is on till plains that have low relief. The landscape consists of low knolls and ridges separated by depressions and flats.

This association makes up about 10 percent of the county. It is about 40 percent Bennington soils, 20 percent Centerburg soils, 15 percent Pewamo soils, and 25 percent soils of minor extent.

Bennington soils are somewhat poorly drained. They are nearly level on flats and in depressions and are gently sloping on low knolls and ridges. Permeability is slow. A seasonal high water table is at a depth of 12 to 30 inches. Typically, the surface layer is dark grayish brown silt loam. The subsoil is yellowish brown, mottled silty clay loam.

Centerburg soils are moderately well drained. They are gently sloping on knolls and are sloping on side slopes in small valleys. Permeability is moderately slow. A seasonal high water table is at a depth of 18 to 36 inches. Typically, the surface layer is dark brown silt loam. The subsoil is yellowish brown silty clay loam and clay loam. It is mottled in the lower part. Many areas of these soils are eroded.

Pewamo soils are very poorly drained, are nearly level, and are on flats and in depressions. Permeability is moderately slow. A seasonal high water table is near or above the surface. Typically, the surface layer is very dark grayish brown, firm silty clay loam. The subsoil is dark gray and gray silty clay loam and silty clay.

Two of the minor soils in this association are Shoals soils on narrow flood plains and the well drained Amanda soils on side slopes along drainageways. Shoals soils formed in alluvium.

Most areas of this association are used as cropland. Corn and soybeans are the principal crops (fig. 3). A small acreage is used for wheat or oats. These soils are well suited or moderately well suited to row crops and woodland. They are well suited to hay and pasture and moderately well suited to generally unsuited to most urban uses.

The seasonal wetness and the erosion hazard are the major limitations affecting cropland. A drainage system is needed in areas of the Bennington and Pewamo soils. Both open ditches and subsurface drains are effective in removing excess water if adequate outlets are available. The seasonal wetness, ponding, and the slow or moderately slow permeability are limitations affecting homesites and septic tank absorption fields. Establishing

Figure 3.—Corn in an area of the Bennington-Centerburg-Pewamo association.

an effective drainage system is more difficult on sites for homes and septic tank absorption fields than on cropland. The soils are better suited to homes without basements than to homes with basements. The knolls and side slopes along small valleys are the best sites for the urban uses.

Deep and Moderately Deep, Well Drained to Somewhat Poorly Drained Soils Formed in Glacial Till and the Underlying Residuum

These soils make up about 33 percent of the county. They are nearly level to very steep soils that formed in moderately coarse textured to moderately fine textured Wisconsin and Illinoian glacial till and in material weathered from sandstone and siltstone bedrock. They are on till plains and moraines. The nearly level to sloping soils are used mainly as cropland. The steep and very steep soils are used mostly for pasture, hay, or woodland. The erosion hazard, slope, moderately slow to very slow permeability, seasonal wetness, and moderate depth to bedrock are the major management concerns.

3. Rittman-Wooster-Wadsworth Association

Deep, nearly level to moderately steep, moderately well drained, well drained, and somewhat poorly drained soils on till plains and moraines

This association is on till plains and moraines. The landscape consists of undulating and rolling ridgetops separated by valleys that have moderately steep side slopes.

This association makes up about 3 percent of the county. It is about 55 percent Rittman soils, 15 percent Wooster soils, 10 percent Wadsworth soils, and 20 percent soils of minor extent.

Rittman soils are moderately well drained. They are gently sloping on broad ridgetops and are sloping on side slopes in stream valleys. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. A seasonal high water table is at a depth of 18 to 36 inches. These soils formed in glacial till. Typically, the surface layer is dark brown silt loam. The subsoil is yellowish brown silty clay loam, clay loam, and loam. It is mottled in the lower part.

Wooster soils are well drained. They are moderately steep and are on side slopes in stream valleys. They have a fragipan. Permeability is moderately slow in the fragipan. A seasonal high water table is at a depth of 30 to 48 inches. These soils formed in glacial till. Typically, the surface layer is dark brown silt loam. The subsoil is yellowish brown silt loam and loam.

Wadsworth soils are somewhat poorly drained. They are nearly level and gently sloping and are in depressions and other concave areas. They have a fragipan. Permeability is moderate or moderately slow above the fragipan and slow or very slow in the fragipan. A seasonal high water table is at a depth of 12 to 24 inches. These soils formed in glacial till. Typically, the surface layer is dark grayish brown silt loam. The subsoil is yellowish brown, mottled silty clay loam and clay loam.

Some of the minor soils in this association are Shoals, Loudonville, and Bogart soils. Shoals soils formed in alluvium on narrow flood plains. The moderately deep Loudonville soils are on the steeper slope breaks. Bogart soils have more sand and gravel in the lower part than the major soils. They are on terraces.

Most areas of this association are used for general livestock or dairy farming. Corn, wheat, and hay are the principal crops. These soils are well suited or moderately well suited to woodland, hay, and pasture. The less sloping soils are well suited or moderately well suited to row crops, but the steeper soils are poorly suited. Because they are less sloping, the Rittman soils are better suited to buildings and septic tank absorption fields than the Wadsworth and Wooster soils.

The major management concerns are the moderately slow or slow permeability of all the major soils; the slope and the erosion hazard in all areas of Wooster soils and in the steeper areas of Rittman soils; and the seasonal wetness of the Wadsworth and Rittman soils. Erosion reduces the depth to the fragipan and results in poorer tilth. Wadsworth soils are difficult to drain.

4. Wooster-Loudonville-Canfield Association

Deep and moderately deep, gently sloping to very steep, well drained and moderately well drained soils on till plains and moraines

The moraines in this association consist of ridges made up of a series of conical hills that have short, irregular slopes. The till plains consist of broad hilltops separated by narrow, steep-sided valleys.

This association makes up about 5 percent of the county. It is about 40 percent Wooster soils, 25 percent Loudonville soils, 15 percent Canfield soils, and 20 percent soils of minor extent.

Wooster soils are deep and well drained. They are gently sloping and sloping on hilltops and are moderately steep to very steep on valley sides. They have a fragipan. Permeability is moderately slow in the fragipan. A seasonal high water table is at a depth of 30 to 48 inches. These soils formed in glacial till. Typically, the surface layer is dark brown silt loam. The subsoil is yellowish brown silt loam and loam.

Loudonville soils are moderately deep and well drained. They are gently sloping and sloping on convex hilltops and are moderately steep and steep on valley sides. Permeability is moderate. These soils formed in glacial till and in the underlying material weathered from sandstone and siltstone bedrock. Typically, the surface layer is dark brown silt loam. The subsoil is yellowish brown and strong brown. It is silt loam in the upper part and channery silt loam in the lower part.

Canfield soils are deep and moderately well drained. They are gently sloping and sloping and are on the concave parts of hilltops, on side slopes in small valleys, and on concave foot slopes. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. A seasonal high water table is at a depth of 18 to 36 inches. These soils formed in glacial till. Typically, the surface layer is dark brown silt loam. The subsoil is yellowish brown silt loam and loam. It is mottled in the lower part.

Two of the minor soils in this association are the somewhat poorly drained Wadsworth soils in depressions and drainageways and Chili soils on small terraces. Chili soils have more sand and gravel in the lower part than the major soils.

Most areas of this association are used as cropland, pasture, or urban land, especially residential housing sites. Corn, small grain, and hay are the principal crops. The less sloping soils are well suited to row crops, hay, pasture, and woodland and are moderately well suited or well suited to most urban uses. The steeper soils are generally unsuited or poorly suited to row crops and urban uses.

The slope and the erosion hazard are the main management concerns if these soils are cultivated. Contour stripcropping and a system of conservation tillage that leaves crop residue on the surface help to control erosion. The seasonal wetness of the Canfield soils and the bedrock at a depth of 20 to 40 inches in the Loudonville soils are limitations affecting most land uses.

5. Homewood-Loudonville-Titusville Association

Deep and moderately deep, gently sloping to steep, well drained and moderately well drained soils on till plains and moraines

This association is in areas on till plains and moraines where glacial till is 2 to 10 feet deep over sandstone and siltstone bedrock. The landscape consists of broad, gently sloping and sloping hilltops separated by narrow valleys that have moderately steep and steep sides.

This association makes up about 25 percent of the county. It is about 40 percent Homewood soils, 25 percent Loudonville soils, 15 percent Titusville soils, and 20 percent soils of minor extent.

Homewood soils are deep and are well drained and moderately well drained. They are gently sloping and sloping on hilltops and are moderately steep and steep on valley sides. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. A seasonal high water table is at a depth of 30 to 48 inches. These soils formed in glacial till. Typically, the surface layer is dark brown silt loam. The subsoil is yellowish brown clay loam. It is mottled in the lower part.

Loudonville soils are moderately deep and well drained. They are gently sloping and sloping on the convex parts of hilltops and are moderately steep and steep on valley sides. Permeability is moderate. These soils formed in glacial till and in the underlying material weathered from sandstone and siltstone bedrock. Typically, the surface layer is dark brown silt loam. The subsoil is yellowish brown and strong brown. It is silt loam in the upper part and channery silt loam in the lower part.

Titusville soils are deep and moderately well drained. They are gently sloping on the concave parts of hilltops and are sloping on the seepy parts of foot slopes. They have a fragipan. Permeability is slow in the fragipan. A seasonal high water table is at a depth of 18 to 36 inches. These soils formed in glacial till. Typically, the surface layer is dark brown silt loam. The subsoil is yellowish brown silt loam, loam, and clay loam. It is mottled in the lower part.

Some of the minor soils in this association are Orrville, Lobdell, and Bogart soils. Orrville and Lobdell soils formed in alluvium on narrow flood plains. Orrville soils are somewhat poorly drained. Bogart soils have more sand and gravel in the lower part than the major soils. They are on narrow terraces.

Most of this association is farmed. Land use is about equally divided between cropland and pasture. Only a very small acreage of the farmland is being converted to housing sites. Small woodlots are on the steeper slopes. The less sloping soils are well suited or moderately well suited to hay, pasture, cultivated crops, woodland, and most urban uses. The steeper soils are generally unsuited or poorly suited to most of these uses. All of the soils are well suited to woodland.

The slope and the erosion hazard are the major management concerns if these soils are cultivated. Maintaining the proper level of lime and the organic matter content also is important. Many areas are well suited to contour stripcropping, which helps to control erosion in many areas. A system of conservation tillage that leaves crop residue on the surface also helps to control erosion. The good natural drainage of the Loudonville soils is favorable on homesites, but the seasonal wetness of the Homewood and Titusville soils is a limitation. The slow permeability of the Homewood and Titusville soils is a limitation on sites for septic tank absorption fields. The bedrock at a depth of 20 to 40 inches in the Loudonville soils interferes with excavation for buildings and septic tank absorption fields.

Moderately Deep and Deep, Well Drained Soils Formed in Colluvium, Residuum, and Glacial Till

These soils make up about 19 percent of the county. They are gently sloping to very steep soils that formed in colluvium and residuum derived from sandstone, siltstone, and shale and in Wisconsin and Illinoian glacial till. They are used dominantly for farming or woodland. The erosion hazard, slope, droughtiness, and moderate depth to bedrock are the major management concerns.

6. Loudonville-Westmoreland-Gilpin Association

Moderately deep and deep, gently sloping to steep, well drained soils on glaciated and unglaciated uplands

This association is in the partly glaciated areas of the county. The landscape is hilly. The hills have been rounded by glacial action. They have broad, gently sloping and sloping tops and moderately steep and steep sides. The valleys between the hills are moderately wide. The interval between one valley and another is wide. Springs are at the base of the hills.

This association makes up about 9 percent of the county. It is about 25 percent Loudonville soils, 20 percent Westmoreland soils, 15 percent Gilpin soils, and 40 percent soils of minor extent.

Loudonville soils are moderately deep. They are gently sloping and sloping on the convex parts of hilltops and are moderately steep and steep on valley sides. Permeability is moderate. These soils formed in glacial till and in the underlying material weathered from sandstone and siltstone bedrock. Typically, the surface layer is dark brown silt loam. The subsoil is yellowish brown and strong brown. It is silt loam in the upper part and channery silt loam in the lower part.

Westmoreland soils are deep, are moderately steep and steep, and are on hillsides. Permeability is moderate. These soils formed in residuum and colluvium derived from interbedded sandstone, siltstone, and shale. Typically, the surface layer is dark grayish brown silt loam. The subsoil is yellowish brown. It is loam and silt loam in the upper part and channery and very channery silt loam in the lower part.

Gilpin soils are moderately deep, are gently sloping and sloping, and generally are on ridgetops. Permeability is moderate. These soils formed in material weathered from siltstone and fine grained sandstone. Typically, the surface layer is dark brown silt loam. The subsoil is yellowish brown and strong brown silt loam and channery loam.

Some of the minor soils in this association are Brownsville, Titusville, Homewood, and Orrville soils. Brownsville soils have a higher content of coarse fragments in the subsoil than the major soils. They are on hillsides. Titusville and Homewood soils have a fragipan in the subsoil. They are on foot slopes. The somewhat poorly drained Orrville soils are on flood plains.

Most areas of this association are used for farming. Dairy and beef cattle enterprises dominate, but the extent of cash-grain farming is increasing. The gentler slopes are used dominantly as cropland, and the steeper slopes are pastured. Forage and corn are the principal crops. The less sloping soils are well suited or moderately well suited to row crops, hay, pasture, and urban uses. The steeper soils are generally unsuited or poorly suited to most of these uses. Some of the soils are well suited to woodland, and others are moderately well suited.

If these soils are cultivated, erosion is a moderate to very severe hazard. In many areas it can be controlled by contour stripcropping and a system of conservation tillage that leaves crop residue on the surface. The good natural drainage of the soils is favorable on homesites, but the bedrock interferes with excavation for basements and septic tank absorption fields. The soils are better suited to buildings without basements than to buildings with basements.

7. Brownsville-Westmoreland-Gilpin Association

Deep and moderately deep, gently sloping to very steep, well drained soils on unglaciated uplands

This association is in areas that show little evidence of glaciation, except in narrow valleys. The landscape consists of gently sloping and sloping ridgetops separated by narrow valleys that have steep and very steep side slopes. It has four distinct parts. The valleys are bordered by long, uniformly sloping, moderately steep to very steep hillsides. Narrow, gently sloping and sloping benches are above the hillsides. Above the benches are shorter, moderately steep and steep hillsides. Gently sloping and sloping ridgetops are in the highest landscape positions. They are a few feet to a half mile wide.

This association makes up about 10 percent of the county. It is about 25 percent Brownsville soils, 15 percent Westmoreland soils, 15 percent Gilpin soils, and 45 percent soils of minor extent.

Brownsville soils are deep. They are moderately steep to very steep on the lower parts of valley side slopes and are sloping on ridgetops. Permeability is moderate or moderately rapid. These soils formed in colluvium and residuum derived from siltstone and fine grained sandstone bedrock. Typically, the surface layer is very dark grayish brown channery silt loam. The subsoil is brown and yellowish brown very channery and extremely channery silt loam.

Westmoreland soils are deep, are moderately steep to very steep, and are on hillsides. Permeability is moderate. These soils formed in residuum and colluvium derived from interbedded sandstone, siltstone, and shale. Typically, the surface layer is dark grayish brown silt loam. The subsoil is yellowish brown. It is loam and silt loam in the upper part and channery and very channery silt loam in the lower part.

Gilpin soils are moderately deep, are gently sloping and sloping, and are on benches and ridgetops. Permeability is moderate. These soils formed in material weathered from siltstone and fine grained sandstone. Typically, the surface layer is dark brown silt loam. The subsoil is yellowish brown and strong brown silt loam and channery loam.

Some of the minor soils in this association are Rigley, Schaffenaker, Coshocton, Glenford, Fitchville, Orrville, and Lobdell soils. Rigley and Schaffenaker soils have more sand in the subsoil than the major soils. They are on high ridges. The moderately well drained Coshocton soils are on high, broad ridgetops and benches. The moderately well drained Glenford soils and the somewhat poorly drained Fitchville soils are on slack water terraces along streams. The somewhat poorly drained Orrville soils and the moderately well drained Lobdell soils are on narrow flood plains.

Most of this association is wooded. There are a few farms, mostly dairy and beef cattle enterprises. Corn and forage are the principal crops. Most buildings are on farmsteads or in recreational areas. Many areas are scenic. As a result, increased recreational development can be expected. The association has substantial oil and gas resources. These soils are well suited or moderately well suited to woodland. The gently sloping and sloping soils are well suited or moderately well suited to row crops, hay, pasture, and buildings. They are moderately well suited or poorly suited to septic tank absorption fields. The steeper soils are generally unsuited to row crops and most urban uses.

The slope, the erosion hazard, droughtiness, and the bedrock at a depth of 20 to 40 inches in the Gilpin soils are the major management concerns. Contour stripcropping helps to control erosion on most of the cropland. If these soils are used as woodland, laying out logging roads and skid trails on the contour reduces the susceptibility to erosion. The north- and east-facing slopes are better woodland sites than the south- and west-facing slopes because of less evapotranspiration and cooler temperatures. The north- and east-facing slopes are less exposed to the drying effects of the prevailing wind and the sun.

Deep, Well Drained to Very Poorly Drained Soils Formed in Glacial Outwash, Alluvium, and Lacustrine Sediments

These soils make up about 24 percent of the county. They are nearly level to steep soils on terraces, flood plains, kames, and outwash plains and fans and in former lakebeds. The nearly level to sloping soils are used mainly as cropland, pasture, or urban land. The moderately steep and steep soils are used mostly as pasture or woodland. Flooding, ponding, wetness, and droughtiness are the main management concerns. Erosion control is important in some areas.

8. Ockley-Bogart-Tioga Association

Deep, nearly level and gently sloping, well drained and moderately well drained soils on terraces, flood plains, and outwash plains and fans

This association is on broad flats in valleys. Short, steep slope breaks are between terraces and flood plains and between different terrace levels.

This association makes up about 11 percent of the county. It is about 25 percent Ockley soils, 15 percent Bogart soils, 10 percent Tioga soils, and 50 percent soils of minor extent.

Ockley soils are well drained, are nearly level and gently sloping, and are on broad terraces. Permeability is moderate. These soils formed in silty deposits and loamy outwash. They are underlain by sandy and gravelly glacial outwash at a depth of 40 to 60 inches. Typically, the surface layer is dark brown silt loam. The upper part of the subsoil is yellowish brown, strong brown, and brown silt loam and silty clay loam. The lower part is brown and dark brown gravelly loam, gravelly coarse sandy loam, and gravelly sandy clay loam.

Bogart soils are moderately well drained and are nearly level and gently sloping. They are in low areas and areas affected by seepage on terraces. Permeability is moderate or moderately rapid in the subsoil and rapid in the substratum. A seasonal high water table is at a depth of 24 to 42 inches. These soils formed in loamy outwash deposits. Typically, the surface layer is dark brown silt loam. The subsoil is yellowish brown. It is silt loam and loam in the upper part and mottled, stratified gravelly loam and gravelly sandy loam in the lower part.

Tioga soils are well drained and nearly level. They are on flood plains and are occasionally flooded. Permeability is moderate or moderately rapid in the upper part of the profile and very rapid in the substratum. A seasonal high water table is at a depth of 36 to 72 inches. These soils formed in alluvium. Typically, the surface layer is dark brown fine sandy loam. The subsoil is yellowish brown loam.

Some of the minor soils in this association are Shoals, Sloan, Medway, Fox, Chili, and Jimtown soils. Shoals, Sloan, and Medway soils are on flood plains. Shoals soils are somewhat poorly drained, and Sloan soils are very poorly drained. Medway soils have a surface layer that is darker than that of the major soils. Fox, Chili, and Jimtown soils are on terraces. Jimtown soils are somewhat poorly drained. Chili and Fox soils have more gravel in the upper part than the Ockley soils.

Most areas of this association are used as cropland. Corn, soybeans, wheat, and hay are the principal crops. These soils are well suited to row crops, small grain, hay, pasture, woodland, orchards, and vegetables. The Ockley and Bogart soils are well suited or moderately well suited to most urban uses, but the Tioga soils are generally unsuited. The Ockley soils are better suited to most uses than the other soils.

Few limitations affect crops on the Ockley and Bogart soils. The Tioga soils, however, are occasionally flooded during the growing season. Also, they are somewhat droughty. The soils in this association are suited to irrigation. The flooding hazard severely limits the Tioga soils as sites for homes and septic tank absorption fields. The seasonal wetness of the Bogart soils is a limitation affecting buildings with basements. It also affects septic tank absorption fields.

9. Orrville-Chili-Bogart Association

Deep, nearly level to steep, somewhat poorly drained, well drained, and moderately well drained soils on flood plains, terraces, fans, kames, and outwash plains

This association is along streams in valleys. The landscape consists of flats surrounded by nearly level to steep terrace breaks and hummocky areas.

This association makes up about 10 percent of the county. It is about 20 percent Orrville soils, 20 percent Chili soils, 10 percent Bogart soils, and 50 percent soils of minor extent. These percentages vary considerably among areas of the association.

Orrville soils are somewhat poorly drained and nearly level. They are on flood plains and are occasionally flooded. Permeability is moderate. A seasonal high water table is at a depth of 12 to 30 inches. These soils formed in alluvium. Typically, the surface layer is dark grayish brown silt loam. The subsoil is brown and grayish brown, mottled silt loam and loam.

Chili soils are well drained and are nearly level to steep. They are on the better drained parts of large terraces and on small terraces and kames. Permeability is moderately rapid. These soils formed in acid glacial outwash. Typically, the surface layer is dark brown silt loam. The subsoil is yellowish brown. It is silt loam, loam, and gravelly loam in the upper part and gravelly sandy loam in the lower part.

Bogart soils are moderately well drained and are nearly level and gently sloping. They are in low areas on terraces. They are subject to seepage. Permeability is moderate or moderately rapid in the subsoil and rapid in the substratum. A seasonal high water table is at a depth of 24 to 42 inches. These soils formed in loamy outwash deposits. Typically, the surface layer is dark brown silt loam. The subsoil is yellowish brown. It is silt loam and loam in the upper part and mottled, stratified gravelly loam and gravelly sandy loam in the lower part.

Some of the minor soils in this association are Holly, Tioga, Homewood, Jimtown, Fitchville, and Glenford soils. The poorly drained and very poorly drained Holly soils are in depressions. Tioga soils are on the higher parts of the flood plains. They formed in alluvium. Homewood soils have a fragipan. Areas of these soils are intermixed with some areas of the Chili soils. Jimtown soils are in depressions on terraces. Fitchville and Glenford soils have more silt throughout than the major soils. They are in some slack water areas.

Most areas of this association are used as cropland or pasture. Corn, soybeans, wheat, and hay are the principal crops. Orrville, Bogart, and the less sloping Chili soils are well suited to row crops, hay, and pasture. Bogart soils and the less sloping Chili soils are well suited or moderately well suited to most urban uses, but the Orrville soils are generally unsuited. All of the soils are well suited to woodland.

The Bogart soils are better suited to cropland than the Chili and Orrville soils. Erosion is a hazard on the steeper Chili soils. A drainage system is needed if the Orrville soils are used for crops. Also, these soils are occasionally flooded during the growing season. Bogart soils and the less sloping Chili soils are suited to irrigation. The flooding hazard severely limits the Orrville soils as sites for homes and septic tank absorption fields. The seasonal wetness of the Bogart soils is a limitation affecting buildings and septic tank absorption fields.

10. Fitchville-Luray Association

Deep, nearly level and gently sloping, somewhat poorly drained and very poorly drained soils in former lakebeds and on slack water terraces

This association is in the beds of former shallow glacial lakes and on slack water terraces adjacent to streams. Areas are basinlike and are surrounded by higher ground. Low knolls and ridges are in the basins.

This association makes up about 3 percent of the county. It is about 35 percent Fitchville soils, 20 percent Luray soils, and 45 percent soils of minor extent. These percentages vary considerably among areas of the association.

Fitchville soils are somewhat poorly drained and are nearly level and gently sloping. They are on flats, on low knolls, on ridges, on the sides of the basins, and on slack water terraces. Permeability is moderately slow. A seasonal high water table is at a depth of 12 to 30 inches. These soils formed in stratified glacial meltwater deposits. Typically, the surface layer is dark grayish brown silt loam. The subsoil is brown, yellowish brown, and dark yellowish brown, mottled silt loam and silty clay loam.

Luray soils are very poorly drained and nearly level. They are on the lowest and flattest parts of the basins. Permeability is moderately slow. A seasonal high water table is near or above the surface. These soils formed in stratified glacial meltwater deposits. Typically, the surface layer is very dark grayish brown silty clay loam. The subsoil is dark grayish brown, grayish brown, and yellowish brown, mottled silty clay loam.

Some of the minor soils in this association are the moderately well drained Glenford and Bogart soils in the higher landscape positions and Sloan, Holly, Orrville, and Shoals soils, which formed in alluvium on narrow flood plains.

Most areas of this association have been drained and are used as cropland. Corn and soybeans are the principal crops. These soils are well suited to cultivated crops, hay, and pasture. They are moderately well suited to woodland and poorly suited or generally unsuited to buildings and septic tank absorption fields.

The seasonal wetness, the moderately slow permeability, and ponding are major management concerns. A drainage system is needed if these soils are used for crops. Both subsurface drains and open ditches are needed in some areas. Establishing an effective drainage system generally is difficult on sites for homes and septic tank absorption fields.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Wooster silt loam, 6 to 12 percent slopes, is one of several phases in the Wooster series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Chili-Homewood silt loams, 6 to 12 percent slopes, is an example.

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

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

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

Soil Descriptions

AdD2—Amanda silt loam, 12 to 18 percent slopes, eroded. This moderately steep, deep, well drained soil is on end moraines and the dissected parts of ground moraines. It is on side slopes in valleys and on isolated hills. Slopes commonly are 150 to 400 feet long. They are irregular and have numerous indentations. Because of erosion, the present surface layer in most areas is a mixture of the original surface layer and the subsoil. Most areas are 5 to 20 acres in size and are long and narrow.

Typically, the surface layer is dark brown, friable silt loam about 7 inches thick. The subsoil is about 48 inches thick. It is yellowish brown. It is friable silt loam and firm silty clay loam in the upper part; mottled, firm clay loam in the next part; and mottled, firm loam in the lower part. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm loam glacial till. Parts of many areas are not significantly eroded. In places the substratum has pockets and lenses of moderately permeable, water-laid soil material.

Included with this soil in mapping are small areas of the somewhat poorly drained Shoals soils on narrow flood plains; small areas of the moderately well drained Centerburg soils on hillsides and ridgetops; and, on the more convex parts of the slopes, small areas of severely eroded soils that have a yellowish brown silty clay loam surface layer. Also included are some springs and seepy areas around which the soil is grayer and more extensively mottled. Included soils make up about 15 percent of most areas.

Permeability is moderately slow in the Amanda soil. The available water capacity is moderate or high. Runoff is very rapid. The seasonal high water table is below a depth of 48 inches. Organic matter content is moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. The subsoil is strongly acid or very strongly acid in the upper part and medium acid or slightly acid in the lower part. The root zone is deep.

Only a few areas are used as cropland, although many formerly were farmed. This soil is poorly suited to cultivated crops. Erosion is a very severe hazard if the soil is cultivated. Intensive management is needed to prevent excessive soil loss. Water tends to concentrate and flow in indentations in the slope. Gullies form in these areas and lengthen into the less sloping, higher lying adjacent areas if not controlled. Establishing grassed waterways on the parts of the slope where water collects helps to prevent gullying. Cover crops, additions of organic matter, and cross-slope tillage help to control erosion. A system of conservation tillage that leaves crop residue on the surface is suitable on this soil.

Some areas are used as hayland and pasture. This soil is moderately well suited to hay and pasture. A cover of grasses and legumes helps to control further erosion. The good natural drainage favors the growth of alfalfa. Pasture plants can be grazed early in the year and grow moderately well during the dry part of the summer. No-till seeding methods help to control erosion.

Many areas are wooded. Some of these areas are old cropland fields where volunteer species have seeded naturally. Some trees have been planted. This soil is well suited to trees. Logging trails should be constructed so that water does not collect and flow on them. Site preparation measures, such as mowing or spraying, help to control plant competition and foster the growth of desirable tree species. Locating logging roads and skid trails across the slope facilitates the use of equipment.

This soil is poorly suited to building site development and septic tank absorption fields. The good natural drainage favors these uses, but the slope is a limitation. Considerable excavation commonly is needed on building sites. Less excavation commonly is needed on sites for structures built into the hillside than on sites for conventional buildings. The erosion hazard is severe during construction. Reseeding or mulching scalped areas helps to prevent gullying and excessive soil loss. Keeping water from collecting and flowing on unpaved streets and driveways also helps to control erosion. The moderately slow permeability limits the soil as a septic tank absorption field. Installing the distribution lines across the slope helps to prevent seepage of the effluent to the surface. The wetter included soils should not be selected as sites for buildings and septic tank absorption fields.

Good pond sites are available in areas where this soil is on both sides of a small valley. Soil conditions at the bottom of these valleys commonly vary. As a result, onsite investigation is needed.

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

AdF2—Amanda silt loam, 18 to 40 percent slopes, eroded. This steep and very steep, well drained soil is on the sides of valleys on the dissected parts of ground and end moraines. In most areas it is on only one side of the valley, but in some areas it is on both sides. Erosion has removed a significant part of the original surface layer throughout a major part of most areas. Slopes commonly are smooth and are 100 to 250 feet long. Individual areas are 2 to 50 acres in size and are long and narrow.

Typically, the surface layer is dark brown, friable silt loam about 4 inches thick. The subsurface layer is pale brown, friable silt loam about 3 inches thick. The subsoil is about 39 inches thick. It is yellowish brown, firm silty clay loam and clay loam. It is mottled below a depth of about 24 inches. The substratum to a depth of about 60 inches is yellowish brown, firm loam. Parts of many areas are not significantly eroded. In places the substratum has pockets and lenses of loamy, water-laid soil material.

Included with this soil in mapping are small areas of the somewhat poorly drained Shoals soils on narrow flood plains, narrow strips where the slope is 50 to 70 percent, and small areas of severely eroded soils that have a yellowish brown surface layer of silty clay loam or clay loam. Also included are springs and seepy areas around which the soil is grayer and more extensively mottled. Included soils make up about 10 percent of most areas.

Permeability is moderately slow in the Amanda soil. Runoff is very rapid. The available water capacity is moderate or high. The seasonal high water table is below a depth of 48 inches. Organic matter content is moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. The subsoil is strongly acid or very strongly acid in the upper part and slightly acid or medium acid in the lower part. The root zone is deep.

Only a few areas are used as cropland. This soil is generally unsuited to cultivated crops because of the slope and a very severe hazard of further erosion. Measures that prevent gullying are needed. Gullies that form in areas of this soil are likely to extend into the less sloping, higher lying adjacent areas. The use of most kinds of farm machinery is limited by the slope.

Many areas are used as pasture. Areas where the slope is 18 to 25 percent are moderately well suited to hay and pasture, and the steeper areas are poorly suited. The good natural drainage favors alfalfa and permits grazing early in spring. No-till methods of seeding help to control erosion.

Some areas are used as woodland. Some woodlots support mature trees, whereas others are new plantations or old cropland fields where volunteer species have seeded naturally. This soil is well suited to trees. Constructing logging roads and skid trails across the slope helps to control erosion and facilitates the use of equipment. Water bars help to control erosion on logging roads and skid trails.

This soil is poorly suited to building site development and generally is unsuited to septic tank absorption fields because of the steep and very steep slopes. Considerable excavation commonly is needed on sites for conventional buildings. Cuts erode rapidly. Underground structures or structures built into the hillside are better suited than other structures, but they should not be built in seepy areas. Keeping as much vegetation on the site as possible during construction helps to control erosion.

Some pond sites are available in areas where this soil is on both sides of a small valley. Onsite investigation is needed to determine soil conditions at the bottom of these valleys.

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

BnA—Bennington silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is on flats and in depressions on till plains. Most areas are 5 to 100 acres in size and are irregularly shaped. They are surrounded by higher areas.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsurface layer is yellowish brown, friable silt loam about 2 inches thick. The subsoil is yellowish brown, mottled, firm silty clay loam about 21 inches thick. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm, calcareous clay loam. In some areas runoff has deposited loose soil material on the surface. In other areas the surface layer is darker. In places the soil is wetter and has a dominantly gray subsoil.

Included with this soil in mapping are small areas of Centerburg and Pewamo soils. The moderately well drained Centerburg soils are on small knolls. The very poorly drained Pewamo soils have a surface layer that is darker than that of the Bennington soil. They are in small, closed depressions. Also included are some areas that are subject to ponding. Included soils make up about 10 percent of most areas.

Permeability is slow in the Bennington soil. Runoff is also slow. The available water capacity is moderate. The seasonal high water table is at a depth of 12 to 30 inches during extended wet periods. Organic matter content is moderate. Tilth is good. The capacity to store and release plant nutrients is high. The subsoil is medium acid to very strongly acid in the upper part and medium acid to neutral in the lower part. The rooting depth is limited by the seasonal high water table.

Most areas are used for crops, especially corn and soybeans. If adequately drained, this soil is well suited to corn, soybeans, and small grain. A drainage system is needed. Subsurface drains are effective if adequate outlets are available. Ditches can be used as outlets in some of the larger areas. The erosion hazard is slight. Measures that maintain tilth and applications of lime and fertilizer are the main management needs once an adequate drainage system is installed. A system of conservation tillage that leaves crop residue on the surface is suitable in adequately drained areas.

Some areas are used for hay and pasture. Much of the pastured acreage is used for row crops and hay part of the time. This soil is well suited to some forage crops. Undrained areas are generally unsuited to alfalfa. They are better suited to birdsfoot trefoil and alsike clover. Grazing early in spring can damage the plants, especially in undrained areas. Pasture production is relatively high during dry periods.

Only a few small areas are used as woodland. This soil is moderately well suited to trees. It is too wet for the optimum growth of some species. The species tolerant of some wetness should be selected for planting. Site preparation measures, such as mowing, spraying, or disking, help to control plant competition and foster the growth of desirable tree species. Removing the less desirable trees, shrubs, and vines also helps to control plant competition.

This soil is poorly suited to building site development and septic tank absorption fields because of the seasonal wetness and the slow permeability. Muddy lots and wet basements can be expected. Installing drains at the base of footings helps to keep basements dry. Installing perimeter drains reduces the wetness in septic tank absorption fields. Enlarging the absorption field helps to overcome the restricted permeability. The wetter included soils should not be selected as sites for buildings or sanitary facilities.

Ponds dug in areas of this soil are likely to hold water. Many areas receive enough runoff to fill the ponds.

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

BnB—Bennington silt loam, 2 to 6 percent slopes. This gently sloping, deep, somewhat poorly drained soil is on till plains. It is on low knolls and ridges that have short, irregular slopes. Individual areas are 5 to 200 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is yellowish brown, mottled, firm silty clay loam about 23 inches thick. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm, calcareous clay loam. In some eroded spots the surface layer is lighter in color. On some small flats the slope is less than 2 percent. In some areas the soil is wetter and has grayer colors in the subsoil. In a few areas around iron-rich springs, the surface layer is reddish brown.

Included with this soil in mapping are small areas of Centerburg and Pewamo soils. The moderately well drained Centerburg soils are on the higher knolls. The very poorly drained Pewamo soils are on flats and in closed depressions. Included soils make up about 10 percent of most areas.

Permeability is slow in the Bennington soil. Runoff is medium. The available water capacity is moderate. The seasonal high water table is at a depth of 12 to 30 inches during extended wet periods. Organic matter content is moderate. Tilth is good. The capacity to store and release plant nutrients is high. The subsoil is medium acid to very strongly acid in the upper part and medium acid to neutral in the lower part. The rooting depth is restricted by the seasonal high water table.

Most areas are used as cropland. If adequately drained, this soil is well suited to corn, soybeans, and small grain. A drainage system is needed in most areas of this soil and in areas of the wetter included soils. Subsurface drains are effective in areas where outlets are available. Because of an uneven land surface in the larger areas, some deep trenching is needed when subsurface drains are installed. Erosion is a moderate hazard, especially on the longer slopes. The surface layer crusts after hard rains. Growing cover crops and returning crop residue to the soil help to control erosion and crusting. A system of conservation tillage that leaves crop residue on the surface is effective in controlling erosion on the short, irregular slopes. It is suitable in adequately drained areas.

Some areas are used for hay and pasture. Much of the pastured acreage is used as cropland part of the time. This soil is well suited to some forage crops. Unless adequately drained, it is generally unsuited to alfalfa. Grazing wet areas early in spring can damage the plants. Pasture production is relatively high during dry periods.

Only a few small areas are used as woodland. This soil is moderately well suited to trees. It is too wet for the optimum growth of some species. The species tolerant of some wetness should be selected for planting. Site preparation measures, such as mowing, spraying, or disking, help to control plant competition and foster the growth of desirable tree species. Removing the less desirable trees, shrubs, and vines also helps to control plant competition.

This soil is poorly suited to building site development and septic tank absorption fields because of the seasonal wetness and the slow permeability. The wetness on building sites can be reduced by installing drains at the base of footings and by building on the higher knolls. Installing perimeter drains reduces the wetness in septic tank absorption fields. Increasing the size of the absorption field helps to overcome the restricted permeability.

Ponds dug in areas of this soil are likely to hold water. Some areas receive a limited amount of water because of the short slopes.

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

BoA—Bogart silt loam, 0 to 2 percent slopes. This nearly level, deep, moderately well drained soil is on terraces and on outwash plains and fans. It makes up the entire area of fan-shaped terraces 2 to 10 acres in size. It is also on the lower lying parts of broad terraces, typically in troughlike areas 5 to 25 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 10 inches thick. The subsoil is about 30 inches thick. It is yellowish brown. The upper part is friable silt loam; the next part is mottled, firm silt loam and loam; and the lower part is friable, stratified gravelly loam and gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, very friable gravelly sandy loam and loose very gravelly loamy sand. It is mottled in the upper part. In some areas the surface layer is gravelly loam. In other areas it is darker. In places the substratum has very few pebbles.

Included with this soil in mapping are small areas of the somewhat poorly drained Jimtown soils. These soils are in seepy areas and depressions. Also included are areas where the substratum has compact glacial till below a depth of 4 to 5 feet. Included soils make up about 5 percent of most areas.

Permeability is moderate or moderately rapid in the subsoil of the Bogart soil and rapid in the substratum. Runoff is slow. The available water capacity is moderate. The seasonal high water table is at a depth of 24 to 42 inches during extended wet periods. Organic matter content is moderate. Tilth is good. The capacity to store and release plant nutrients is moderate. Where the soil is not limed, the subsoil is slightly acid to strongly acid. The root zone is deep.

Most areas are used as cropland. This soil is well suited to corn, soybeans, and small grain. The erosion hazard is slight. Natural drainage is generally adequate, but randomly spaced subsurface drains are needed in the wetter included soils. Some areas are wet because of seepage from springs in the adjacent hillsides. Subsurface drains along the base of the slopes can intercept this water. The amount of available moisture is occasionally deficient for brief periods. A system of conservation tillage that leaves crop residue on the surface conserves moisture by reducing the evaporation rate at the surface. The soil is well suited to irrigation.

Some areas are used for hay and improved pasture. This soil is well suited to forage crops. Most pastures are in a rotation with cropland. Intensive pasture management can be applied. Pasture plants can be expected to grow well.

A few areas are used as woodland. This soil is well suited to trees. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is moderately well suited to building site development and septic tank absorption fields. The nearly level slopes favor these uses, but the seasonal wetness is a limitation. Subsurface drains can be used to lower the water table. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Perimeter drains reduce the wetness in septic tank absorption fields. Installing the distribution lines in these fields too deep into the soil can result in the pollution of ground water supplies.

Although the substratum has some sand and gravel, this soil is an improbable source of these materials. Excavated ponds are unlikely to hold water unless they are sealed.

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

BoB—Bogart silt loam, 2 to 6 percent slopes. This gently sloping, deep, moderately well drained soil is on terraces and outwash plains. It makes up the entire area of terraces 2 to 20 acres in size. These terraces commonly slope in one direction. The soil also is in troughs and on low knolls on larger terraces and on isolated knolls on till plains. Most of these areas are 5 to 30 acres in size, vary in shape, and slope in several directions.

Typically, the surface layer is dark brown, friable silt loam about 10 inches thick. The subsoil is about 38 inches thick. It is yellowish brown. The upper part is mottled, firm silt loam, and the lower part is friable gravelly loam and gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose gravelly loamy sand. In some areas the surface layer is loam or gravelly loam. In other areas the soil is well drained and is not mottled. In many areas the subsoil and substratum have very few pebbles.

Included with this soil in mapping are small areas of the somewhat poorly drained Jimtown soils. These soils are in closed depressions and around springs and seeps. Also included are small areas where compact glacial till or shattered sandstone bedrock is at a depth of 4 to 5 feet. Included soils make up about 10 percent of most areas.

Permeability is moderate or moderately rapid in the subsoil of the Bogart soil and rapid in the substratum. Runoff is medium. The available water capacity is moderate. The seasonal high water table is at a depth of 24 to 42 inches during the wettest parts of the year. The periods of excessive wetness are brief. Organic matter content is moderate. Tilth is good. The capacity to store and release plant nutrients is moderate. Where the soil is not limed, the subsoil is slightly acid to strongly acid. The root zone is deep.

Most areas are used as cropland. This soil is well suited to corn, soybeans, and small grain. Erosion is a moderate hazard. It commonly can be controlled by cultivating across the slope and by returning crop residue to the soil. A system of conservation tillage that leaves crop residue on the surface helps to control erosion and conserves moisture. Natural drainage is generally adequate for crops, but randomly spaced subsurface drains are needed in the wetter included soils. Wetness is most likely to be a problem in areas that are below the steeper slopes. The soil is somewhat droughty during extended dry periods. It is suited to irrigation if erosion is controlled.

Some areas are used for hay and improved pasture. This soil is well suited to forage crops. Alfalfa can be grown. Pasture plants can be grazed early in the year. They grow moderately well during the dry part of the summer. Intensive pasture management can be applied.

A few areas are used as woodland. This soil is well suited to trees. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

Because of the seasonal wetness, this soil is only moderately well suited to building site development and septic tank absorption fields. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. In undulating areas the higher rises should be selected as sites for buildings and septic tank absorption fields. Installing perimeter drains around septic tank absorption fields helps to lower the seasonal high water table. The wetter included soils should not be selected as sites for absorption fields. Installing the distribution lines in these fields too deep into the soil can result in the pollution of ground water supplies.

Although the substratum has some sand and gravel, this soil is an improbable source of these materials. Few natural pond sites are available, and excavated ponds are unlikely to hold water.

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

BrC—Brownsville channery silt loam, 6 to 12 percent slopes. This sloping, deep, well drained soil is on ridgetops and the upper part of hillsides. Numerous fragments of thin, flat sandstone are on the surface and throughout the soil. Most slopes are 100 to 250 feet long. Individual areas are dominantly 5 to 20 acres in size and are long and narrow.

Typically, the surface layer is dark brown, friable channery silt loam about 10 inches thick. The subsoil is yellowish brown, friable very channery silt loam about 24 inches thick. The substratum is yellowish brown, very friable extremely channery silt loam about 11 inches thick. Fine grained sandstone bedrock is at a depth of about 45 inches. In some eroded spots the surface layer is very channery silt loam. In a few areas it is very channery sandy loam or flaggy silt loam. In places the depth to bedrock is 30 to 40 inches.

Included with this soil in mapping are small areas of soils that have a subsoil of channery silty clay loam. These soils are not so droughty as the Brownsville soil. A few springs and seepy areas are also included. Included soils make up about 10 percent of most areas.

Permeability is moderate or moderately rapid in the Brownsville soil. Runoff is rapid. The available water capacity is low. Organic matter content is moderately low. Tilth is good. The capacity to store and release plant nutrients is low. Unless the soil is limed, the subsoil is strongly acid or very strongly acid. The root zone is deep.

Some areas are used as cropland. Because of a severe erosion hazard and the droughtiness, this soil is only moderately well suited to corn, soybeans, and small grain. Erosion removes the finer soil particles, leaving behind the rock fragments. It reduces the available water capacity. Some areas are suitable for contour stripcropping. A system of conservation tillage that leaves crop residue on the surface helps to control erosion and conserves moisture. Growing cover crops, including forage crops in the cropping sequence, and applying organic material help to control erosion and runoff. Additions of lime and fertilizer are needed. Because of possible leaching losses, frequent, light applications of plant nutrients are preferable to less frequent, heavier applications.

Some areas are used as hayland and pasture. This soil is moderately well suited to hay and pasture. It is well suited to grazing early in spring. Native pasture plants grow slowly during dry periods. Intensive pasture management can be applied. The rock fragments on the surface in some areas interfere with seedling emergence. No-till seeding helps to control erosion and conserves moisture.

Some areas are used as woodland. Because of the low available water capacity, this soil is only moderately well suited to trees. The good natural drainage favors tree growth. Seedling mortality can be controlled by mulching or by planting seedlings that have been transplanted once.

This soil is only moderately well suited to building site development because of the slope and the rock fragments in the surface layer. The good natural drainage is favorable, and most of the rock fragments in the upper 4 feet are small enough to be excavated without difficulty. The buildings should be designed so that they conform to the natural slope of the land. Erosion is a severe hazard during construction. It can be controlled by keeping as much vegetation on the site as possible. The surface layer should be stockpiled and returned to the construction site as soon as possible.

Because of the slope and the bedrock as shallow as 40 inches, this soil is poorly suited to septic tank absorption fields. Effluent that enters cracks in the underlying bedrock can move a considerable distance and thus can pollute ground water supplies. Installing the distribution lines in suitable filtering material reduces the pollution hazard.

Few natural pond sites are available in areas of this soil, and excavated ponds are very unlikely to hold water.

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

BrD—Brownsville channery silt loam, 12 to 18 percent slopes. This moderately steep, deep, well drained soil is on hillsides. In most areas it is on side slopes below less sloping hilltops or ridgetops. In some areas it is on shoulder slopes. Numerous fragments of flat, angular sandstone are on the surface and throughout the soil. Slopes are mainly 100 to 400 feet long. Most areas slope uniformly in one direction, range from 10 to 50 acres in size, and are long and narrow.

Typically, the surface layer is dark brown, friable channery silt loam about 8 inches thick. The subsoil is yellowish brown, very friable very channery silt loam about 24 inches thick. The substratum is yellowish brown, very friable extremely channery silt loam about 16 inches thick. Thin bedded, fine grained sandstone bedrock is at a depth of about 48 inches. In some eroded spots the surface layer is very channery silt loam. In some areas bedrock is at a depth of 30 to 40 inches.

Included with this soil in mapping are soils that have channery clay loam in the part of the subsoil below a depth of 24 inches. These soils have a higher available water capacity than the Brownsville soil. Also included are seeps and springs. Inclusions make up about 15 percent of most areas.

Permeability is moderate or moderately rapid in the Brownsville soil. Runoff is rapid. The available water capacity is low. Organic matter content is moderately low. Tilth is good. The capacity to store and release plant nutrients is low. Unless the soil is limed, the subsoil is strongly acid or very strongly acid. The root zone is deep.

A few areas are used as cropland. This soil is poorly suited to corn, soybeans, and small grain because of a very severe erosion hazard and the droughtiness. Erosion removes the finer soil particles, leaving behind the rock fragments. It reduces the available water capacity. Many areas are suitable for contour stripcropping and for a system of conservation tillage that leaves crop residue on the surface. One or both of these practices are used in most cultivated areas. Applications of a substantial amount of lime and fertilizer are needed. Leaching of plant nutrients is a hazard. The surface stones generally do not interfere with cultivation. They cover enough of the surface in some areas to reduce the density of the stand of small grain or forage.

Some areas are used as pasture. This soil is moderately well suited to pasture and hay. The good natural drainage permits grazing early in spring, but growth is slow during the dry part of the summer. Cultivating during seedbed preparation and overgrazing increase the erosion hazard. No-till seeding methods help to control erosion. Applications of lime and fertilizer help to maintain the stands.

Some areas are used as woodland. Because of the low available water capacity, this soil is only moderately well suited to trees. Constructing logging roads and skid trails across the slope facilitates the use of equipment. Seedling mortality can be controlled by mulching or by planting seedlings that have been transplanted once. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and a lower evapotranspiration rate because of less exposure to the prevailing wind and the sun.

Because of the slope, this soil is poorly suited to building site development. The good natural drainage is favorable, but considerable excavation commonly is needed. The buildings should be designed so that they conform to the natural slope of the land. Most of the rock fragments in the upper 4 feet can be excavated without difficulty. Erosion is a hazard during construction. It can be controlled by keeping as much vegetation on the site as possible during construction. Establishing lawns is difficult. The surface layer should be stockpiled and returned to the construction site as soon as possible.

Because of the slope and the bedrock as shallow as 40 inches, this soil is poorly suited to septic tank absorption fields. These fields should be established on the better suited soils nearby. Installing the distribution lines across the slope results in a more even distribution of the effluent.

Ponds dug in areas of this soil are unlikely to hold water.

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

BsE—Brownsville-Westmoreland complex, 18 to 25 percent slopes. These steep, deep, well drained soils are on valley side slopes. Most areas are below less sloping hilltops or benches. Some include both sides of a small valley, whereas others include only one side. Slopes commonly are smooth and are 150 to 600 feet long. Individual areas generally are 10 to 100 acres in size and are long and narrow.

Most areas are about 60 percent Brownsville channery silt loam and 30 percent Westmoreland silt loam. The Brownsville soil is commonly on the middle part of the slopes, and the Westmoreland soil is on the upper and lower parts, which generally are not quite so steep as the middle part. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Brownsville soil has a surface layer of very dark grayish brown, very friable channery silt loam about 2 inches thick. The subsoil is yellowish brown, very friable very channery silt loam about 32 inches thick. The substratum is yellowish brown, very friable extremely channery silt loam about 14 inches thick. Sandstone and siltstone bedrock is at a depth of about 48 inches. In places the surface layer is very channery silt loam.

Typically, the Westmoreland soil has a surface layer of dark grayish brown, very friable silt loam about 3 inches thick. The subsoil is about 31 inches thick. It is dark yellowish brown and yellowish brown. The upper part is friable and very friable loam and silt loam; the next part is friable channery silt loam; and the lower part is friable very channery silt loam. The substratum is yellowish brown, friable extremely channery silt loam about 14 inches thick. Sandstone and siltstone bedrock is at a depth of about 48 inches. In previously cultivated areas the surface layer is dark brown. In some areas it is channery silt loam. In a few areas bedrock is at a depth of 30 to 40 inches. Parts of many areas have a slope of 25 to 30 percent.

Included with these soils in mapping are small areas of the moderately well drained Coshocton soils on slight benches. Also included are a few areas of very stony soils. Included soils make up about 10 percent of most areas.

Permeability is moderate or moderately rapid in the Brownsville soil and moderate in the Westmoreland soil. The available water capacity is low in the Brownsville soil and low or moderate in the Westmoreland soil. Runoff is very rapid on both soils. Organic matter content is moderately low. The capacity to store and release plant nutrients is low in the Brownsville soil and low or moderate in the Westmoreland soil. Tilth is good in both soils. The root zone is deep. Unless the soils are limed, the subsoil of the Brownsville soil is strongly acid or very strongly acid and that of the Westmoreland soil is very strongly acid to medium acid.

A few areas are used as cropland. These soils are poorly suited to corn and small grain and are generally unsuited to soybeans because of the steep slope and a very severe erosion hazard. Also, the Brownsville soil is droughty. Most areas used as cropland are contour strips that are kept in forage crops much of the time. The long, uniform slopes are well suited to contour stripcropping. A system of conservation tillage that leaves crop residue on the surface helps to control erosion and conserves moisture.

Some areas are used as pasture and hayland. These soils are moderately well suited to hay and pasture. The slope limits the application of some pasture improvement measures. Alfalfa can grow well, but applications of lime are needed. Because of possible leaching and runoff losses, frequent, light applications of lime and fertilizer are preferable to less frequent, heavier applications. No-till seeding helps to control erosion. The good natural drainage permits grazing early in spring. The grasses and legumes in unimproved pastures grow very poorly during extended dry periods.

Many areas are used as woodland. These soils are moderately well suited to trees. Because of the lower available water capacity, growth rates are slower on the Brownsville soil than on the Westmoreland soil. They commonly are faster on north- and east-facing slopes than on south- and west-facing slopes because of cooler temperatures and less evapotranspiration. Constructing logging roads and skid trails across the slope facilitates the use of equipment and helps to control erosion. Seedling mortality on the Brownsville soil can be controlled by mulching or by planting seedlings that have been transplanted once. Plant competition on the Westmoreland soil can be controlled by spraying, mowing, or disking.

Numerous oil and gas wells are in areas of these soils. Severe erosion occurs when water collects and flows on the access roads to these wells. Keeping the gradient of these roads as low as possible and establishing water bars help to control erosion.

These soils are poorly suited to building site development and generally are unsuited to septic tank absorption fields because of the steep slopes. Considerable excavation is needed on building sites, and erosion during construction is a major problem. The buildings should be designed so that they conform to the natural slope of the land. Keeping as much vegetation on the site as possible during construction helps to control erosion.

The land capability classification is IVe. The woodland ordination symbol of the Brownsville soil is 3f on north aspects, 4f on south aspects; that of the Westmoreland soil is 2r on north aspects, 3r on south aspects.

BsF—Brownsville-Westmoreland complex, 25 to 40 percent slopes. These very steep, deep, well drained soils are on valley side slopes. Most areas are below benches or less sloping hilltops and extend down to a flood plain or a terrace. Some include both sides of a valley, whereas others include only one side. Slopes are smooth and commonly are steepest in the middle part of the side slopes. While the entire slope averages 25 to 40 percent, the middle part of many slopes has a gradient of 40 to 50 percent. Slopes are 100 to 800 feet long. Individual areas generally are 10 to 200 acres in size and are long and narrow.

Most areas are about 60 percent Brownsville channery silt loam and 30 percent Westmoreland silt loam. Commonly, the Brownsville soil is on the middle, steepest part of the slopes, and the Westmoreland soil is on the upper and lower parts. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Brownsville soil has a surface layer of very dark grayish brown, very friable channery silt loam about 2 inches thick. The subsoil is yellowish brown, very friable very channery silt loam about 32 inches thick. The substratum is yellowish brown, very friable extremely channery silt loam about 14 inches thick. Sandstone and siltstone bedrock is at a depth of about 48 inches. In places the surface layer is very channery silt loam.

Typically, the Westmoreland soil has a surface layer of dark grayish brown, very friable silt loam about 3 inches thick. The subsoil is about 37 inches thick. It is dark yellowish brown and yellowish brown. The upper part is friable and very friable loam and silt loam, the next part is friable channery silt loam, and the lower part is friable very channery silt loam. The substratum is yellowish brown, friable extremely channery silt loam about 10 inches thick. Sandstone and siltstone bedrock is at a depth of about 50 inches. In some areas the surface layer is channery silt loam. In other areas bedrock is at a depth of 30 to 40 inches.

Included with these soils in mapping are small areas of the moderately well drained Coshocton soils on slight benches, some areas of very stony soils, and a few areas of rock outcrop. The rock outcrop is on the upper part of the side slopes. Inclusions make up about 10 percent of most areas.

Permeability is moderate or moderately rapid in the Brownsville soil and moderate in the Westmoreland soil. The available water capacity is low in the Brownsville soil and low or moderate in the Westmoreland soil. Runoff is very rapid on both soils. Organic matter content is moderately low. The capacity to store and release plant nutrients is low in the Brownsville soil and low or moderate in the Westmoreland soil. Both soils have a deep root zone. The subsoil of the Brownsville soil is strongly acid or very strongly acid, and that of the Westmoreland soil is very strongly acid to medium acid.

A few areas are used as pasture. These soils generally are unsuited to row crops and are poorly suited to pasture because of the very steep slope and very severe hazards of erosion and drought. Slopes are too steep to permit intensive pasture management. Grasses in unimproved pastures grow poorly during all periods, except for early in spring.

Most areas are wooded. These soils are moderately well suited to trees. Because of the lower available water capacity, growth is slower on the Brownsville soil than on the Westmoreland soil. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and a lower evapotranspiration rate because of less exposure to the prevailing wind and the sun. The very steep slopes limit the use of some types of equipment. Erosion during harvest is a major hazard on the Westmoreland soil. Gullies form if water is allowed to collect and flow on logging trails. Laying out logging roads and skid trails across the slope helps to control erosion and facilitates the use of equipment. Water bars also help to control erosion. Seedling mortality on the Brownsville soil can be controlled by mulching or by planting seedlings that have been transplanted once.

Erosion is a major problem on access roads to oil and gas wells in areas of these soils. It can be controlled by constructing these roads across the slope, by mulching and reseeding, and by establishing water bars.

These soils generally are unsuited to building site development and septic tank absorption fields because of the very steep slopes.

The land capability classification is VIe. The woodland ordination symbol of the Brownsville soil is 3f on north aspects, 4f on south aspects; that of the Westmoreland soil is 2r on north aspects, 3r on south aspects.

BuG—Brownsville-Rock outcrop complex, 35 to 60 percent slopes. This map unit occurs as areas of a very steep, deep, well drained Brownsville soil intricately mixed with areas of Rock outcrop. It is on valley side slopes. It generally is below less sloping hilltops and above terraces or colluvial foot slopes. Most slopes are 100 to 500 feet long. They slope in one direction. Most areas are 20 to 250 acres in size and are long and narrow. They are about 65 percent Brownsville channery silt loam and 15 percent Rock outcrop. The Brownsville soil and Rock outcrop occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Brownsville soil has a surface layer of very dark grayish brown, very friable channery silt loam about 2 inches thick. The subsoil is yellowish brown, very friable very channery silt loam about 28 inches thick. The substratum is yellowish brown, very friable extremely channery silt loam about 12 inches thick. Sandstone bedrock is at a depth of about 42 inches.

The Rock outcrop is on vertical cliffs and ledges. The maximum height of the cliffs is about 25 feet. Some of the Rock outcrop is the sides of large rock masses that are not attached to solid rock.

Included in this unit in mapping are shallow and moderately deep soils in which 6 to 40 inches of very channery or extremely channery silt loam overlies bedrock. These soils make up about 20 percent of most areas.

Permeability is moderate or moderately rapid in the Brownsville soil. Runoff is very rapid. The available water capacity is low. The root zone is deep. Organic matter content is moderately low. The capacity to store and release plant nutrients is low.

Most areas are wooded. This map unit generally is unsuited to cultivated crops, pasture, and building site development because of the very steep slopes and the erosion hazard. The Brownsville soil is moderately well suited to woodland. Tree growth is slow because of the limited available water capacity. Because of the slope and the Rock outcrop, woodland improvement measures are severely limited and harvesting timber is difficult. Downslope slippage of mature trees is common. Laying out skid trails across the slope helps to control erosion and facilitates the use of equipment. Water bars also help to control erosion. Seedling mortality on the Brownsville soil can be controlled by mulching or by planting seedlings that have been transplanted once. Coves and north- and east-facing slopes are the best woodland sites.

The land capability classification is VIIe. The woodland ordination symbol of the Brownsville soil is 3f on north aspects, 4f on south aspects; the Rock outcrop is not assigned a woodland ordination symbol.

CaB—Canfield silt loam, 2 to 6 percent slopes. This gently sloping, deep, moderately well drained soil is on till plains. The largest areas are on hilltops that are surrounded by steeper slopes. These areas have long, uniform slopes and slope outward from a central dome or ridge line. They are 20 to 200 acres in size and are irregularly shaped. The smaller areas, 4 to 20 acres in size, are on foot slopes below steeper hillsides and on the concave parts of hilltops dominated by better drained soils. Many of these smaller areas are long and narrow.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is about 46 inches thick. It is mottled below a depth of about 16 inches. The upper part is yellowish brown and brown, firm, friable, and very firm silt loam and loam; the next part is a fragipan of yellowish brown, very firm, dense loam; and the lower part is yellowish brown, firm loam. The substratum to a depth of about 60 inches is dark yellowish brown, mottled, firm loam glacial till. In some spots the soil is eroded and has a surface layer of yellowish brown gravelly silt loam. In some small areas the soil is better drained and is not mottled above the fragipan. In some areas thin layers of sandy and gravelly material are in the substratum. In a few areas shattered sandstone bedrock is below a depth of 4 feet. In places the surface layer is thicker.

Included with this soil in mapping are small areas of the somewhat poorly drained Wadsworth soils in depressions and on the distinctly concave parts of the landscape. These soils make up about 5 percent of most areas.

Permeability is moderate above the fragipan of the Canfield soil and slow in the fragipan. Runoff is medium. The root zone is restricted by the dense fragipan at a depth of 18 to 28 inches. The available water capacity is low above the fragipan. A perched seasonal high water table is at a depth of 1.5 to 3.0 feet during extended wet periods. Organic matter content is moderately low or moderate. Tilth is good. The capacity to store and release plant nutrients is moderate. Where the soil is not limed, the upper part of the subsoil is strongly acid or very strongly acid.

Most areas are used as cropland. This soil is well suited to corn, soybeans, and small grain. Erosion is a moderate hazard in cultivated areas, especially those where slopes are long. It reduces the depth to the top of the fragipan, the depth to the perched seasonal high water table, and the thickness of the root zone. Cross-slope cultivation, forage crops, and a system of conservation tillage that leaves crop residue on the surface help to control erosion. Natural drainage is generally adequate for farming, but randomly spaced subsurface drains are needed in the wetter included soils. Good outlets for these drains are available in most areas. Measures that maintain tilth and applications of lime, fertilizer, and organic material are needed. Additions of organic material help to maintain tilth and control crusting.

Some areas are used for pasture and hay. This soil is well suited to forage crops. Most pastures are used as cropland part of the time. Intensive pasture management can be applied. Moderate to heavy applications of lime are needed if the forage mixture includes alfalfa. Long-term alfalfa stands can be damaged by the seasonal wetness early in spring. Pastures can be grazed early in spring.

A few areas are used as woodland. This soil is well suited to trees. Because of the gentle slopes, intensive woodland management can be applied. The windthrow hazard is moderate during wet periods. Selecting species for planting that are tolerant of a root-restricting layer in the subsoil helps to control seedling mortality and reduces the windthrow hazard. Also, frequent, light thinning and harvesting increase the vigor of the stand and reduce the windthrow hazard. Site preparation measures, such as mowing, spraying, or disking, help to control plant competition and foster the growth of desirable tree species. Removing the less desirable trees, shrubs, and vines also helps to control plant competition.

Because of the seasonal wetness, this soil is only moderately well suited to building site development. Water moves laterally along the top of the fragipan. Installing drains at the base of footings removes this water and helps to keep basements dry. Distinctly concave parts of the landscape should not be selected as building sites.

This soil is only moderately well suited to septic tank absorption fields because of the slow permeability and the seasonal wetness. Increasing the size of the absorption field and installing the distribution lines as shallow as possible help to overcome the restricted permeability. Installing perimeter drains around the absorption field lowers the seasonal high water table.

Excavated ponds in areas of this soil are likely to hold water. Onsite investigation is needed. Some areas do not receive enough runoff to fill a pond.

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

CaC—Canfield silt loam, 6 to 12 percent slopes. This sloping, deep, moderately well drained soil is on till plains. It is on side slopes in small valleys and on concave foot slopes that are subject to seepage. Some areas slope in one direction, whereas others include both sides of a small valley. Slopes are 100 to 350 feet long. Most areas are 5 to 30 acres in size and are long and narrow.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is about 42 inches thick. It is mottled below a depth of about 17 inches. The upper part is yellowish brown, firm silt loam and loam; the next part is a fragipan of yellowish brown, very firm loam; and the lower part is yellowish brown, firm loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm loam glacial till. In some areas the soil is eroded and has a surface layer of yellowish brown gravelly silt loam. In places shattered bedrock or thin layers of sandy loam or gravelly loam are below a depth of 4 feet.

Included with this soil in mapping are small areas of the somewhat poorly drained Wadsworth soils. These soils are in concave areas and around springs and seepy areas. Also included are very narrow strips of soils that do not have a fragipan. These soils are in valleys and commonly are wetter than the Canfield soil. Included soils make up about 15 percent of most areas.

Permeability is moderate above the fragipan of the Canfield soil and slow in the fragipan. Runoff is rapid. The root zone is restricted by the dense fragipan at a depth of 18 to 28 inches. The available water capacity is low above the fragipan. A perched seasonal high water table is at a depth of 1.5 to 3.0 feet during extended wet periods. Organic matter content is moderately low or moderate. Tilth is good. The capacity to store and release plant nutrients is moderate. Where the soil is not limed, the upper part of the subsoil is strongly acid or very strongly acid.

Some areas are used as cropland. This soil is moderately well suited to corn and small grain and to soybeans occasionally grown in a rotation that includes small grain or forage. If the soil is cultivated, erosion is a severe hazard. It is especially severe when the rotation consists mainly of corn and soybeans. Erosion reduces the depth to the dense fragipan layer and the available water capacity. It can be controlled by applying a system of conservation tillage that leaves crop residue on the surface, cultivating across the slope, including forage crops in the cropping sequence, and returning crop residue to the soil. Leaving small natural drainageways where water collects and flows in a permanent cover of vegetation helps to prevent gullying. Natural drainage is generally adequate for crops, but randomly spaced subsurface drains are needed in springs, seeps, and the wetter included soils. Additions of organic matter help to restore the productivity of eroded spots.

Some areas are used as pasture. This soil is well suited to a variety of forage crops. Pastures can be grazed early in spring. Intensive pasture management can be applied. No-till seeding methods help to control erosion. Moderate to heavy applications of lime are needed if the forage mixture includes alfalfa.

Some areas are used as woodland. This soil is well suited to trees. The windthrow hazard is moderate during wet periods. Selecting species for planting that are tolerant of a root-restricting layer in the subsoil helps to control seedling mortality and reduces the windthrow hazard. Also, frequent, light thinning and harvesting increase the vigor of the stand and reduce the windthrow hazard. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is moderately well suited to building site development. Buildings should be designed so that they conform to the natural slope of the land. The susceptibility to erosion increases during construction. It can be reduced by reseeding or mulching. Water seeps along the top of the fragipan. Installing drains at the base of footings removes this water and helps to keep basements dry. These drains are especially needed on the upslope side of the basement. Distinctly concave areas, seepy spots, and springs should not be selected as building sites.

This soil is poorly suited to septic tank absorption fields because of the slow permeability and the seasonal wetness. Effluent seeps downslope along the top of the fragipan. This seepage can be controlled by increasing the size of the absorption field and by installing the distribution lines as shallow as possible. Installing the distribution lines across the slope helps to prevent seepage of the effluent to the surface. Installing perimeter drains around the absorption fields lowers the seasonal high water table.

Ponds dug in areas of this soil are likely to hold water. Onsite investigation is needed. Some natural pond sites are in areas where the soil is on both sides of a small natural drainage course.

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

CdB—Centerburg silt loam, 2 to 6 percent slopes. This gently sloping, deep, moderately well drained soil is on hilltops and knolls on till plains. The larger areas, 20 to 200 acres in size, are on broad hilltops between narrow, steep-sided valleys. They are irregularly shaped and slope outward from a ridge line. The areas on knolls are roughly circular and are 2 to 10 acres in size. They rise above a landscape dominated by wetter soils.

Typically, the surface layer is dark brown, friable silt loam about 7 inches thick. The subsoil is about 44 inches thick. It is yellowish brown. The upper part is friable silt loam and firm silty clay loam, and the lower part is mottled, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm loam. In some eroded spots the surface layer is lighter colored. In places pockets and lenses of sandy loam and gravelly loam are below a depth of 3 feet. In some areas the soil is deeper to carbonates and has a thicker subsoil.

Included with this soil in mapping are small areas of the somewhat poorly drained Bennington and poorly drained Condit soils in small, closed depressions and on the lower, more concave parts of some slopes. These soils make up about 10 percent of most areas.

Permeability is moderately slow in the Centerburg soil. Runoff is medium. The available water capacity is moderate or high. The seasonal high water table is at a depth of 18 to 36 inches during extended wet periods. Organic matter content is moderate. Tilth is good. The capacity to store and release plant nutrients is high. The subsoil is medium acid to very strongly acid in the upper part and medium acid to neutral in the lower part.

Most areas of this soil are used as cropland. This soil is well suited to corn, soybeans, and small grain. Erosion is a moderate hazard in cultivated areas. The hazard is greatest where slopes are long. Stripcropping or cross-slope cultivation helps to control erosion where slopes are uniform. A system of conservation tillage that leaves crop residue on the surface is suitable in most areas, including those where slopes are short and irregular. Additions of organic matter help to maintain tilth. Cover crops reduce the runoff rate. Natural drainage is generally adequate for most crops, but randomly spaced subsurface drains are beneficial, especially in the larger areas of the wetter included soils. Applications of lime and fertilizer are needed.

Some areas are used as pasture. This soil is well suited to a variety of pasture and hay species. A cover of forage crops is effective in controlling erosion. Pasture plants can be grazed early in the year and grow well during dry periods.

A few areas are used as woodland. This soil is well suited to trees. Site preparation measures, such as mowing, spraying, or disking, help to control plant competition and foster the growth of desirable tree species.

This soil is moderately well suited to building site development. The seasonal wetness is a limitation, especially on sites for buildings with basements. This limitation can be minimized by installing drains at the base of footings and by selecting the highest landscape positions as sites for buildings. Erosion is a hazard during construction. It can be controlled by maintaining a vegetative cover or by mulching. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling.

This soil is moderately well suited to septic tank absorption fields. The seasonal wetness and the moderately slow permeability are severe limitations. Increasing the size of the absorption field helps to overcome the restricted permeability. Installing perimeter drains around the absorption field lowers the seasonal high water table. The wetter included soils should not be selected as sites for absorption fields.

Ponds dug in areas of this soil are likely to hold water. Most areas on knolls and some on hilltops do not receive enough runoff to fill a pond.

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

CdB2—Centerburg silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, moderately well drained soil is on hilltops and knolls on till plains. Erosion has removed part of the original surface soil, and the present plow layer contains some subsurface and subsoil material. The larger areas, 20 to 200 acres in size, are on hilltops between narrow, steep-sided valleys. They are irregularly shaped and slope outward from a ridge line. The areas on knolls are roughly circular and are 2 to 10 acres in size. They rise above a landscape dominated by wetter soils.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is yellowish brown, firm silty clay loam and clay loam about 39 inches thick. It is mottled below a depth of about 18 inches. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm loam. In places pockets and lenses of gravelly loam are below a depth of 3 feet. In some areas the soil is deeper to carbonates and has a thicker subsoil.

Included with this soil in mapping are small severely eroded areas where the surface layer is yellowish brown silty clay loam. Also included are small areas of the somewhat poorly drained Bennington soils in low or concave spots and the poorly drained Condit soils in narrow drainageways. Included soils make up about 10 percent of most areas.

Permeability is moderately slow in the Centerburg soil. Runoff is medium. The available water capacity is moderate. The seasonal high water table is at a depth of 18 to 30 inches during extended wet periods. Organic matter content is moderately low. Tilth is good. The capacity to store and release plant nutrients is high. The subsoil is medium acid to very strongly acid in the upper part and medium acid to neutral in the lower part.

Most areas are or formerly were used as cropland. This soil is well suited to corn and small grain and is moderately well suited to soybeans. If the soil is cultivated, erosion is a hazard. It has reduced productivity. In the larger areas cultivating across the slope, returning crop residue to the soil, applying a system of conservation tillage that leaves crop residue on the surface, and growing forage crops help to control further erosion. Many of the smaller areas on knolls are parts of fields that are not actively managed for erosion control. In these areas additions of organic material help to restore productivity and control erosion. In most areas natural drainage is adequate for crops, but randomly spaced subsurface drains are needed in the wetter included areas. The smaller areas on knolls commonly are drained along with the surrounding wetter soils.

A few areas are used as hayland and pasture. This soil is well suited to hay and pasture. A cover of grasses and legumes helps to control further erosion and increases the organic matter content. No-till seeding methods also help to control erosion. Pasture plants can be grazed early in the year and grow moderately well during dry periods.

The only woodland is in fields formerly used as cropland. This soil is well suited to trees. Site preparation measures, such as mowing, spraying, or disking, help to control plant competition and foster the growth of desirable tree species.

This soil is moderately well suited to building site development. The seasonal wetness is a limitation, especially on sites for buildings with basements. This limitation can be minimized by installing drains at the base of footings and by selecting the highest landscape positions as sites for buildings. Erosion is a hazard during construction. It can be controlled by maintaining a vegetative cover or by mulching. Mulching helps to establish lawns. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling.

This soil is moderately well suited to septic tank absorption fields. The seasonal wetness and the moderately slow permeability are severe limitations. Increasing the size of the absorption field helps to overcome the restricted permeability. Installing perimeter drains around the absorption field lowers the seasonal high water table. The wetter included soils should not be selected as sites for absorption fields.

Ponds dug in areas of this soil are likely to hold water. Many areas on knolls and some on hillsides do not receive enough runoff to fill a pond.

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

CdC—Centerburg silt loam, 6 to 12 percent slopes. This sloping, deep, moderately well drained soil is on knolls and the sides of small valleys on till plains. Most areas include both sides of drainageways. Slopes in these areas are mostly 80 to 250 feet long and are smooth. Those on the knolls are mostly 60 to 200 feet long and are irregular. Seeps and springs are in a few areas. Individual areas are mainly 4 to 80 acres in size and vary in shape.

Typically, the surface layer is dark brown, friable silt loam about 7 inches thick. The subsoil is about 42 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is yellowish brown, mottled, firm silty clay loam and clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm loam. In many small areas the slope is less than 6 percent. In some eroded spots the surface layer is lighter colored. In places pockets and lenses of gravelly loam are below a depth of 3 feet. In a few areas the soil is deeper to carbonates and has a thicker subsoil.

Included with this soil in mapping are small areas of the somewhat poorly drained Bennington and Shoals soils and the poorly drained Condit soils. Bennington soils are on the lower, more concave parts of the slopes and in closed depressions. Condit soils are along drainageways. Shoals soils are on narrow flood plains. Included soils make up about 15 percent of most areas.

Permeability is moderately slow in the Centerburg soil. Runoff is rapid. The available water capacity is moderate or high. The seasonal high water table is at a depth of 18 to 36 inches during extended wet periods. Organic matter content is moderate. Tilth is good. The capacity to store and release plant nutrients is high. The subsoil is medium acid to very strongly acid in the upper part and medium acid to neutral in the lower part.

Some areas are used as cropland. This soil is moderately well suited to corn, soybeans, and small grain. If the soil is cultivated, erosion is a severe hazard. It can be controlled by cover crops and a system of conservation tillage that leaves crop residue on the surface. Only a few areas have slopes smooth enough for contour stripcropping. Natural drainage is generally adequate for farming, but randomly spaced subsurface drains are needed in springs, seeps, and the wetter included soils. Small natural drainage courses cross many areas. Establishing grassed waterways in these areas helps to prevent gullying. Grassed strips on the concave parts of irregular slopes also help to prevent gullying.

Some areas are used as hayland and pasture. This soil is well suited to hay and pasture. Leaving the soil in sod is a good erosion-control practice. No-till seeding methods also help to control erosion. Pasture plants can be grazed early in the year and grow moderately well during dry periods.

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

This soil is moderately well suited to building site development and septic tank absorption fields. The seasonal wetness, the slope, the moderately slow permeability, and a moderate shrink-swell potential are limitations. Installing drains at the base of footings helps to keep basements dry. Erosion is a hazard during construction, especially in the larger developments. As a result, a plant cover should be reestablished as soon as possible. Settling basins are needed in some large construction projects. Buildings should be designed so that they conform to the natural slope of the land. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent lateral seepage of the effluent to the surface. Increasing the size of the absorption field helps to overcome the restricted permeability.

Some good pond sites are available in areas where this soil is on both sides of a small valley. Onsite investigation is needed because soil conditions vary greatly at the bottom of these valleys.

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

CdC2—Centerburg silt loam, 6 to 12 percent slopes, eroded. This sloping, deep, moderately well drained soil is on till plains. It is on rounded hilltops, side slopes in small valleys, and high knolls. Erosion generally has removed part of the original surface layer, and the present plow layer contains some subsoil material. Seeps are in a few areas. Slopes on the hilltops and the sides of valleys are smooth or irregular and are 100 to 600 feet long. These areas are mostly 10 to 100 acres in size and are long and narrow. Slopes on the knolls are irregular and are 50 to 200 feet long. The knolls are 3 to 10 acres in size and are roughly circular.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is yellowish brown, firm silty clay loam and clay loam about 32 inches thick. It is mottled below a depth of about 16 inches. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm loam. In some areas the soil is significantly eroded and has a darker surface layer. In places pockets and lenses of gravelly loam are in the substratum. In numerous small areas the slope is less than 6 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Bennington and Shoals soils and the poorly drained Condit soils. Bennington soils are on the lower, more concave parts of slopes and in closed depressions. Condit soils are in drainageways. Shoals soils are on flood plains. Also included are severely eroded soils that have a yellowish brown silty clay loam surface layer. These soils are dominant in a few areas but more commonly are confined to spots less than 3 acres in size on the higher, steeper parts of the landscape. Included soils make up about 20 percent of most areas.

Permeability is moderately slow in the Centerburg soil. Runoff is rapid. The available water capacity is moderate. The seasonal high water table is at a depth of 18 to 36 inches during extended wet periods. Organic matter content is moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. The subsoil is medium acid to very strongly acid in the upper part and medium acid to neutral in the lower part.

Most areas are or formerly were used as cropland. This soil is moderately well suited to corn and small grain and to occasionally grown soybeans. Significant erosion has occurred and is likely to continue unless the soil is carefully managed. Suitable erosion-control practices include cross-slope cultivation, cover crops, a system of conservation tillage that leaves crop residue on the surface, and a cropping sequence that includes forage crops. Additions of organic material help to restore productivity. Many of the smaller areas of this soil are parts of fields dominated by less sloping soils that are not intensively managed for erosion control. Adding organic material and returning crop residue to the soil help to control further erosion in these areas. Natural drainage is generally adequate for crops, but randomly spaced subsurface drains are needed in the wetter included soils and in seeps. Careful design of the drainage system is needed to avoid an excessive grade.

Only a few areas are used for hay and pasture. This soil is well suited to forage crops. A cover of forage plants helps to control erosion and increases the organic matter content. Pasture plants can be grazed early in the year and grow moderately well during dry periods. No-till seeding methods help to control erosion.

The only woodland is in fields formerly used as cropland or pasture. This soil is well suited to trees. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is moderately well suited to building site development and septic tank absorption fields. The slope, the seasonal wetness, the moderately slow permeability, and a moderate shrink-swell potential are limitations. Installing drains at the base of footings helps to keep basements dry. The buildings should be designed so that they conform to the natural slope of the land. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Erosion is a hazard during construction, especially in the larger developments. Scalped areas should be reseeded as soon as possible. Adding organic matter and mulching help to establish lawns. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent lateral seepage of the effluent to the surface. Increasing the size of the absorption field helps to overcome the restricted permeability. The wetter included soils should not be selected as sites for absorption fields or buildings.

Some good pond sites are available in areas where this soil is on both sides of a small valley. Soil conditions vary at the bottom of these valleys. As a result, onsite investigation is needed.

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

ChB—Chili gravelly loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is on terraces and outwash plains. Slopes are dominantly short and irregular. Most areas are 3 to 15 acres in size and are roughly circular.

Typically, the surface layer is dark brown, friable gravelly loam about 9 inches thick. The subsoil is about 41 inches thick. It is yellowish brown. The upper part is loam and gravelly loam, and the lower part is gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose gravelly loamy sand. The surface layer is loam or silt loam in some areas.

Included with this soil in mapping are small areas of the somewhat poorly drained Jimtown soils and, on the outwash plains, many small areas of soils that have glacial till at a depth of 5 to 8 feet. Jimtown soils are in depressions and seepy areas. Also included are soils that have a sandy loam surface layer and subsoil and are more droughty than the Chili soil. These droughtier soils occur as small spots in many areas. They are dominant in some areas north of Knox Lake, in Berlin Township. Included soils make up about 15 percent of most areas.

Permeability is moderately rapid in the Chili soil. Runoff is slow. The available water capacity is low or moderate. Organic matter content is moderate or moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. The subsoil is slightly acid to strongly acid.

Some areas are used as cropland. This soil is well suited to corn, soybeans, and small grain. Erosion is a hazard in cultivated areas. Some erosion-control measures, such as contour stripcropping, are not suitable in many areas because of the irregular slopes. The soil is droughty. It is very well suited to no-till or other systems of conservation tillage that leave crop residue on the surface. These systems help to control erosion and conserve moisture. Cover crops also help to control erosion. The soil is suited to irrigation if erosion is controlled. Additions of lime and fertilizer are needed. Some leaching of plant nutrients can be expected.

Some areas are used as hayland and pasture. This soil is well suited to hay and pasture. The good natural drainage permits grazing early in spring. Intensive pasture management can be applied. Grasses in unimproved pastures do not grow well during extended dry periods. Those in seeded and fertilized pastures grow better during these periods. In areas where lime has been applied, alfalfa is suitable. Because of deep rooting, it can withstand drought better than most other legumes.

A few areas are used as woodland. This soil is well suited to trees. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is well suited to building site development and septic tank absorption fields. The gentle slope, the moderately rapid permeability, and the good natural drainage favor these uses. Mulching may be needed on lawns if subsoil and substratum layers are exposed during construction. Installing the distribution lines in septic tank absorption fields too deep into the soil can result in the pollution of ground water supplies. Safety precautions are needed to prevent the caving of cutbanks in excavations.

This soil is a probable source of sand and gravel. The best sources are on terraces in the major stream valleys. The depth to useable gravel deposits and the thickness of these deposits vary greatly. The included soils on outwash plains have glacial till at a depth of 5 to 8 feet. They have only a thin layer of sand or gravel. Ponds dug in areas of this soil are very unlikely to hold water.

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

ChC—Chili gravelly loam, 6 to 12 percent slopes. This deep, sloping, well drained soil is dominantly on kames. In some areas, however, it is on breaks between two terrace levels or between a terrace and a flood plain. Most areas on kames have one or more conical knolls, each of which has its own set of short, complex slopes. The larger areas on kames have a very complex slope pattern. Slopes are commonly 60 to 250 feet long. Individual areas are 2 to 40 acres in size and vary in shape.

Typically, the surface layer is dark brown, friable gravelly loam about 8 inches thick. The subsoil is about 40 inches thick. It is yellowish brown. The upper part is loam and gravelly loam, and the lower part is gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose gravelly loamy sand. In some areas the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are soils having a sticky gravelly clay loam subsoil that extends to a depth of 10 feet or more. These soils are less droughty than the Chili soil. They are most common on high kames along the Mohican River. Also included are small areas of soils that have a sandy loam surface layer and a sandy loam or loamy sand subsoil, wet spots in depressions between kames, and small areas of soils that have glacial till at a depth of 5 to 8 feet. The sandier soils are more droughty than the Chili soil. They occur as spots in most areas. They are the dominant soils in the areas of this unit on the north side of Knox Lake, in Berlin Township. Included soils make up about 15 percent of most areas.

Permeability is moderately rapid in the Chili soil. Runoff is medium. The available water capacity is low or moderate. Organic matter content is moderate or moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. The subsoil is strongly acid to slightly acid. The root zone is deep.

Most areas are used as cropland. This soil is moderately well suited to corn, soybeans, and small grain. If the soil is cultivated, erosion is a severe hazard. Also, the soil is droughty. A system of conservation tillage that leaves crop residue on the surface is well suited to this soil. The buildup of crop residue on the surface helps to control erosion and conserves moisture. Cover crops also help to control erosion. A few areas are suited to contour stripcropping, but many areas have slopes that are too irregular for this practice.

Some areas are used as pasture and hayland. This soil is well suited to hay and pasture. In areas where lime has been applied, alfalfa is suitable. Because plant nutrients are moderately rapidly leached, plants on this soil generally respond better to smaller, more frequent or more timely applications of fertilizer than to one large application. The good natural drainage permits grazing early in spring. Pasture grasses do not grow well during extended dry periods. Alfalfa grows better than other species during these periods. Slopes do not restrict pasture seeding and management.

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

This soil is moderately well suited to building site development and septic tank absorption fields. The good natural drainage and the moderately rapid permeability favor these uses, but the slope is a limitation. The buildings should be designed so that they conform to the natural slope of the land. Erosion is a hazard during construction. It can be controlled by keeping as much vegetation on the site as possible during construction. If the subsoil and substratum are exposed in excavations, reseeding is difficult. Septic tank effluent can seep downslope. This seepage can be controlled by installing the distribution lines in septic tank absorption fields across the slope. Installing the distribution lines too deep into the soil can result in the pollution of ground water supplies.

This soil is a probable source of sand and gravel. The depth to useable layers, the thickness of these layers, and the size of the material vary greatly. The thickest deposits commonly are on terraces in the major stream valleys. The small areas of included soils that are underlain by glacial till at a depth of 5 to 8 feet have only a thin layer of sand and gravel. Ponds dug in areas of this soil are very unlikely to hold water.

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

ChD—Chili gravelly loam, 12 to 18 percent slopes. This moderately steep, deep, well drained soil is dominantly on terraces, outwash plains, and kames. The kames are rounded hills that have short, very irregular slopes. Areas on terraces have short slopes that separate two terrace levels or a terrace and a flood plain. These areas slope uniformly in one direction. A few areas are on side slopes in valleys on till-capped outwash plains. Both sides of the valley commonly are included in these areas. Most slopes are 60 to 300 feet long. Areas generally are 5 to 40 acres in size. Most areas on terraces and outwash plains are long and narrow.

Typically, the surface layer is dark brown, friable gravelly loam about 7 inches thick. The subsoil is about

48 inches thick. It is yellowish brown. The upper part is friable gravelly loam, and the lower part is very friable gravelly sandy loam and gravelly loamy sand. The substratum to a depth of about 60 inches is yellowish brown, loose very gravelly loamy sand. In places, the surface layer is loam or gravelly sandy loam and the subsoil is sandy loam or gravelly sandy loam throughout.

Included with this soil in mapping are areas of soils that have 12 to 18 inches of loam or silt loam glacial till in the upper part. These soils are on the upper part of the slopes. They are most extensive in the North Liberty area and in the valleys connecting the Mohican River and Jelloway Creek, north of Danville. Also included are soils having a sticky gravelly clay loam subsoil that extends to a depth of 8 feet or more and some springs and seepy areas, where the soil is mottled. The soils that have a sticky subsoil are most common on the side slopes of large valleys and on high kames in the eastern part of the county. Inclusions make up about 15 percent of most areas.

Permeability is moderately rapid in the Chili soil. Runoff is rapid. The available water capacity is low. Organic matter content is moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. The subsoil is strongly acid or medium acid in the upper part and strongly acid to slightly acid in the lower part.

Some areas are used as cropland. Most of these areas are in parts of fields dominated by less sloping soils. Because of the erosion hazard and droughtiness, this soil is poorly suited to conventionally tilled corn and small grain and generally is unsuited to soybeans. If the soil is cultivated, erosion is a very severe hazard. It removes the finer soil particles that store water and plant nutrients, leaving the gravel behind. If carefully managed for erosion control, the soil is suited to occasionally grown corn. Some areas are suited to contour stripcropping and to cross-slope cultivation. A system of conservation tillage that leaves crop residue on the surface helps to control erosion and conserves moisture. Additions of organic material help to maintain the productivity of the soil. Because of runoff and leaching, frequent, light applications of lime and fertilizer are preferable to less frequent, heavier applications.

Many areas are used as hayland and pasture. This soil is well suited to forage crops that are tolerant of drought. The good natural drainage permits grazing early in spring. Most pasture plants do not grow well during the dry part of the summer. Alfalfa grows better than other species during dry periods. Overgrazing results in erosion. Plant nutrients are moderately rapidly leached from this soil.

Some areas are wooded. This soil is well suited to trees. Logging trails should be constructed so that water does not collect and flow on them. Constructing logging roads and skid trails across the slope facilitates the use of equipment and helps to control erosion. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is poorly suited to building site development and septic tank absorption fields. The good natural drainage favors these uses, but the slope is a limitation. Considerable excavation commonly is needed on building sites. Less excavation commonly is needed on sites for structures built into the hillside. Scalped areas are erosive and difficult to reseed. The surface layer should be stockpiled and returned to the construction site as soon as possible. Downslope seepage of septic tank effluent is likely. This seepage can be controlled by installing the distribution lines in septic tank absorption fields across the slope. Installing the distribution lines too deep into the soil can result in pollution of ground water supplies.

This soil is a probable source of gravel and sand. The depth to and thickness of such deposits and the amount and size of the pebbles vary greatly. The thickest layers of gravel are in the terraces along the major stream valleys. Cobbles and small boulders are mixed with the gravel in areas along the Mohican River. Because of seepage, ponds dug in areas of this soil are unlikely to hold water.

The land capability classification is IVe. The woodland ordination symbol is 2r.

ChE—Chili gravelly loam, 18 to 25 percent slopes. This steep, deep, well drained soil is on kames, terraces and valley sidewalls. Areas on terraces have short slopes that separate two terrace levels or a terrace and a flood plain. These areas slope uniformly in one direction and are long and narrow. Areas on kames have short, irregular slopes and are rounded. Those on valley sidewalls slope in one direction and are long and narrow. Slopes are 60 to 300 feet long. Most areas are 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown gravelly loam about 2 inches thick. The subsoil is about 45 inches thick. It is yellowish brown. The upper part is friable gravelly loam, and the lower part is very friable gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose gravelly loamy sand. In some areas on valley sides, shattered bedrock or glacial till is below a depth of 40 inches. In places the surface layer and the upper part of the subsoil are gravelly sandy loam.

Included with this soil in mapping are many narrow strips where the slope is 25 to 50 percent and some sizable areas south of Brinkhaven, in Union Township, where the slope is 40 to 50 percent. In some included areas along the valley of the Mohican River, the soils have a sticky gravelly clay loam subsoil that extends to a depth of 8 feet or more. In a few included areas near North Liberty and in southern Jefferson Township, the soils have a thin cap of loam glacial till. Also included are a few springs and seepy areas, where the soils are wetter than the Chili soil. Inclusions make up about 20 percent of most areas.

Permeability is moderately rapid in the Chili soil. Runoff is very rapid. The available water capacity is low. Organic matter content is moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. The subsoil is strongly acid to slightly acid.

Few areas are used as cropland. These areas are commonly in small parts of fields dominated by less sloping soils. Most of these areas are difficult to manage separately. This soil generally is unsuited to cultivated crops because of a very severe erosion hazard. Also, the soil is droughty. The use of some kinds of machinery is limited by the slope. Leaving the soil in sod helps to control erosion.

Some areas are used as pasture. This soil is moderately well suited to pasture and is poorly suited to hay. The good natural drainage permits grazing early in spring. Growth is slow during the dry part of the summer. Drought-resistant species, such as alfalfa, are the best suited plants. Overgrazing results in erosion. The slope prohibits some management practices. No-till methods of seeding help to control erosion.

Some areas are wooded. This soil is well suited to trees. Planting trees in areas where the soil is in narrow strips is a good erosion-control measure. The use of some types of logging equipment is hampered by the slope. Constructing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is poorly suited to building site development and septic tank absorption fields because of the steep slopes. Considerable excavation commonly is needed on building sites. The soil is best suited to specially designed structures built into the hillside. The good natural drainage favors underground dwellings. Downhill seepage of effluent from septic tanks is a serious limitation. It can be controlled by installing the distribution lines in septic tank absorption fields on the contour. Erosion can be controlled by keeping as much vegetation on the site as possible during construction.

This soil is a probable source of sand and gravel. The amount and size of the pebbles differ between areas and between layers in the substratum. Cobbles and small boulders are mixed with the gravel in some layers, especially in areas along the Mohican River. Because of seepage, ponds dug in areas of this soil are unlikely to hold water.

The land capability classification is VIe. The woodland ordination symbol is 2r.

CmA—Chili silt loam, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on terraces. Individual areas are 5 to 50 acres in size and vary in shape.

Typically, the surface layer is dark brown, friable silt loam about 10 inches thick. The subsoil is about 42 inches thick. The upper part is yellowish brown, firm silt loam and clay loam, and the lower part is strong brown, friable and firm, sticky gravelly loam and gravelly clay loam. The substratum to a depth of about 60 inches is yellowish brown, loose, stratified gravelly sand and gravelly loamy sand. In some areas glacial till or shattered bedrock is at a depth of 4 to 5 feet. In other areas the surface layer is sandy loam or gravelly loam. In some concave areas the soil is moderately well drained.

Included with this soil in mapping are small areas of soils that have more silt and clay in the substratum. These soils are not a probable source of sand and gravel. They make up about 10 percent of most areas.

Permeability is moderately rapid in the Chili soil. Runoff is slow. The available water capacity is moderate. Organic matter content is moderate or moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. The subsoil is strongly acid to slightly acid. The root zone is deep.

Most areas are used as cropland. This soil is well suited to corn, soybeans, small grain, and specialty crops. The hazard of erosion is slight. The soil is droughty during dry periods. The main management concerns are conserving moisture and maintaining fertility, a sufficient amount of lime, and the organic matter content. This soil is well suited to irrigation and to no-till planting or other systems of conservation tillage that leave crop residue on the surface.

Some areas are used as pasture. This soil is well suited to a variety of forage plants. Intensive pasture management can be applied. In areas where lime has been applied, alfalfa is suitable. Because of deep rooting, it can withstand drought better than most other legumes. Pasture plants can be grazed early in the year and grow moderately well throughout the dry part of the summer. Cultivated crops can be grown to aid in seedling establishment and weed control.

Only a few small areas are used as woodland. This soil is well suited to trees. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is well suited to building site development and septic tank absorption fields. The good natural drainage and the nearly level slope favor these uses. Safety precautions are needed to prevent the caving of cutbanks in excavations. Installing the distribution lines in septic tank absorption fields too deep into the soil can result in the pollution of ground water supplies.

This soil is a probable source of sand and gravel. The amount and size of the pebbles differ considerably between areas and between layers in the substratum. Ponds dug in areas of this soil are very unlikely to hold water.

The land capability classification is IIs. The woodland ordination symbol is 2o.

CmB—Chili silt loam, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on terraces. It makes up the entire area of some terraces and the gently undulating or gently sloping parts of others. A few areas are on fans and on foot slopes along the sides of valleys. Some areas slope smoothly in one direction. Others have wavy or hummocky surfaces. Individual areas are 5 to 50 acres in size and vary in shape.

Typically, the surface layer is dark brown, friable silt loam about 10 inches thick. The subsoil is about 42 inches thick. The upper part is yellowish brown, firm silt loam and clay loam, and the lower part is strong brown, friable and firm gravelly loam and gravelly clay loam. The substratum to a depth of about 60 inches is yellowish brown, very friable, stratified gravelly sand and gravelly loamy sand. In some areas glacial till or shattered bedrock is at a depth of 4 to 5 feet. In other areas the surface layer is sandy loam. In places the lower part of the subsoil and the substratum have less gravel.

Included with this soil in mapping are small areas of soils that have more silt and clay in the substratum. These soils are not a probable source of sand and gravel. They make up about 10 percent of most areas.

Permeability is moderately rapid in the Chili soil. Runoff is slow. The available water capacity is moderate. Organic matter content is moderate or moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. The root zone is deep. The subsoil is slightly acid to strongly acid.

Most areas are used as cropland. The soil is well suited to corn, soybeans, small grain, orchards, and specialty crops. It is well suited to no-till planting or other systems of conservation tillage that leave crop residue on the surface. These tillage systems conserve moisture and help to control erosion (fig. 4). Including an occasional forage crop in the cropping sequence also reduces the erosion hazard. Because the soil is droughty, irrigation is needed during dry periods if shallow rooted crops are grown.

Some areas are used for hay and pasture. This soil is well suited to forage crops. Intensive pasture management can be applied. Most pastured areas are used as cropland part of the time. The good natural drainage permits grazing early in spring. Pasture plants grow moderately well during the dry part of the summer. In areas where lime has been applied, alfalfa is suitable. Because of deep rooting, it can withstand drought better than most other legumes.

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

This soil is well suited to building site development and septic tank absorption fields. The gentle slope, the good natural drainage, and the moderately rapid permeability favor these uses. Safety precautions are needed to prevent the caving of cutbanks in excavations. Installing the distribution lines in septic tank absorption fields too deep into the soil can result in the pollution of ground water supplies.

This soil is a probable source of sand and gravel. Ponds dug in areas of this soil are very unlikely to hold water.

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

CnC—Chili-Homewood silt loams, 6 to 12 percent slopes. These sloping, deep soils are on moraines, on kames, in valley plugs, and in areas where a mantle of glacial till is on outwash plains. The Chili soil is well drained, and the Homewood soil is well drained and moderately well drained. Most areas are along the sides of wide valleys between bedrock-controlled hills. Many are on or near a divide across the valley. Some are along the sides and at the mouth of narrow, steep-sided valleys. Most of the gravel in these areas is angular sandstone fragments. Some areas have short, irregular slopes, and some slope uniformly in one direction. Slopes are 60 to 300 feet long. Most areas range from 2 to 20 acres in size. They vary in shape.

Most areas are about 55 percent Chili silt loam and 35 percent Homewood silt loam. In the North Liberty area, the Homewood soil commonly is higher on the landscape than the Chili soil. In most areas, however, the two soils do not occur in a predictable pattern. They occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Chili soil has a surface layer of dark brown, friable silt loam about 7 inches thick. The subsoil is about 45 inches thick. It is yellowish brown. The upper part is friable loam and silt loam, the next part is very friable gravelly loam, and the lower part is very friable gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose gravelly loamy sand. In places the subsoil and substratum have only a few pebbles. In some areas the soil is eroded. In some spots the surface layer is loam or sandy loam.

Typically, the Homewood soil has a surface layer of dark brown, friable silt loam about 10 inches thick. The subsoil is about 42 inches thick. The upper part is yellowish brown, firm loam and clay loam, and the lower part is a fragipan of yellowish brown, mottled, very firm, dense clay loam. The substratum to a depth of about 60 inches is yellowish brown, firm loam. In some areas the soil does not have a fragipan or has only a thin fragipan. In other areas the soil is eroded. In a few areas bedrock is at a depth of 40 to 60 inches.

Included with these soils in mapping are small areas of the somewhat poorly drained Jimtown and Fitchville soils in depressions, in seepy areas, and around springs. These soils make up about 10 percent of most areas.

Permeability is moderately rapid in the Chili soil. It is moderate above the fragipan in the Homewood soil and slow in and below the fragipan. Runoff is medium on the Chili soil and rapid on the Homewood soil. The available

Figure 4.—Crop residue on the surface in an area of Chili silt loam, 2 to 6 percent slopes.

water capacity is low or moderate in the Chili soil and low in the Homewood soil. The Homewood soil has a perched seasonal high water table at a depth of 30 to 48 inches during extended wet periods. Organic matter content is moderate or moderately low in both soils. Tilth is good. The Chili soil has a deep root zone and a strongly acid to slightly acid subsoil. The root zone of the Homewood soil is restricted by the dense fragipan at a depth of 20 to 36 inches. Where this soil is unlimed, the subsoil is strongly acid or very strongly acid.

Many areas are used as cropland. These soils are moderately well suited to corn and small grain and to soybeans grown as part of a rotation system. Erosion is a severe hazard if the soils are cultivated. Some areas are suited to contour stripcropping, but many have slopes that are too short and irregular for this practice. Applying a system of conservation tillage that leaves crop residue on the surface and including meadow crops in the rotation help to control erosion. Natural drainage is adequate for crops in all areas, except for the wetter included soils.

Some areas are used for hay and pasture. These soils are well suited to forage crops. Natural drainage permits grazing early in spring. An occasional row crop can be grown to aid in weed control and seedling establishment. All commonly grown forage species are suited to these soils, but applications of lime are needed if the mixture includes alfalfa.

Only a few areas are wooded. These soils are well suited to trees. They are not too steep for intensive woodland management. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

These soils are moderately well suited to building site development and septic tank absorption fields. The Chili soil is better suited to these uses than the Homewood soil. Erosion is a hazard in areas scalped during construction. Reseeding these areas as soon as possible helps to minimize soil loss. Water moves downslope along the top of the fragipan in the Homewood soil. As a result, wet basements can be expected. Installing drains at the base of footings helps to keep basements dry. Downslope seepage of effluent from septic tanks can be controlled by installing the distribution lines across the slope. Increasing the size of the absorption field and installing the distribution lines as shallow as possible help to overcome the restricted permeability in the Homewood soil. Installing interceptor drains upslope from the absorption field reduces the seasonal wetness of the Homewood soil. Springs and seepy areas should not be selected as sites for buildings and absorption fields.

The sand and gravel deposits in the Chili soil are commonly of small extent. The Homewood soil is an improbable source of sand and gravel. Ponds dug in areas of these soils are likely to have excessive seepage rates.

The land capability classification is IIIe. The woodland ordination symbol of the Chili soil is 2o, and that of the Homewood soil is 1o.

CnD—Chili-Homewood silt loams, 12 to 18 percent slopes. These moderately steep, deep soils are on moraines, on kames, in valley plugs, and in other areas that have a complex mixture of glacial soil material. The Chili soil is well drained, and the Homewood soil is well drained and moderately well drained. Some areas are along the sides of narrow valleys. Most of the gravel in these areas is small angular sandstone fragments. Some areas have short, irregular slopes. Others slope smoothly in one direction. Slopes are 80 to 500 feet long. Areas generally range from 2 to 30 acres in size. They vary in shape.

Most areas are about 50 percent Chili silt loam and 40 percent Homewood silt loam. The Chili soil is commonly on the lower part of the landscape and the Homewood soil on the upper part. In many areas, however, the two soils do not occur in a predictable pattern. They occur as areas so intricately mixed that mapping them separately is not practical.

Typically, the Chili soil has a surface layer of dark brown, friable silt loam about 7 inches thick. The subsoil is about 45 inches thick. It is yellowish brown. The upper part is friable loam, the next part is very friable gravelly loam, and the lower part is very friable gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose gravelly loamy sand. In places the subsoil and substratum have only a few pebbles. In some areas the soil is eroded. In a few areas the surface layer is sandy loam or gravelly loam.

Typically, the Homewood soil has a surface layer of dark brown, friable silt loam about 8 inches thick. The subsoil is yellowish brown, firm loam and clay loam about 42 inches thick. It is a very dense, mottled fragipan in the lower part. The substratum to a depth of about 60 inches is yellowish brown, firm loam glacial till. In some areas the soil does not have a fragipan or has only a thin fragipan. In other areas the soil is eroded. In a few areas bedrock is at a depth of 40 to 60 inches.

Included with these soils in mapping are small areas of the somewhat poorly drained Fitchville, Gresham, and Jimtown soils in closed depressions and around springs. These soils make up about 10 percent of most areas.

Permeability is moderately rapid in the Chili soil. It is moderate above the fragipan of the Homewood soil and slow in and below the fragipan. Runoff is rapid on the Chili soil and very rapid on the Homewood soil. The available water capacity is low or moderate in the Chili soil and low in the Homewood soil. The Homewood soil has a perched seasonal high water table at a depth of 30 to 48 inches during extended wet periods. Both soils have a moderately low organic matter content. Tilth is good. The Chili soil has a deep root zone and a strongly acid to slightly acid subsoil. The root zone of the Homewood soil is restricted by the dense fragipan at a depth of 20 to 36 inches. Where the soil is limed, the subsoil is strongly acid or very strongly acid.

Some areas are used as cropland. These soils are poorly suited to cropping systems that include a high percentage of corn and soybeans. Erosion is a very severe hazard if the soils are cultivated. Where slopes are smooth, contour stripcropping is a well suited means of controlling erosion. The soils also are well suited to a system of conservation tillage that reduces the erosion hazard by leaving crop residue on the surface. They are moderately well suited to no-till corn as part of a rotation that includes small grain and forage. Including forage crops in the rotation is an effective erosion-control practice. Natural drainage is adequate for crops. Additions of manure help to control erosion, conserve moisture, and maintain tilth.

Some areas are used for hay and pasture. These soils are moderately well suited to forage crops. Natural drainage permits grazing early in spring. Intensive pasture management can be applied. An occasional row crop can be grown to aid in weed control and seedling establishment. No-till seeding methods help to control erosion. Applications of lime are needed if the forage mixture includes alfalfa.

A few areas are used as woodland. These soils are well suited to trees. They are not too steep for intensive woodland management. Removing the less desirable trees, shrubs, and vines helps to control plant competition. Erosion is a hazard when the trees are logged. Logging roads and skid trails should be constructed so that water does not collect and flow on them. Constructing these trails and roads on the contour facilitates the use of equipment.

Because of the slope of both soils and the seasonal wetness and slow permeability of the Homewood soil, this map unit is poorly suited to building site development and septic tank absorption fields. Considerable excavation commonly is needed on building sites. The Chili soil is a good site for buildings constructed into the hillside. The included springs and seepy areas should not be selected as sites for such structures. Buildings should be designed so that they conform to the natural slope of the land. Reseeding scalped areas immediately after construction helps to control erosion. Gullies can form on unpaved access roads unless water is controlled. Downslope seepage of septic tank effluent is likely. It can be controlled by installing the distribution lines in septic tank absorption fields across the slope.

The Chili soil has pockets of useable gravel, but these commonly are small and widely scattered. A few small gravel pits have been dug. The gravel is used mostly on farm lanes. Ponds dug in areas of these soils are likely to have excessive seepage rates.

The land capability classification is IVe. The woodland ordination symbol of the Chili soil is 2r, and that of the Homewood soil is 1r.

Cr—Condit silt loam. This nearly level, deep, poorly drained soil is on flats, in depressions, and along small natural drainage courses on till plains. It is on the lowest part of the landscape and is subject to ponding. Slope is 0 to 2 percent. Most areas are 2 to 20 acres in size and are long and narrow.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is firm, mottled silty clay loam about 39 inches thick. It is grayish brown and gray in the upper part and dark gray and yellowish brown in the lower part. The substratum to a depth of about 60 inches is gray, mottled, firm, calcareous silty clay loam. In a few areas the surface layer is darker. In a few places the substratum is not so dense.

Permeability is slow. Runoff is very slow or ponded. The available water capacity is moderate. Organic matter content also is moderate. Tilth is good. The capacity to store and release plant nutrients is high. The subsoil is medium acid or strongly acid in the upper part and slightly acid or neutral in the lower part. The root zone is deep but is limited by a seasonal high water table near or above the surface during extended wet periods.

Some areas are used as cropland. If drained, this soil is moderately well suited to corn, soybeans, and small grain. It is better suited to corn and soybeans than to winter grain. Many areas lack suitable natural outlets for subsurface drains. As a result, open ditches are needed. If outlets are available, subsurface drains are generally effective. Because of the slow permeability, the drains should be closely spaced. Surface drains are needed in ponded areas. The surface layer crusts after hard rains. Returning crop residue to the soil helps to control crusting.

Some areas are pastured. This soil is moderately well suited to pasture. Undrained areas are too wet for alfalfa. Grazing early in spring can damage the plants. Production is moderate during dry periods. Wetness interferes with spring seeding in undrained areas.

A few areas are used as woodland. This soil is moderately well suited to trees. Ponding can kill or damage tree seedlings. It limits the use of equipment. The trees can be logged during the drier parts of the year. Planting species that are tolerant of wetness helps to control seedling mortality and reduces the windthrow hazard.

This soil generally is unsuited to building site development and septic tank absorption fields because of the ponding and the slow permeability.

Ponds dug in areas of this soil are likely to hold water. Most areas receive enough runoff to fill a pond of average size.

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

CvB—Coshocton silt loam, 2 to 6 percent slopes. This gently sloping, deep, moderately well drained soil is on unglaciated hilltops. In some areas it is on the highest part of the landscape, and in others it is below sandstone ridges. Slopes commonly are smooth and are 60 to 450 feet long. Most areas are 4 to 80 acres in size and vary in shape.

Typically, the surface layer is dark brown, friable silt loam about 6 inches thick. The subsoil is about 44 inches thick. It is yellowish brown. It is mottled below a depth of about 15 inches. The upper part is firm loam, and the lower part is firm clay loam and silty clay loam. The substratum is olive, very firm silty clay loam about 8 inches thick. Shale bedrock is at a depth of about 58 inches. In wooded areas and in areas that have not been plowed for many years, the surface layer is darker. In parts of the larger areas, the soil is nearly level. In some areas the upper part of the soil is glacial till.

Included with this soil in mapping are small areas of the well drained Gilpin and Rigley soils along the edges of some hilltops and small areas of somewhat poorly drained soils on the concave parts of hilltops. Also included, in Jackson Township, are some areas of soils that have a silty clay subsoil. These areas are poorly suited to crops. They are dominantly 15 to 30 acres in size, but some are less than 5 acres. Included soils make up about 20 percent of most areas.

Permeability is slow or moderately slow in the Coshocton soil. Runoff is medium. The available water capacity is moderate. Organic matter content is moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. Where the soil is unlimed, the subsoil is strongly acid to extremely acid. The perched seasonal high water table is at a depth of 18 to 42 inches during extended wet periods. The root zone is deep.

Most areas were formerly used as cropland, but only a few areas are still used for cultivated crops. This soil is moderately well suited to corn and small grain. Erosion is a moderate hazard if the soil is cultivated. Cultivating across the slope, planting cover crops, and returning plant residue to the soil help to control erosion. Applications of lime, organic material, and fertilizer are needed. A drainage system is needed in some of the wetter included soils. Because of the slow permeability, however, subsurface drains are only moderately effective.

Many areas are pastured. This soil is moderately well suited to pasture. Forage species can be grazed moderately early in spring and grow moderately well throughout the dry part of the summer. Applications of lime are needed, especially if alfalfa is grown. The wetter included soils are too wet for alfalfa.

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

This soil is only moderately well suited to building site development because of the seasonal wetness and the moderate shrink-swell potential. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling.

This soil is poorly suited to septic tank absorption fields. The seasonal wetness and the slow or moderately slow permeability are limitations. Increasing the size of the absorption fields and installing the distribution lines as shallow as possible help to overcome the restricted permeability. Installing perimeter drains around the absorption fields lowers the seasonal high water table. Distinctly concave areas should not be selected as sites for absorption fields.

Ponds dug in areas of this soil are likely to hold water. In many areas the shale bedrock is underlain by shattered sandstone within a depth of 8 feet. If the excavation reaches this sandstone, excessive seepage is likely.

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

CvC—Coshocton silt loam, 6 to 12 percent slopes. This deep, sloping, moderately well drained soil is on high unglaciated hilltops. In some areas it is below less sloping hilltops, and in others it extends across the hilltop. In a few areas it is on benches below very high sandstone ridges. Most slopes are 100 to 400 feet long. Individual areas are 2 to 30 acres in size and vary in shape.

Typically, the surface layer is dark brown, friable silt loam about 6 inches thick. The subsoil is about 42 inches thick. The upper part is yellowish brown, friable loam and firm clay loam; the next part is yellowish brown, mottled, firm channery clay loam and very firm clay loam; and the lower part is light yellowish brown, mottled, very firm silty clay loam. The substratum is olive, mottled, very firm silty clay loam about 10 inches thick. Weathered shale bedrock is at a depth of about 58 inches. In wooded areas and in areas that have not been plowed for many years, the surface layer is darker. In some eroded spots the surface layer is lighter in color. In some areas the upper part of the soil is glacial till.

Included with this soil in mapping are small areas of the well drained Gilpin, Rigley, and Westmoreland soils on side slopes and, in Jackson Township, areas of soils that have a silty clay subsoil and are poorly suited to crops. The areas in Jackson Township are 15 to 20 acres in size. Also included are some springs, seeps, and very stony spots. Inclusions make up about 20 percent of most areas.

Permeability is slow or moderately slow in the Coshocton soil. Runoff is rapid. The available water capacity is moderate. Organic matter content is moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. Where the soil is unlimed, the subsoil is strongly acid to extremely acid. A perched seasonal high water table is at a depth of 18 to 42 inches during extended wet periods. The root zone is deep.

Some areas are used for cultivated crops. Many formerly cropped areas are now used for other purposes. This soil is moderately well suited to corn and small grain. If cultivated crops are grown, erosion is a severe hazard. It removes the friable surface layer and exposes the subsoil. Some areas are suited to contour stripcropping. Growing cover crops and including forage in the crop rotation help to control erosion. Seeps and springs in some areas interfere with tillage. Because of the slow or moderately slow permeability, subsurface drains are only moderately effective in draining the seeps and springs. Applications of lime and fertilizer are needed.

Some areas are pastured. This soil is moderately well suited to pasture. Forage species can be grazed early in spring. Growth is only moderate during extended dry periods. Lime and fertilizer are needed, especially if alfalfa is grown. The wetter included soils are too wet for alfalfa.

Many of the formerly cropped fields are reverting to woodland. This soil is moderately well suited to trees. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is only moderately well suited to building site development because of the slope, the seasonal wetness, and a moderate shrink-swell potential. Erosion is a hazard during construction. It can be controlled by keeping as much vegetation on the site as possible. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling.

Because of the seasonal wetness and the slow or moderately slow permeability, this soil is poorly suited to septic tank absorption fields. Installing perimeter drains around the absorption field lowers the seasonal high water table. Increasing the size of the absorption field and installing the distribution lines across the slope and as shallow as possible help to overcome the restricted permeability and help to prevent seepage of the effluent to the surface.

Ponds dug in areas of this soil are likely to hold water. In many areas the shale bedrock is underlain by shattered sandstone within a depth of 5 to 8 feet. If the excavation reaches this sandstone, excessive seepage is likely.

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

CvD—Coshocton silt loam, 12 to 18 percent slopes. This moderately steep, deep, moderately well drained soil is on unglaciated hillsides. Most areas are on high shoulder slopes, above steeper valley sides and below less sloping ridgetops. Slopes are dominantly 100 to 400 feet long. Most areas are 5 to 10 acres in size and are long and narrow.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is about 44 inches thick. The upper part is brown, firm silty clay loam, and the lower part is yellowish brown and grayish brown, mottled, very firm clay loam and silty clay loam. The substratum is olive, very firm silty clay loam about 6 inches thick. Weathered shale bedrock is at a depth of about 58 inches. In some eroded spots the surface layer is lighter in color. In wooded areas the soil has a thin, dark surface layer. Some areas are stony.

Included with this soil in mapping are small areas of the well drained Westmoreland soils on the upper part of the slopes. Also included are springs, seeps, and small areas of soils that have a silty clay subsoil and are wetter than the Coshocton soil. These included areas are most extensive in Jackson Township. Inclusions make up about 10 percent of most areas.

Permeability is moderately slow or slow in the Coshocton soil. Runoff is rapid. The available water capacity is moderate. Organic matter content is moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. A perched seasonal high water table is at a depth of 18 to 42 inches during extended wet periods. Where the soil is not limed, the subsoil is strongly acid to extremely acid. The root zone is deep.

Some areas were formerly farmed, but only a few areas are now used as cropland. This soil is poorly suited to cultivated crops. It is acid and is highly susceptible to erosion if cultivated. If the cropping system includes meadow crops most of the time, row crops can be grown occasionally. The included seeps and springs cannot be easily drained. A system of conservation tillage that leaves crop residue on the surface and cross-slope cultivation help to control erosion.

Some areas are used as pasture. This soil is moderately well suited to forage crops. Pastures can be grazed early in spring. Growth is only moderate during dry periods. Heavy applications of lime are needed if alfalfa is grown. Acid-tolerant legumes, such as birdsfoot trefoil, are suitable. No-till methods of seeding help to control erosion.

Most areas are used as woodland. This soil is moderately well suited to trees. Erosion is a hazard during and following periods when the trees are logged. Logging roads and skid trails should be constructed across the slope, so that water does not collect and flow on them. Constructing them across the slope also facilitates the use of equipment. Water bars help to control erosion. Seedling mortality on south aspects can be controlled by planting seedlings that have been transplanted once or by mulching. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

Numerous oil and gas wells are in areas of this soil. Erosion on and along access roads to these wells is a major problem. Building these roads with the least possible gradient, constructing water bars, and providing outlets for the water that collects in the water bars help to control erosion.

Because of the slope and the seasonal wetness, this soil is poorly suited to building site development. Considerable excavation is needed on building sites. The buildings should be designed so that they conform to the natural slope of the land. Construction sites erode rapidly. Mulching or keeping as much vegetation on the site as possible during construction helps to control erosion. The subsoil is very acid and is difficult to reseed when exposed. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry.

This soil is poorly suited to septic tank absorption fields because of the slope, the seasonal wetness, and the moderately slow or slow permeability. Increasing the size of the absorption field and installing the distribution lines on the contour help to overcome the restricted permeability and help to prevent seepage of the effluent to the surface. Installing subsurface drains on the upslope side of the field lowers the seasonal high water table.

A few sites for natural ponds are available in areas of this soil. In many areas the shale bedrock is underlain by shattered sandstone within a depth of 5 to 8 feet. Excavated ponds are likely to hold water if the excavation does not reach the shattered sandstone bedrock. The best sites are around and below springs.

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

CzA—Crane silt loam, 1 to 4 percent slopes. This deep, nearly level and gently sloping, somewhat poorly drained soil is in low lying areas on stream terraces and on low knolls and ridges on outwash plains. Slopes are short and irregular. Most areas are 2 to 10 acres in size and vary in shape.

Typically, the surface layer is very dark grayish brown, friable silt loam about 9 inches thick. The subsurface layer is also very dark grayish brown, friable silt loam. It is about 5 inches thick. The subsoil is about 38 inches thick. It is yellowish brown and dark yellowish brown. It is mottled to a depth of about 42 inches. It is firm silty clay loam and clay loam in the upper part and friable gravelly loam in the lower part. The substratum to a depth of about 60 inches is yellowish brown, mottled, loose, calcareous gravelly loamy sand. In some areas the surface layer and subsurface layer are thinner. In other areas the surface layer is gravelly loam or loam.

Included with this soil in mapping are small areas of soils that are not mottled in the upper part of the subsoil. These soils are better drained than the Crane soil. Also included are areas of soils that have a loamy substratum. These soils are an improbable source of sand and gravel. Included soils make up about 10 percent of most areas.

Permeability is moderately slow in the subsoil of the Crane soil and very rapid in the substratum. Runoff is slow. The available water capacity is high. The seasonal high water table is at a depth of 12 to 36 inches during extended wet periods. It restricts the rooting depth. Organic matter content is moderate. Tilth is good. The capacity to store and release plant nutrients is high. The soil is medium acid to neutral in the root zone of most crops.

Most areas are used as cropland. If adequately drained, this soil is well suited to corn, soybeans, and small grain. A drainage system is needed. Subsurface drains are effective in most areas. If the drains are installed in the very friable or loose layers of the subsoil and substratum, a fiber envelope or a filter of gravel or crushed stone helps to keep fine sand from filling the drains. Most areas have suitable outlets for subsurface drains.

A few areas are used for hay and pasture. This soil is well suited to forage crops. Undrained areas are not suited to alfalfa. They are better suited to bluegrass pasture. Grazing early in spring, when the soil is soft, damages the sod. Pasture plants grow well in dry periods.

This soil is poorly suited to building site development and septic tank absorption fields because of the seasonal wetness and the moderately slow permeability. A drainage system is needed. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Installing perimeter drains around septic tank absorption fields helps to lower the seasonal high water table. Enlarging the absorption field helps to overcome the restricted permeability.

Ponds dug in areas of this soil are very unlikely to hold water.

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

Du—Dumps. This map unit occurs as areas that have been filled in with nonsoil material, such as trash, debris, or cinders. Most dumps have slopes of 0 to 6 percent. Included in mapping are small areas that are blanketed with soil material.

Dumps vary considerably in their ability to support vegetation. They are generally unsuited to crops. Most abandoned dumps support brush and are used as wildlife habitat or recreational areas. Some of the dumps that have not been reclaimed can be developed for recreational uses, openland wildlife habitat, or other uses. Onsite investigation is needed to determine suitability. Providing a blanket of suitable soil material reduces the hazards of erosion and ground water pollution. The soil material should be seeded with grasses or planted to trees that can tolerate a very low available water capacity.

No land capability classification or woodland ordination symbol is assigned.

FcA—Fitchville silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is mainly on flats in former lakebeds and on slack water terraces along streams. In a few areas it is in upland draws. Many areas receive runoff and seepage from the higher areas nearby. Individual areas are mainly 2 to 25 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsurface layer is brown, mottled, friable silt loam about 5 inches thick. The subsoil is yellowish brown and dark yellowish brown, mottled, firm and friable silt loam and silty clay loam about 34 inches thick. The substratum to a depth of about 60 inches is grayish brown and yellowish brown, friable silt loam. The surface layer is 10 to 24 inches thick in some areas that receive sediment from the higher lying soils nearby. In places the surface layer contains gravel. In some areas the soil is wetter and has a dominantly gray subsoil. The substratum is gravelly loam in a few areas. On a few low knolls, the slope is more than 2 percent.

Included with this soil in mapping are small areas of soils that have a substratum of dense, slowly permeable silty clay. Also included, near streams, are narrow strips that are subject to flooding during periods when the water level in the streams is extremely high. Included soils make up about 5 percent of most areas.

Permeability is moderately slow in the Fitchville soil. Runoff is slow. The available water capacity is high. The seasonal high water table is at a depth of 12 to 30 inches during extended wet periods. Organic matter content is moderate. Tilth is good. The capacity to store and release plant nutrients is high. The subsoil is medium acid to very strongly acid in the upper part and medium acid to neutral in the lower part. The rooting depth is restricted by the seasonal high water table.

Most areas are used as cropland. If adequately drained, this soil is well suited to corn, soybeans, and small grain. Corn and soybeans can be grown year after year. The seasonal wetness is a major management concern. Subsurface and surface drains can remove excess water if adequate outlets are available. Because of a lack of outlets, open ditches are needed in some of the larger areas. Some areas are only a few feet above the level of a stream. They are difficult to drain even with ditches. Measures that control surface crusting and applications of lime and fertilizer are the major management needs once a drainage system is established. Returning crop residue to the soil and tilling only during periods of optimum moisture help to control crusting.

Some areas are pastured. This soil is well suited to hay and pasture, but it is poorly suited to grazing early in spring. Most pastures are not adequately drained. Undrained areas are poorly suited to deep rooted legumes, such as alfalfa. They are better suited to alsike clover and birdsfoot trefoil. Pasture plants grow fairly well during extended dry periods.

This soil is moderately well suited to woodland. The species tolerant of some wetness should be selected for planting. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

Because of the seasonal wetness and the moderately slow permeability, this soil is poorly suited to building site development and septic tank absorption fields. Landscaping helps to keep water away from foundations and absorption fields. Installing drains at the base of footings helps to keep basements dry. Installing perimeter drains around septic tank absorption fields lowers the seasonal high water table. Enlarging the absorption fields helps to overcome the restricted permeability. Ponds dug in areas of this soil are likely to have excessive seepage rates.

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

FcB—Fitchville silt loam, 2 to 6 percent slopes. This gently sloping, deep, somewhat poorly drained soil is in former lakebeds and on slack water terraces along streams. A few areas are in upland draws. In lakebed areas the soil is on the lower side slopes and on low knolls. On the terraces it is in concave areas. It commonly makes up the entire bottom of the upland draws. Many areas receive runoff and seepage from higher areas nearby. Water flows in some of the upland draws during very wet periods. Individual areas are mostly 2 to 20 acres in size and vary in shape.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsurface layer is brown, mottled, friable silt loam about 3 inches thick. The subsoil is yellowish brown, mottled, firm silt loam and silty clay loam about 34 inches thick. The substratum to a depth of about 60 inches is grayish brown and yellowish brown, mottled, friable silt loam. The surface layer is 10 to 24 inches thick in some areas that receive sediment from the higher lying adjacent soils. In places, stones are on the surface and the surface layer contains gravel. In a few closed depressions, the soil is poorly drained and the subsoil is dominantly gray. In some areas gravel or shattered bedrock is at a depth of 4 to 5 feet.

Included with this soil in mapping are small areas of the moderately well drained Glenford soils on the higher knolls and the upper parts of slopes. Also included are very narrow strips of Holly, Orrville, and Shoals soils along small intermittent streams in the upland draws. Included soils make up about 15 percent of most areas.

Permeability is moderately slow in the Fitchville soil. Runoff is medium. The available water capacity is high. The seasonal high water table is at a depth of 12 to 30 inches during extended wet periods. Organic matter content is moderate. Tilth is good. The capacity to store and release plant nutrients is high. The subsoil is medium acid to very strongly acid in the upper part and medium acid to neutral in the lower part. The rooting depth is restricted by the seasonal high water table.

Many areas are used as cropland. If adequately drained, this soil is well suited to corn, soybeans, and small grain. A moderate hazard of erosion and the seasonal wetness are the main management concerns. The ease with which adequate drainage can be established differs considerably from area to area. Subsurface drains are effective in some areas, but in other areas both surface and subsurface drains are needed. Upland draws that have intermittent streams are among the most difficult areas to drain. The surface layer crusts after hard rains. Leaving crop residue on the surface reduces the erosion hazard and helps to control crusting. Establishing grassed waterways in upland draws helps to prevent gullying.

Some areas are pastured, especially those in the narrower upland draws. This soil is well suited to hay and pasture but is poorly suited to grazing early in spring. Maximum pasture yields are obtained from adequately drained areas. Pasture plants grow relatively well in dry periods. Undrained areas are poorly suited to deep rooted legumes, such as alfalfa. They are better suited to alsike clover and birdsfoot trefoil.

A few areas are wooded. This soil is moderately well suited to trees. The species tolerant of some wetness should be selected for planting. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is poorly suited to building site development and septic tank absorption fields because of the seasonal wetness and the moderately slow permeability. Landscaping helps to keep water away from foundations and absorption fields. Installing drains at the base of footings helps to keep basements dry. Subsurface drains are needed in lawns and gardens. Areas with intermittent streams should not be selected as building sites. Installing perimeter drains around septic tank absorption fields lowers the seasonal high water table. Enlarging the absorption field helps to overcome the restricted permeability.

Because of seepage, ponds dug in areas of this soil are unlikely to hold water.

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

FoA—Fox gravelly loam, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on terraces that are typically low and are separated from flood plains and higher terraces by short, steep slopes. Most areas are 20 to 200 acres in size and are long and narrow.

Typically, the surface layer is dark brown, friable gravelly loam about 9 inches thick. The subsoil is about 30 inches thick. The upper part is dark brown, friable gravelly loam; the next part is brown, firm gravelly loam; and the lower part is dark brown, firm, sticky gravelly clay loam. The substratum to a depth of about 60 inches is dark brown, very friable and loose, calcareous gravelly loamy sand and gravelly sand. In some areas the surface layer is darker. In other areas the subsoil is thicker. In a few areas the surface layer is loam or silt loam.

Permeability is moderate in the subsoil and rapid or very rapid in the substratum. Runoff is slow. The available water capacity is moderate. Organic matter content is moderate or moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. The subsoil is strongly acid to slightly acid in the upper part and neutral or mildly alkaline in the lower part.

Most areas are used as cropland. This soil is well suited to corn, soybeans, and small grain. If irrigated, it is well suited to orchards, vegetables, and nursery crops. Drought is a moderate hazard during dry periods. Roots are unlikely to grow into the underlying sand and gravel during these periods. The soil is well suited to irrigation. The erosion hazard is slight. The gravel in the plow layer does not interfere with cultivation. Some loss of plant nutrients through leaching is likely following large applications of fertilizer. Frequent, light applications are preferable to infrequent, large applications. The soil is very well suited to a system of conservation tillage that leaves crop residue on the surface. The resulting buildup of crop residue conserves moisture.

Some areas are pastured. This soil is well suited to deep rooted forage species, such as alfalfa. The good natural drainage permits grazing early in spring. If the pasture includes alfalfa, growth is poor or moderate throughout the dry part of the summer. Native grasses grow well in the spring but poorly during hot, dry periods. Intensive pasture management can be applied.

A few areas are used as woodland. This soil is well suited to trees, but growth is not so good as that on less droughty soils. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

The soil is well suited to building site development and septic tank absorption fields. The gentle slope and the good natural drainage favor these uses. Lawns may be hard to establish where the sandy and gravelly substratum is exposed during construction. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. The soil readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity may result in the pollution of ground water supplies. Installing the absorption field in suitable fill material improves the filtering capacity.

This soil is a probable source of sand and gravel. The thickness of and depth to these deposits vary. Excavated ponds in areas of this soil are very unlikely to hold water.

The land capability classification is IIs. The woodland ordination symbol is 2o.

FoB—Fox gravelly loam, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on terraces. Most areas are long, narrow strips that separate two terrace levels or a terrace and a flood plain. These areas generally are 10 to 100 acres in size. They slope uniformly in one direction. In places the soil makes up the entire area of irregularly shaped terraces and alluvial fans 3 to 10 acres in size.

Typically, the surface layer is dark brown, friable gravelly loam about 9 inches thick. The subsoil is about

27 inches thick. The upper part is dark yellowish brown, friable gravelly loam, and the lower part is brown, firm gravelly loam and gravelly clay loam. The substratum to a depth of about 60 inches is yellowish brown, loose, calcareous gravelly sand. In some areas the surface layer is darker. In some narrow areas the slope is less than 2 percent.

Included with this soil in mapping are small areas of the moderately well drained Bogart soils in shallow troughs. Also included are the nearly level Ockley soils. These soils have less gravel in the upper part than the Fox soil. They are on ridge crests. Included soils make up less than 5 percent of most areas.

Permeability is moderate in the subsoil of the Fox soil and rapid or very rapid in the substratum. Runoff is slow. The available water capacity is moderate. Organic matter content is moderate or moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. The subsoil is strongly acid to slightly acid in the upper part and neutral or mildly alkaline in the lower part.

Many areas are used as cropland. This soil is well suited to corn, soybeans, and small grain, but drought and erosion are moderate hazards. Cover crops, a system of conservation tillage that leaves crop residue on the surface, and cross-slope cultivation help to control erosion. If erosion is controlled, the soil is suited to irrigation. Leaving crop residue on the surface conserves moisture by reducing the evaporation rate at the surface. Because of leaching losses, frequent, light applications of fertilizer are preferable to less frequent, heavier applications.

Some areas are used for hay and pasture. This soil is well suited to deep rooted forage crops, such as alfalfa. The good natural drainage permits grazing early in spring. In seeded and fertilized pastures that include alfalfa, growth is poor or moderate throughout the dry part of the summer. Native pasture grasses grow well in the spring but poorly in hot, dry periods. Intensive pasture management can be applied.

Only a few areas are used as woodland. This soil is well suited to trees. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is well suited to building site development and septic tank absorption fields. The gentle slopes and the good natural drainage favor these uses. Lawns may be hard to establish in areas where the sandy and gravelly substratum is exposed during construction. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the damage caused by shrinking and swelling. The soil readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity may result in the pollution of ground water supplies. Installing the absorption field in suitable fill material improves the filtering capacity.

This soil is a probable source of sand and gravel. The thickness of and depth to these deposits vary. Excavated ponds in areas of this soil are very unlikely to hold water.

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

FoC—Fox gravelly loam, 6 to 12 percent slopes. This sloping, deep, well drained soil is on terraces and kames. On terraces it commonly is on short slopes that separate two terrace levels or a terrace and a flood plain. These areas are long and narrow, slope in one direction, and range from 5 to 20 acres in size. In places the soil makes up the entire area of small kames and the top of large ones. These areas are roughly circular, have irregular slopes, and range from 2 to 10 acres in size. Slopes are generally 80 to 350 feet long.

Typically, the surface layer is dark brown, friable gravelly loam about 8 inches thick. The subsoil is yellowish brown gravelly clay loam about 30 inches thick. The upper part is firm, and the lower part is sticky. The substratum to a depth of about 60 inches is yellowish brown, loose, calcareous gravelly sand.

Included with this soil in mapping are small areas of the moderately well drained Bogart soils. Also included are small areas of Ockley soils, which have less gravel in the upper part than the Fox soil. Both of the included soils are on the lower, more concave parts of the landscape. They make up less than 5 percent of most areas.

Permeability is moderate in the subsoil of the Fox soil and rapid or very rapid in the substratum. Runoff is medium. The available water capacity is low. Organic matter content is moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. The subsoil is strongly acid to slightly acid in the upper part and neutral or mildly alkaline in the lower part.

Most areas are used as cropland. They are cropped along with the less sloping soils nearby. This soil is moderately well suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a hazard. It reduces the depth to the sandy and gravelly substratum, thus reducing the available water capacity. The soil is droughty during dry periods. Growing cover crops, returning crop residue to the soil, and cultivating across the slope help to control erosion and conserve moisture.

A few areas are used for hay and pasture. This soil is well suited to deep rooted forage crops, such as alfalfa. Shallow rooted grasses grow well early in spring and during other wet periods. Pastures can be grazed early in the year. Intensive pasture management can be applied.

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

This soil is moderately well suited to building site development and septic tank absorption fields. The good natural drainage favors these uses. The buildings should be designed so that they conform to the natural slope of the land. Excavation during construction is likely to expose the sandy and gravelly substratum, which is droughty and difficult to reseed. Erosion is a hazard during construction. It can be controlled by keeping as much vegetation on the site as possible during construction. The soil readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity may result in the pollution of ground water supplies. Installing the absorption field in suitable fill material improves the filtering capacity. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface.

This soil is a probable source of sand and gravel. The amount and size of the pebbles and the thickness of these deposits vary greatly within small areas. Ponds dug in areas of this soil are very unlikely to hold water.

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

FoD—Fox gravelly loam, 12 to 25 percent slopes. This moderately steep and steep, deep, well drained soil is on kames and terraces. It is on the tops and sides of kames, which are rounded hills that have short, irregular slopes. These areas range from 5 to 40 acres and are roughly circular. On the terraces the soil is on short, smooth slopes that separate two terrace levels or a terrace and a flood plain. These areas are long and narrow, slope in one direction, and range from 2 to 20 acres. Slopes are generally 80 to 350 feet long.

Typically, the surface layer is dark brown, very friable gravelly loam about 6 inches thick. The subsoil is about 31 inches thick. The upper part is brown and yellowish brown, very friable loam and firm gravelly loam; the next part is brown, firm gravelly clay loam; and the lower part is brown, very friable, stratified gravelly loam and gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown and dark yellowish brown, loose, calcareous gravelly loamy sand and gravelly sand. In some areas the surface layer is loam. In numerous small areas on kames, the slope is more than 25 percent.

Included with this soil in mapping are small areas of Bogart and Jimtown soils in closed depressions on kames and along the base of slopes. These soils are wetter than the Fox soil. Also included are gently sloping and sloping soils on the tops of kames. Included soils make up about 5 percent of most areas.

Permeability is moderate in the subsoil of the Fox soil and rapid or very rapid in the substratum. Runoff is rapid. The available water capacity is low. Organic matter content also is low. Tilth is good. The capacity to store and release plant nutrients is moderate. The subsoil is strongly acid to slightly acid in the upper part and neutral or mildly alkaline in the lower part.

A few areas are used as cropland. Most of these areas are narrow strips that are farmed along with the less sloping soils nearby. Because of the very severe hazards of erosion and drought, this soil is poorly suited to cultivated crops. Erosion reduces the depth to the sandy and gravelly substratum, thus reducing the available water capacity. The complex slopes in most areas are not suited to stripcropping. Cross-slope cultivation is impractical on the kames. Erosion can be controlled by growing forage crops most of the time and returning crop residue to the surface.

Most areas are pastured. This soil is moderately well suited to permanent pasture. Native pasture grasses grow poorly in all periods, except for early in spring. Deep rooted plants, such as alfalfa, grow moderately well throughout the grazing season. No-till seeding methods help to control erosion. Most pasture management practices can be applied. A good fertilizer program helps to maintain the stand of grasses and legumes.

Only a few small areas are used as woodland. This soil is well suited to trees. Planting trees in narrow or odd-shaped areas is a good erosion-control measure. The use of some types of equipment is limited by the slope. Constructing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Seedling mortality can be controlled by mulching or by planting seedlings that have been transplanted once.

This soil is poorly suited to building site development and septic tank absorption fields. The good natural drainage favors these uses, but the slope is a limitation. Erosion is a hazard during construction. Eroded and scalped areas are difficult to reseed because of the droughty nature of the subsoil and substratum. Some gently sloping and sloping included areas on the tops of kames are well suited to building site development. The soil readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity may result in the pollution of ground water supplies. Installing the distribution lines across the slope helps to prevent seepage of the effluent to the surface.

This soil is a probable source of sand and gravel. The size and amount of the pebbles and the thickness of useable layers vary within small areas. Ponds dug in areas of this soil are very unlikely to hold water.

The land capability classification is IVe. The woodland ordination symbol is 2r.

GhB—Gilpin silt loam, 2 to 6 percent slopes. This gently sloping, moderately deep, well drained soil is primarily on ridgetops that are the highest part of the landscape. A few areas are on benches below high ridges and above valley side slopes. Individual areas are 5 to 50 acres in size and vary in shape.

Typically, the surface layer is dark brown, friable silt loam about 9 inches thick. The subsoil is yellowish brown and strong brown, friable and firm silt loam and channery loam about 28 inches thick. Hard sandstone bedrock is at a depth of about 37 inches. In wooded areas the surface layer is thinner and darker. In places, the surface layer and the upper part of the subsoil are sandy loam or the surface layer is channery silt loam. In some areas bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of the moderately well drained Coshocton soils on benches and the wider ridgetops. Also included are a few very stony areas on benches, just below high ridges. Included soils make up about 10 percent of most areas.

Permeability is moderate in the Gilpin soil. Runoff is medium. The available water capacity is low. Organic matter content is moderately low or moderate. Tilth is good. The capacity to store and release plant nutrients is moderate. Unless limed, the soil is strongly acid or very strongly acid. The rooting depth is limited by the sandstone and siltstone bedrock at a depth of 20 to 40 inches.

Some areas are used as cropland. If erosion is controlled and moisture conserved, this soil is well suited to corn and small grain. If the soil is cultivated, erosion is a moderate hazard. It reduces the depth to bedrock, thus reducing the thickness of the root zone. The soil is somewhat droughty, especially during extended dry periods. Cover crops, contour stripcropping, and cross-slope cultivation are suitable erosion-control measures. The soil is well suited to a system of conservation tillage that leaves crop residue on the surface. This system helps to control erosion and conserves moisture. The plants respond well to applications of lime and fertilizer. Returning crop residue to the soil and applying barnyard manure conserve moisture and help to maintain tilth.

Some areas are used for pasture and hay. This soil is well suited to forage crops. The good natural drainage permits grazing early in spring. Because of the droughtiness, production is limited during the dry part of the summer. Heavy applications of lime are needed if the forage mixture includes alfalfa. Alfalfa withstands drought better than most other forage plants.

Some areas are used as woodland. This soil is well suited to trees. Because of the gentle slopes, intensive woodland management can be applied. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is moderately well suited to building site development and septic tank absorption fields. The good natural drainage and the gentle slope favor these uses. In some areas the bedrock interferes with excavation for basements, utility lines, and septic tank absorption fields. It is shattered enough in some areas to be excavated without blasting. The soil above the bedrock is not thick enough to adequately filter effluent from septic tanks. Effluent that seeps into cracks in the rock can move a considerable distance and thus can pollute ground water supplies. Installing the absorption field in suitable fill material improves the filtering capacity.

Ponds dug in areas of this soil are very unlikely to hold water.

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

GhC—Gilpin silt loam, 6 to 12 percent slopes. This sloping, moderately deep, well drained soil is on very high ridges. Some areas are below a less sloping ridgetop, and others extend across the ridge crest. A few areas are on benches below the very high ridges. Slopes are 50 to 400 feet long. Individual areas are 5 to 80 acres in size and vary in shape.

Typically, the surface layer is dark brown, friable silt loam about 9 inches thick. The subsoil is yellowish brown, friable and firm silt loam about 21 inches thick. The substratum is yellowish brown, firm channery loam about 3 inches thick. Sandstone bedrock is at a depth of about 33 inches. In wooded areas the surface layer is thinner and darker. In places, the surface layer and the upper part of the subsoil are sandy loam or the surface layer is channery silt loam. In some areas bedrock is at a depth of 40 to 60 inches. In a few areas numerous fragments of chert are throughout the soil.

Included with this soil in mapping are small areas of the moderately well drained Coshocton soils on benches and very high ridgetops and small very stony areas on benches just below high ridges. Also included, on benches, are springs and seeps around which the soil is much wetter than the Gilpin soil and has mottles. Inclusions make up 20 percent of most areas.

Permeability is moderate in the Gilpin soil. Runoff is rapid. The available water capacity is low. Organic matter content is moderately low or moderate. Tilth is good. The capacity to store and release plant nutrients is moderate. Unless limed, the soil is strongly acid or very strongly acid. The rooting depth is limited by the sandstone and siltstone bedrock at a depth of 20 to 40 inches.

Some areas are used as cropland. If erosion is controlled and moisture conserved, this soil is moderately well suited to corn and small grain. If the soil is cultivated, erosion is a severe hazard. It reduces the depth to bedrock, thus reducing the thickness of the root zone. The soil is droughty. Contour stripcropping has been used in many of the larger areas to reduce the hazard of erosion. A system of conservation tillage that leaves crop residue on the surface helps to control erosion and conserves moisture. The cropping system includes a high percentage of forage crops in many areas. Heavy applications of lime and fertilizer are needed.

Some areas are pastured. This soil is well suited to pasture. The good natural drainage permits grazing early in spring. Growth is poor during extended dry periods, especially in unimproved grass pastures. Heavy applications of lime are needed if the forage mixture includes alfalfa.

Some areas are used as woodland. This soil is well suited to trees. It is not too steep for intensive woodland management. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is moderately well suited to building site development and septic tank absorption fields. The good natural drainage favors these uses, but the moderate depth to bedrock and the slope are limitations. In some areas the bedrock at a depth of 20 to 40 inches interferes with excavation for basements and utility lines. It is shattered enough in some areas to be excavated without blasting. The buildings should be designed so that they conform to the natural slope of the land. Erosion is a hazard during construction. It can be controlled by maintaining as much vegetation on the site as possible. The soil above the bedrock is not thick enough to adequately filter effluent from septic tanks. Effluent that seeps into cracks in the underlying rock can move for a considerable distance and thus can contaminate springs and other ground water supplies. Installing the absorption field in suitable fill material improves the filtering capacity. Seepy spots and springs should not be selected as sites for buildings and septic tank absorption fields.

A few sites for natural ponds are available in areas of this soil. Excavated ponds are unlikely to hold water because of seepage into cracks in the underlying rock.

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

GnA—Glenford silt loam, 0 to 2 percent slopes. This nearly level, deep, moderately well drained soil is on slack water terraces and in former lakebeds. Some areas are high on the landscape, and others are low. Most are 5 to 10 acres in size and are irregularly shaped.

Typically, the surface layer is dark brown, friable silt loam about 11 inches thick. The subsoil is yellowish brown, friable and firm silt loam about 33 inches thick. It is mottled below a depth of about 20 inches. The substratum to a depth of about 60 inches is yellowish brown, very friable silt loam that has a few thin layers of sandy material. In places, stones are on the surface and the surface layer contains gravel. In a few areas the surface layer is darker.

Included with this soil in mapping are small areas of the somewhat poorly drained Fitchville soils on flats and in slight depressions and small areas of soils that are dominantly sandy loam or gravelly loam below a depth of 40 inches. Included soils make up about 10 percent of most areas.

Permeability is moderately slow in the Glenford soil. Runoff is slow. The available water capacity is high. The seasonal high water table is at a depth of 24 to 42 inches during extended wet periods. Organic matter content is moderate or moderately low. Tilth is good. The capacity to store and release plant nutrients is high. The subsoil is medium acid or strongly acid in the upper part and medium acid to neutral in the lower part. The root zone is deep.

Most areas are used as cropland, although only a few areas are large enough to form the major part of a field. This soil is well suited to corn, soybeans, and small grain. Natural drainage generally is adequate for crops, although randomly spaced subsurface drains are beneficial in the wetter included soils. The main management concerns are controlling crusting and maintaining fertility, a sufficient amount of lime, and the organic matter content. Returning crop residue to the soil and tilling and harvesting at optimum moisture levels control crusting and help to maintain tilth.

Some areas are used for hay or for pastures in rotation with crops. This soil is well suited to forage crops. Some areas are a little too wet for alfalfa. Pasture plants can be grazed fairly early in spring. They grow well in dry periods.

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

This soil is only moderately well suited to building site development and septic tank absorption fields. Buildings and septic tank absorption fields should be located on the highest part of the landscape. The seasonal wetness is a limitation. Drains are commonly installed at the base of footings to remove excess water. Landscaping and diversions help to keep water away from foundations. The soil material is quite unstable when wet, and foundation stability may be a problem in inadequately drained areas. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. The moderately slow permeability and the seasonal wetness are limitations on sites for septic tank absorption fields. Increasing the size of the absorption field helps to overcome the restricted permeability. Perimeter drains lower the seasonal high water table.

A few sites for natural ponds are available in areas of this soil. Because of seepage, excavated ponds are not likely to hold water.

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

GnB—Glenford silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is on low knolls and in troughs on slack water terraces and on foot slopes below steep hillsides. A few areas are in upland draws. Most are bounded by higher lying soils on one or more sides. Many areas are above a wetter soil on an adjacent terrace or flood plain. Some slope in one direction, some include the facing side slopes of a small natural drainageway, and others slope outward from a central dome. Most slopes are short. Areas generally range from 2 to 15 acres in size and vary in shape.

Typically, the surface layer is dark brown, friable silt loam about 11 inches thick. The subsoil is yellowish brown, very friable to firm silt loam about 33 inches thick. It is mottled below a depth of about 23 inches. The substratum to a depth of about 60 inches is yellowish brown, mottled, very friable silt loam that has a few layers of sandy material. In places, stones are on the surface and the surface layer contains gravel. In a few eroded spots, the surface layer is lighter colored. In some areas in upland draws, it is very thick because it receives sediment from the adjacent soils. In some of these areas, the depth to the subsoil is 3 to 4 feet.

Included with this soil in mapping are small areas of the somewhat poorly drained Fitchville and poorly drained Sebring soils on flats and in depressions, drainageways, and seepy spots around springs. These soils make up about 10 percent of most areas.

Permeability is moderately slow in the Glenford soil. Runoff is medium. The available water capacity is high. The seasonal high water table is at a depth of 24 to 42 inches during extended wet periods. Most periods of extended wetness do not occur during the growing season. Organic matter content is moderate or moderately low. Tilth is good. The capacity to store and release plant nutrients is high. The root zone is deep. The subsoil is medium acid or strongly acid in the upper part and medium acid to neutral in the lower part.

Most areas are used as cropland. If properly managed, this soil is well suited to corn, soybeans, and small grain. If the soil is cultivated, erosion is a moderate hazard. It is most severe in the upland draws, where the soil receives surface water from adjacent slopes. The surface in these areas is loose, and even a small amount of flowing water can cause gullying. Many of these upland draws are natural sites for grassed waterways. A good plant cover is needed in the grassed waterways. In most areas the principal erosion-control measures are cross-slope cultivation, the use of mulch, and conservation tillage. Natural drainage is generally adequate for farming, but randomly spaced subsurface drains are beneficial in the wetter included soils and seeps.

Some areas are pastured. This soil is well suited to pasture and hay. Forage plants can be grazed fairly early in spring. They grow well throughout the dry part of the summer. Intensive pasture management can be applied.

Only the small, inaccessible areas are used as woodland. This soil is well suited to trees. Because of the gentle slopes, intensive woodland management can be applied. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

The suitability of this soil for building site development varies from area to area. Most areas are moderately well suited, but those in upland draws are poorly suited. Distinctly concave areas and seepy spots should not be selected as building sites. Water flowing in some of the draws during very wet periods causes wetness in basements and damage to foundations and basement walls. In other areas drains are needed at the base of footings to help keep basements dry. The soil is unstable when wet. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Foundation stability can be a problem.

Most areas of this soil are moderately well suited to septic tank absorption fields. The moderately slow permeability and the seasonal wetness are limitations. Perimeter drains lower the seasonal high water table. Increasing the size of the absorption area helps to overcome the restricted permeability. The included seepy areas should not be selected as sites for absorption fields.

A few sites for natural ponds are available in areas of this soil. Excavated ponds are likely to have excessive seepage rates.

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

GnC—Glenford silt loam, 6 to 12 percent slopes. This sloping, deep, moderately well drained soil is on foot slopes. Most areas are below a steeper hillside and slope down to a flood plain or a terrace. Many of these areas receive seepage and runoff from higher lying adjacent soils. Slopes are 100 to 300 feet long. Most areas are 5 to 10 acres in size and are long and narrow.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is yellowish brown, firm and friable silt loam about 40 inches thick. It is mottled below a depth of about 20 inches. The substratum to a depth of about 60 inches is yellowish brown, mottled, friable, stratified loam, silt loam, and sandy loam. In some eroded spots the surface layer is lighter colored. In some places small stones are on the surface. In other places the soil is well drained.

Included with this soil in mapping are small areas of Fitchville and Sebring soils around springs and in seepy spots. These soils are wetter than the Glenford soil. Also included are small areas of soils containing a considerable amount of gravel and rock fragments in the lower part. Included soils make up about 15 percent of most areas.

Permeability is moderately slow in the Glenford soil. Runoff is rapid. The available water capacity is high. The seasonal high water table is at a depth of 24 to 42 inches during extended wet periods. Most periods of extended wetness do not occur during the growing season. Organic matter content is moderate or moderately low. Tilth is good. The capacity to store and release plant nutrients is high. The root zone is deep. The subsoil is medium acid or strongly acid in the upper part and medium acid to neutral in the lower part.

Some areas are used as cropland. This soil is moderately well suited to corn and small grain and to soybeans grown as a minor part of the crop rotation. If the soil is cultivated, the erosion hazard is severe. Most cultivated areas are parts of fields dominated by less sloping soils that are less erosive. Cross-slope cultivation, the use of mulch, forage crops, and no-till planting and other systems of conservation tillage that leave crop residue on the surface help to control erosion. A few of the larger areas are suited to contour stripcropping. Natural drainage is generally adequate for crops, but randomly spaced subsurface drains are needed in wet spots and springs. Some of the wet spots are quite difficult to drain since the water originates in springs in the adjacent rock hills and seeps underground for a considerable distance. Additions of organic material are beneficial in restoring the productivity of eroded spots.

Some areas are pastured. This soil is well suited to hay and pasture. Forage plants can be grazed fairly early in spring and grow rather well throughout the dry part of the summer. Intensive pasture management can be applied. Some of the included springs can be developed as sources of livestock water. Erosion is a hazard if pastures are overgrazed. No-till methods of seeding help to prevent excessive soil loss.

Some areas are used as woodland. This soil is well suited to trees. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is only moderately well suited to building site development. The slope and the seasonal wetness are limitations. Most areas are subject to seepage. Drains at the base of footings intercept this water, especially on the uphill side of the buildings. Cuts and fills made during construction are easily eroded. They should be reseeded or mulched as soon as possible. The soil is very unstable when wet. Surface water can deposit soil material against basement walls. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling.

This soil is only moderately well suited to septic tank absorption fields. The moderately slow permeability and the seasonal wetness are limitations. Perimeter drains lower the seasonal high water table. Increasing the size of the absorption area helps to overcome the restricted permeability. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface. The included springs and seeps should not be selected as sites for absorption fields.

The capacity of ponds to hold water differs considerably from area to area. Onsite investigation is needed before ponds are constructed.

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

GrB—Gresham silt loam, 2 to 6 percent slopes. This gently sloping, deep, somewhat poorly drained soil is on till plains. It is in draws and depressions, which commonly are on the lowest part of the landscape. Areas generally receive seepage, runoff, or both from higher lying areas nearby. Most areas are 2 to 10 acres in size and are long and narrow.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 57 inches thick. It is yellowish brown and mottled. The upper part is friable to very firm loam and silt loam; the next part is a fragipan of very firm, dense loam; and the lower part is firm loam. The substratum to a depth of about 73 inches is grayish brown, mottled, firm channery loam. In numerous areas the surface layer is covered by loose sediment from adjacent slopes. In some areas thin layers of water-laid silty material are below the fragipan. In other areas the soil is wetter and has a dominantly gray subsoil.

Included with this soil in mapping are narrow strips of Holly and Orrville soils on very narrow flood plains. These soils do not have a fragipan. Also included are small areas of soils that have more clay than the Gresham soil and are more slowly permeable. Included soils make up about 15 percent of most areas.

Permeability is moderate or moderately slow above the fragipan of the Gresham soil and slow in the fragipan. Runoff is medium. The root zone is restricted by the dense fragipan at a depth of 24 to 35 inches. The available water capacity is moderate or low above the fragipan. A perched seasonal high water table is at a depth of 6 to 24 inches during wet periods. Organic matter content is moderate. Tilth is good. The capacity to store and release plant nutrients is moderate. Unless limed, the soil is strongly acid or very strongly acid above the fragipan.

Some areas are used as cropland along with the surrounding soils of greater extent. This soil is moderately well suited to corn, small grain, and soybeans. The hazard of erosion and the wetness are the major management concerns. Gullying is a hazard in the lowest parts of long, narrow areas. Streams flow in some of these areas during wet periods. Establishing grassed waterways in the lowest landscape positions and installing subsurface drains on both sides of the waterway reduce the wetness and help to control erosion. Leaving crop residue on the surface also helps to control erosion. The soil commonly occurs as troublesome wet streaks in fields dominated by better drained soils. Subsurface drains should be closely spaced because of the slow permeability of the fragipan. Heavy applications of lime and fertilizer are needed.

Some areas are pastured. This soil is well suited to pasture, especially if the pasture includes grasses. Grazing early in spring, when the soil is soft and wet, damages the plants. Pasture production is moderate throughout the dry part of the summer. A drainage system is needed. Birdsfoot trefoil is better suited than deep rooted legumes, such as alfalfa.

Some areas are used as woodland. This soil is moderately well suited to trees. The species that can tolerate some wetness should be selected for planting. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is poorly suited to building site development and septic tank absorption fields because of the wetness and the slow permeability. Installing drains at the base of footings helps to keep basements dry. Landscaping helps to keep water away from foundations and absorption fields. Installing perimeter drains around the absorption field lowers the seasonal high water table. Enlarging the absorption field helps to overcome the restricted permeability.

Ponds can be developed in some areas of this soil. Most areas receive sufficient runoff to fill the ponds. Onsite investigation is needed.

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

Ho—Holly silt loam, frequently flooded. This deep, nearly level, poorly drained and very poorly drained soil is on flood plains. It commonly is on the lowest and wettest part of the flood plains, away from the stream channels. It is subject to flooding. Seeps and springs are in some areas. Slope is 0 to 2 percent. Individual areas are 5 to 100 acres in size and are long and narrow.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is gray and grayish brown, mottled, friable and firm silt loam about 29 inches thick. The substratum to a depth of about 60 inches is gray and dark gray, mottled, firm and very friable, stratified loam, silt loam, and fine sandy loam. In some areas shattered bedrock is within a depth of 60 inches. In other areas the soil has a dark buried surface layer.

Included with this soil in mapping are small areas of the somewhat poorly drained Shoals and Orrville soils in the slightly higher landscape positions. Also included are some areas of soils that are subject to ponding. Included soils make up about 10 percent of most areas.

Permeability is moderate or moderately slow in the subsoil of the Holly soil and moderate or moderately rapid in the substratum. Runoff is very slow. The available water capacity is high. The water table is near the surface for extended periods under natural conditions. Many areas around springs and seeps are permanently wet. Organic matter content is moderate or high. Tilth is good. The capacity to store and release plant nutrients is high. The subsoil is slightly acid or neutral.

Some areas are used as cropland. These areas are commonly small parts of fields dominated by better drained soils. If adequately drained, this soil is moderately well suited to corn and soybeans. Severe wetness must be overcome before these crops can be grown successfully. Both surface and subsurface drains are needed to adequately drain most areas. Areas containing springs are very difficult to drain. In many areas the stream channel is shallow and poorly defined. Thus, it is not a good outlet. Few areas have been drained adequately for alfalfa or winter grain, but some have been drained well enough for corn and soybeans. The crops and drainage systems are subject to damage by floodwater.

Most areas are used for pasture or are left idle. This soil is moderately well suited to pasture grasses but is too wet for most legumes. Bluegrass and reed canarygrass are well suited pasture species. Grasses grow rather well throughout the dry part of the summer. Grazing when the soil is wet and soft damages the plants. This damage is difficult to avoid since the soil is wet much of the time. Rushes and cattails are common in pastures that include extremely wet spots.

This soil is moderately well suited to woodland. Because of the wetness, many species are not suitable. The wetness limits the use of logging equipment in winter and spring. The trees can be logged during the drier parts of the year. Seedlings can be damaged by floodwater. Frequent, light thinning and harvesting increase the vigor of the stand and reduce the windthrow hazard. Seedling mortality can be controlled by planting trees that have been transplanted once or by mulching.

Because of the hazard of flooding and the extreme natural wetness, this soil generally is unsuited to building site development and septic tank absorption fields.

Some natural, spring-fed pond sites are in areas of this soil. Because of seepage, excavated ponds are not likely to hold a sufficient amount of water unless they are fed by strong, year-round springs. Flood damage is a hazard.

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

HwB—Homewood silt loam, 2 to 6 percent slopes. This gently sloping, deep, well drained and moderately well drained soil is on till plains. Most areas are on hilltops that slope outward from a central dome or a ridge line. Slopes generally are long and smooth. Individual areas range from 5 to 200 acres in size and are irregularly shaped.

Typically, the surface layer is dark brown, friable silt loam about 10 inches thick. The subsoil is about 57 inches thick. It is yellowish brown. It is mottled below a depth of about 23 inches. The upper part is friable silt loam and firm and very firm clay loam, and the lower part is a fragipan of very firm, dense clay loam. The substratum to a depth of about 80 inches is yellowish brown, firm silt loam glacial till. In some areas the soil is eroded and has a lighter colored surface layer. In a few areas it is nearly level. In places water-laid silty material or shattered bedrock is at a depth of 3 to 5 feet.

Included with this soil in mapping, especially near North Liberty, are small areas of soils that have a thinner and less restrictive fragipan. Also included are small areas of the somewhat poorly drained Gresham soils on the concave parts of the landscape. Included soils make up about 15 percent of most areas.

Permeability is moderate above the fragipan in the Homewood soil and slow in and below the fragipan. Runoff is medium. The root zone is restricted by the dense fragipan at a depth of 20 to 36 inches. The available water capacity is low above the fragipan. A perched seasonal high water table is at a depth of 2.5 to 4.0 feet during extended wet periods. Water moves laterally along the top of the fragipan and surfaces in seepy areas on the slopes. Organic matter content is moderate or moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. Unless limed, the soil is strongly acid or very strongly acid above the fragipan.

Most areas are used as cropland. If properly managed for erosion control, this soil is well suited to corn, soybeans, and small grain. Erosion is a moderate hazard. Since slopes commonly are long, high velocity runoff is common on the lower part of the slopes. A system of conservation tillage that leaves crop residue on the surface, cover crops, and cross-slope cultivation help to control erosion. Conservation tillage has been very effective on this soil. Heavy applications of lime are needed. A considerable amount of fertilizer is also needed, but it may not be effective unless the lime level is corrected. Natural drainage is adequate for the production of corn, soybeans, and some forage mixtures. Subsurface drains, however, are needed for some crops, especially in areas where wetter soils are included. The earlier that the crop is planted in spring, the more likely the need for a drainage system.

Some areas are used as pasture. This soil is well suited to hay and pasture. The good natural drainage permits grazing early in spring. Growth is moderate during the dry part of the summer. If forage mixtures include alfalfa, heavy applications of lime are needed. Some included soils are too wet for the optimum growth of alfalfa.

A few areas are used as woodland. This soil is well suited to trees, but the dense fragipan restricts the rooting depth. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is moderately well suited to building site development and septic tank absorption fields. The seasonal wetness and the slow permeability are limitations. Installing drains at the base of footings helps to keep basements dry. Distinctly concave parts of the landscape should not be selected as sites for buildings and septic tank absorption fields. Increasing the size of the absorption field and installing the distribution lines as shallow as possible help to overcome the restricted permeability. Downslope seepage of effluent occurs along the top of the fragipan. Installing interceptor drains upslope from the absorption field reduces the seasonal wetness.

Some natural pond sites are available at the head of draws. Ponds dug in areas of this soil are likely to hold water. Onsite investigation is needed.

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

HwC—Homewood silt loam, 6 to 12 percent slopes. This sloping, deep, well drained and moderately well drained soil is on till plains. It is on rounded hilltops and the sides of small valleys. Slopes are long and smooth or are short and irregular. Slopes are 75 to 650 feet long. Most areas range from 4 to 100 acres in size and vary in shape.

Typically, the surface layer is dark brown, friable silt loam about 10 inches thick. The subsoil is about 57 inches thick. It is yellowish brown. The upper part is friable silt loam and firm and very firm clay loam, and the lower part is a fragipan of mottled, very firm, dense clay loam. The substratum to a depth of about 72 inches is yellowish brown, firm loam. In some eroded spots on the higher and steeper parts of some cultivated fields, the surface layer is lighter in color. In some areas thin layers of sandy loam are in the substratum. In other areas shattered sandstone bedrock is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Chili, Gresham, and Orrville soils. Chili soils have more sand and gravel in the substratum than the Homewood soil. They are on valley side slopes. The somewhat poorly drained Gresham soils are around springs and in seepy areas. The somewhat poorly drained Orrville soils are on very narrow flood plains. Included soils make up about 10 percent of most areas.

Permeability is moderate above the fragipan in the Homewood soil and slow in and below the fragipan. Runoff is rapid. The root zone is restricted by the dense fragipan at a depth of 20 to 36 inches. The available water capacity is low above the fragipan. A perched seasonal high water table is at a depth of 2.5 to 4.0 feet during extended wet periods. Water moves laterally along the top of the fragipan and surfaces in seepy spots on the slopes. Organic matter content is moderate or moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. Unless limed, the soil is strongly acid or very strongly acid above the fragipan.

Some areas are used as cropland. If carefully managed for erosion control, this soil is moderately well suited to corn and small grain and to occasionally grown soybeans. Erosion reduces the depth to the fragipan. Many areas are well suited to contour stripcropping. This erosion-control practice has been widely used. The soil is well suited to a system of conservation tillage that leaves crop residue on the surface. Returning crop residue to the surface, cultivating across the slope, and growing forage crops part of the time also help to control erosion. Maintaining fertility, a sufficient amount of lime, and the organic matter content is a major management concern. Heavy applications of lime are needed. Natural drainage is adequate for most crops, but in many areas random subsurface drains are needed in the wetter included soils. The earlier that the crop is planted in the spring, the more likely the need for a drainage system.

Some areas are used for hay and pasture. This soil is well suited to forage crops. The good natural drainage permits grazing early in spring. Pasture plants grow moderately well throughout the dry part of the summer. Intensive pasture management can be applied. No-till seeding methods help to control erosion. Heavy applications of lime are needed if the seeding mixture includes alfalfa.

A few areas are used as woodland. This soil is well suited to trees, but the dense fragipan restricts the rooting depth. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is moderately well suited to building site development and septic tank absorption fields. Basements can be wet for brief periods. Installing drains at the base of footings helps to keep basements dry. Erosion is a hazard during construction. It can be controlled by reseeding scalped areas. If a large tract is to be developed, only a small area should be bare at any given time. Springs and seepy areas should not be selected as sites for buildings and absorption fields. The slow permeability and the seasonal wetness limit the soil as an absorption field. Downslope seepage of effluent occurs along the top of the fragipan. Increasing the size of the absorption field and installing the distribution lines as shallow as possible help to overcome the restricted permeability. Installing the distribution lines across the slope helps to prevent seepage of the effluent to the surface.

Some good natural pond sites are available in areas where this soil is on both sides of a small valley. Onsite investigation is needed. Excavated ponds are likely to hold water. In most areas there is enough runoff to fill a pond.

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

HwD2—Homewood silt loam, 12 to 18 percent slopes, eroded. This moderately steep, deep, well drained and moderately well drained soil is on till plains. It is on the sides of small valleys. Some areas include only one valley side, whereas others include both sides and the narrow bottom. Slopes commonly are smooth and are 75 to 400 feet long. Erosion has removed a significant part of the original surface layer. Erosion losses have been greatest in cultivated areas but have also occurred in other areas. Most areas range from 2 to 20 acres in size and are long and narrow.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 52 inches thick. It is yellowish brown. The upper part is firm clay loam, and the lower part is a fragipan of mottled, very firm, dense clay loam. The substratum to a depth of about 72 inches is yellowish brown, firm loam. In some areas the surface layer is darker.

Included with this soil in mapping are small areas of Chili, Gresham, Loudonville, and Orrville soils. Chili soils have more sand and gravel in the substratum than the Homewood soil. They are on valley side slopes. The somewhat poorly drained Gresham soils are on distinctly concave parts of slopes and around springs. The somewhat poorly drained Orrville soils are on very narrow flood plains. The moderately deep Loudonville soils are on shoulder slopes. Also included are spots of severely eroded soils that have a yellowish brown channery clay loam surface layer. These soils are on the higher, more convex parts of slopes. Included soils make up about 10 percent of most areas.

Permeability is moderate above the fragipan in the Homewood soil and slow in and below the fragipan. Runoff is very rapid. The root zone is restricted by the fragipan at a depth of 20 to 36 inches. The available water capacity is low above the fragipan. A perched seasonal high water table is at a depth of 2.5 to 4.0 feet during extended wet periods. Water moves laterally along the top of the fragipan and surfaces in springs and seepy areas. Organic matter content is moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. Unless limed, the soil is strongly acid or very strongly acid above the fragipan.

Some areas are used as cropland. This soil is poorly suited to conventionally tilled row crops. If the soil is cultivated, erosion is a very severe hazard. It reduces the content of organic matter and the depth to the dense fragipan. Growing forage a high percentage of the time in the cropping system helps to control erosion. A system of conservation tillage that leaves crop residue on the surface also helps to control erosion. Some areas are suited to contour stripcropping and cross-slope cultivation. Establishing grassed waterways and grass strips on the concave parts of the slopes helps to prevent gullying. Returning crop residue to the soil helps to control erosion, helps to maintain the organic matter content, and improves tilth. Applications of fertilizer and lime are needed.

A large acreage is used for hay and pasture. This soil is moderately well suited to forage crops. Erosion is a severe hazard in overgrazed pastures. The good natural drainage permits grazing early in spring. Pasture production is moderate during dry periods. Because of runoff losses, smaller, more frequent or more timely applications of lime and fertilizer are more effective than one large application. Most pasture management practices can be applied. Small grain can be grown occasionally to aid in seedling establishment and weed control. No-till seeding methods help to control erosion.

Some areas are used as woodland. This soil is well suited to trees, but the dense fragipan restricts the rooting depth. Laying out skid trails so that they do not collect runoff helps to control erosion. Constructing skid trails and logging roads across the slope facilitates the use of equipment.

This soil is poorly suited to building site development because of the slope and the seasonal wetness. Erosion is a hazard during construction, especially in large developments. It can be controlled by reseeding scalped areas as soon as possible. Gullies can form easily in streets and driveways that are not paved and curbed. Land shaping is needed in many areas. The buildings should be designed so that they conform to the natural slope of the land. Because of water moving laterally along the top of the fragipan, basements can be wet late in winter and early in spring. Installing drains at the base of footings helps to keep basements dry.

Because of the slow permeability, the slope, and the seasonal wetness, this soil is poorly suited to septic tank absorption fields. Downslope seepage of effluent may occur along the top of the fragipan. Installing interceptor drains upslope from the absorption field reduces the seasonal wetness. Installing the distribution lines across the slope helps to prevent seepage of the effluent to the surface. Increasing the size of the absorption field and installing the distribution lines as shallow as possible help to overcome the restricted permeability.

Some good natural pond sites are available in areas where this soil is on both sides of a small valley. Onsite investigation is needed.

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

HwE2—Homewood silt loam, 18 to 25 percent slopes, eroded. This steep, deep, well drained and moderately well drained soil is on till plains. It is on the sides of valleys. Erosion has removed part of the original surface layer. Slopes are 75 to 250 feet long. Most areas slope in only one direction, are 2 to 10 acres in size, and are long and narrow.

Typically, the surface layer is very dark brown, friable silt loam about 2 inches thick. The subsurface layer is pale brown, friable silt loam about 3 inches thick. The subsoil is about 48 inches thick. It is yellowish brown. The upper part is firm clay loam, and the lower part is a fragipan of mottled, very firm, dense clay loam. The substratum to a depth of about 60 inches is yellowish brown, firm loam glacial till. In some cultivated areas the surface layer is brown. In other areas shattered bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of the moderately deep Loudonville soils on shoulder slopes and small areas of Chili soils on valley side slopes. Chili soils have more sand and gravel in the substratum than the Homewood soil. Also included are some seepy spots, springs, and areas where the slope is 25 to 60 percent. Inclusions make up about 10 percent of most areas.

Permeability is moderate above the fragipan in the Homewood soil and slow in the fragipan. Runoff is very rapid. The root zone is restricted by the fragipan at a depth of 20 to 36 inches. The available water capacity is low above the fragipan. A perched seasonal high water table is at a depth of 2.5 to 4.0 feet during the wettest part of the year. Organic matter content is moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. Unless limed, the soil is very strongly acid or strongly acid above the fragipan.

Some areas were used for crops in the days of horse-drawn implements. This soil generally is unsuited to cultivated crops. Erosion is a severe hazard if the soil is cultivated, and the slope limits the use of some kinds of equipment.

Some areas are pastured. This soil is moderately well suited to pasture. The good natural drainage permits grazing early in spring. Erosion is a severe hazard if pastures are overgrazed. Intense rains while the sod cover is sparse can dislodge and move soil particles. The slope limits fertilizing, mowing, and renovation of pastures. No-till seeding methods help to control erosion. Seeding a small grain companion crop also helps to control erosion.

Most areas are used as woodland. This soil is well suited to trees, but the dense fragipan restricts the rooting depth. The slope limits some woodland improvement measures and harvesting. Constructing logging roads and skid trails across the slope facilitates the use of equipment. Erosion is a hazard when the trees are logged. Logging trails should be constructed so that they do not collect flowing water. Gullies can form on these trails. They can extend into the more nearly level, higher lying areas if they are not controlled. Establishing water bars on logging roads helps to control erosion.

This soil generally is unsuited to building site development and septic tank absorption fields because of the steep slope, the slow permeability, and the seasonal wetness.

A few natural pond sites are available in areas where this soil is on both sides of a small valley. Onsite investigation is needed.

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

JmA—Jimtown silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is on terraces and on outwash plains and fans. It commonly is on low or concave parts of the landscape. Many areas receive runoff or seepage from higher lying adjacent soils. Most are irregularly shaped and range from 2 to 20 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 12 inches thick. The subsoil is about 34 inches thick. The upper part is yellowish brown, mottled, friable loam; the next part is yellowish brown, mottled, friable and very friable very gravelly loam; and the lower part is dark yellowish brown, friable very gravelly loam. The substratum to a depth of about 60 inches is yellowish brown, friable very gravelly loam. In some areas the substratum is loamy sand or gravelly loamy sand. In other areas the surface layer is darker. In places the soil is wetter and is grayer in the subsoil.

Included with this soil in mapping are small areas of soils that are more clayey and more slowly permeable in the substratum. These soils make up about 10 percent of most areas.

Permeability is moderate in the Jimtown soil. Runoff is slow. The available water capacity is moderate. The seasonal high water table is at a depth of 12 to 30 inches during extended wet periods. Organic matter content is moderate. Tilth is good. The capacity to store and release plant nutrients is moderate. The subsoil is very strongly acid to slightly acid in the upper part and strongly acid to neutral in the lower part.

Many areas are used as cropland. If adequately drained, this soil is well suited to corn, soybeans, and small grain. A drainage system is needed. Subsurface drains are effective in areas where outlets are available. Open ditches can be used as outlets in some areas. If subsurface drains are installed in the more gravelly areas, a fiber envelope or a filter of gravel or crushed stone helps to keep fine sand from filling the drains. The erosion hazard is slight. This soil is droughty during extended dry periods, but these periods are infrequent and of short duration. Returning crop residue to the soil conserves moisture and increases the organic matter content.

Some areas are used as hayland and pasture. This soil is well suited to hay and pasture, especially if it is adequately drained. A variety of hay and pasture species can be grown in adequately drained areas. Alfalfa is not suited to areas that are not adequately drained. Birdsfoot trefoil and alsike clover are better suited legumes in these areas. Grazing early in spring is likely to damage the sod in undrained areas. Pasture plants grow moderately well during dry periods.

A few areas are used as woodland. This soil is moderately well suited to trees. The species tolerant of some wetness should be selected for planting. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is poorly suited to building site development and septic tank absorption fields because of the seasonal wetness. Landscaping helps to keep water away from foundations. Drains at the base of footings should be large enough to handle large volumes of water. Coating the exterior of basement walls helps to keep basements dry. Installing perimeter drains around septic tank absorption fields lowers the seasonal high water table. Increasing the size of the absorption field helps to overcome the restricted permeability. In most areas the soil is permeable enough for the absorption field to function properly during periods when the water table is deep.

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

JmB—Jimtown silt loam, 2 to 6 percent slopes. This gently sloping, deep, somewhat poorly drained soil is on terraces, fans, and outwash plains. Many areas receive seepage or runoff from higher lying adjacent soils. Most areas have short, irregular slopes, but some smaller areas slope uniformly in one direction. Areas generally range from 2 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 34 inches thick. It is yellowish brown, mottled, and friable. The upper part is loam, and the lower part is very gravelly loam. The substratum to a depth of about 60 inches is yellowish brown, friable gravelly loam. In some areas it is loamy sand or gravelly loamy sand. In other areas the surface layer is gravelly loam. In places the soil is wetter and is grayer in the subsoil.

Included with this soil in mapping are small areas of the moderately well drained Bogart soils on the higher knolls and some small areas of soils that have shattered bedrock at a depth of 4 to 5 feet. Also included are small areas of soils that are more clayey and more slowly permeable in the substratum than the Jimtown soil. Included soils make up about 10 percent of most areas.

Permeability is moderate in the Jimtown soil. Runoff is slow. The available water capacity is moderate. The seasonal high water table is at a depth of 12 to 30 inches during extended wet periods. Organic matter content is moderate. Tilth is good. The capacity to store and release plant nutrients is moderate. The subsoil is very strongly acid to slightly acid in the upper part and strongly acid to neutral in the lower part.

Many areas are used as cropland. If adequately drained and protected from erosion, this soil is well suited to corn, soybeans, and small grain. A drainage system is needed. Returning crop residue to the soil and planting cover crops help to control erosion. A system of conservation tillage that leaves crop residue on the surface is suitable in adequately drained areas. Subsurface drains lower the water table. Suitable outlets for such drains are available in most areas. If subsurface drains are installed in the more gravelly areas, a fiber envelope or a filter of gravel or crushed stone helps to keep fine sand from filling the drains. The soil is droughty during extended dry periods.

Some areas are used as hayland and pasture. This soil is well suited to hay and pasture. Adequately drained areas are suited to a wider variety of plants than undrained areas. Alfalfa is generally unsuitable in undrained areas. Birdsfoot trefoil and alsike clover are better suited legumes in these areas. Grazing early in spring damages the sod in undrained areas. Pasture plants grow moderately well during the dry part of the summer.

A few areas are used as woodland. This soil is moderately well suited to trees. The species tolerant of some wetness should be selected for planting. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is poorly suited to building site development and septic tank absorption fields. A drainage system is needed on building sites. Installing drains at the base of footings helps to keep basements dry. The higher areas should be favored in site selection. The seasonal wetness hampers construction in winter and spring. Perimeter drains around septic tank absorption fields lower the water table and remove seepage. Distinctly low or concave areas should not be selected as sites for absorption fields.

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

La—Landes fine sandy loam, occasionally flooded. This nearly level, deep, well drained soil is on flood plains. Commonly, it is between the stream channels and the slope breaks to terraces or uplands. It is subject to flooding. Slope is 0 to 2 percent. Individual areas are 5 to 100 acres in size and are long and narrow.

Typically, the surface layer is very dark grayish brown, very friable fine sandy loam about 10 inches thick. The subsurface layer is very dark grayish brown, very friable fine sandy loam about 12 inches thick. The subsoil is brown and dark yellowish brown, very friable sandy loam and fine sandy loam about 17 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown and yellowish brown, very friable and loose, stratified sandy loam, loamy sand, gravelly sand, and gravelly loamy sand. In some places the soil is dark to a greater depth. In other places the surface layer is gravelly sandy loam. In some areas the subsoil is sand or loamy sand.

Included with this soil in mapping are some old stream channels that have steep side slopes. These inclusions make up less than 5 percent of most areas. Also included are some areas in the flood pool of Mohawk Dam. These areas are subject to controlled flooding.

Permeability is rapid in the Landes soil. Runoff is slow. The available water capacity is low or moderate. The seasonal high water table is at a depth of 4 to 6 feet during extended wet periods. Organic matter content is moderate. Tilth is good. The capacity to store and release plant nutrients is low. The soil is slightly acid to mildly alkaline throughout.

Most areas are used for corn or soybeans. This soil is moderately well suited to these crops. The hazards of flooding and drought are the major management concerns. Floodwater washes away or drowns seedlings, cuts channels, and removes plant nutrients. Planting is delayed in the flood pool of Mohawk Dam during wet years. Returning crop residue to the soil and applying no-till or other systems of conservation tillage conserve moisture. The soil can be irrigated and is suited to vegetable crops if protected from flooding.

This soil is not used extensively for hay and pasture. It is moderately well suited to forage crops. Grasses are likely to be damaged by drought and legumes by flooding.

This soil is not used for woodland. It is well suited to trees, but the flooding interferes with the establishment of new plantings. Young trees are likely to be washed away or drowned before they are large enough to withstand the flooding.

Because of the hazard of flooding and the rapid permeability, this soil generally is unsuited to building site development, septic tank absorption fields, and ponds.

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

Ln—Linwood muck. This nearly level, deep, very poorly drained soil is in depressions on till plains, in former lakebeds, and on outwash terraces. Some areas are on flood plains. The soil is in the lowest part of the landscape and receives runoff and seepage from higher lying adjacent soils. It is subject to ponding. Springs drain into some areas. Slope is 0 to 2 percent. Most areas are 2 to 20 acres in size and vary in shape.

Typically, the surface layer is black, very friable muck about 9 inches thick. The next layer is very dark brown, black, and very dark grayish brown, firm and friable muck about 35 inches thick. The substratum to a depth of about 60 inches is gray, very friable, calcareous, stratified silt loam, sandy loam, and very fine sandy loam. In some areas the deposit of muck is more than 50 inches thick. In other areas a thin layer of mineral soil material is deposited on the muck.

Included with this soil in mapping are some areas of soils on flood plains. These soils are subject to frequent flooding.

Permeability is moderately slow to moderately rapid in the organic layers of the Linwood soil and moderate in the loamy material. Runoff is very slow or ponded. The available water capacity is very high. The seasonal high water table is near or above the surface for long periods. Organic matter content is very high. Tilth is good. The capacity to store and release plant nutrients is very high. The rooting depth is limited by the water table.

Few areas are used as cropland. If adequately drained, this soil is well suited to corn, soybeans, and vegetable crops. Draining most areas is difficult, and small areas commonly are not drained. An adequate drainage system typically includes both surface and subsurface drains. Ditchbank stability is poor. Subsurface drains installed in the muck layers are likely to shift. They are most effective if installed in the mineral part of the soil.

Some areas are pastured. This soil is well suited to pasture grasses. Many small areas that are inadequately drained support these grasses. Native pasture grasses grow very well, even in dry periods. Reed canarygrass is a well suited species. Because the soil is very soft in the spring, grazing during this period can cause extensive damage to the plants.

Most areas are used as woodland. This soil is poorly suited to trees because of the wetness. It is well suited to habitat for wetland wildlife.

Because of the extreme natural wetness and the unstable nature of the soil material, this soil generally is unsuited to building site development and septic tank absorption fields. The best pond sites are in small, closed depressions on till plains where the substratum is compact glacial till. In most other areas, excessive seepage can be expected.

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

Lo—Lobdell silt loam, occasionally flooded. This deep, nearly level, moderately well drained soil is on flood plains. In the wider valleys it is commonly on the higher part of the flood plains adjacent to the stream channels. It makes up the entire flood plain in narrow valleys. It is flooded for brief periods in winter and spring. Slope is 0 to 2 percent. Individual areas are 5 to 100 acres in size and are long and narrow.

Typically, the surface layer is dark brown, friable silt loam about 3 inches thick. The subsoil is about 39 inches thick. It is yellowish brown. It is mottled below a depth of about 16 inches. The upper part is friable silt loam, and the lower part is very friable, stratified loam and silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, friable, stratified silt loam, loam, and very fine sandy loam. In some areas the surface layer and subsoil are sandy loam or gravelly loam. In a few areas pockets and lenses of sand and gravel are in the substratum.

Included with this soil in mapping are small areas of Holly, Orrville, and Shoals soils in depressions and old stream channels and around springs near breaks to uplands. These soils are wetter than the Lobdell soil. Also included are some areas of soils that have bedrock at a depth of 3 to 5 feet and areas in the flood pool of Mohawk Dam that are subject to controlled flooding. Included soils make up about 15 percent of most areas.

Permeability is moderate in the Lobdell soil. Runoff is slow. The available water capacity is high. The seasonal high water table is at a depth of 24 to 42 inches during extended wet periods. Organic matter content is moderately low or moderate. Tilth is good. The capacity to store and release plant nutrients is moderate. The soil is strongly acid to neutral in the root zone of most crops.

A few areas in the wider valleys are used as cropland. This soil is well suited to cultivated crops, but many areas are too narrow, too inaccessible, or too dissected by old stream channels to be easily farmed. The main problem is the constant danger of flooding. Floodwater can cut gullies, damage crops, and remove recently applied plant nutrients. Corn, soybeans, and other crops that are planted after the normal period of flooding are less likely to be damaged than perennial forage seedlings. Natural drainage is adequate for farming in most of the wide valleys. Randomly spaced subsurface drains are needed, however, in the wetter included soils.

Many areas are pastured. This soil is well suited to pasture. Most areas can be grazed early in spring. Pasture plants grow relatively well during dry periods. Bluegrass is a well suited species.

Some areas are used as woodland. This soil is well suited to trees. Young trees are subject to flood damage, especially in the included areas in the flood pool of Mohawk Dam. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil generally is unsuited to building site development and septic tank absorption fields because of the hazard of flooding and the seasonal wetness. Ponds in areas of this soil are subject to flood damage and are unlikely to hold water.

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

LvB—Loudonville silt loam, 2 to 6 percent slopes. This gently sloping, moderately deep, well drained soil is on hilltops. Most areas are high on the landscape and are surrounded by steeper slopes. Slopes commonly are long and smooth. Individual areas generally are 5 to 200 acres in size and irregularly shaped.

Typically, the surface layer is dark brown, friable silt loam about 10 inches thick. The subsoil is about 27 inches thick. It is yellowish brown and strong brown. The upper part is friable and firm silt loam, and the lower part is firm channery and very channery silt loam. Sandstone bedrock is at a depth of about 37 inches. In some areas the surface layer is channery silt loam. In other areas the lower part of the subsoil is yellowish red. In some places the soil is moderately well drained and is mottled in the lower part of the subsoil. In other places solid bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are springs, seepy areas, and small distinctly concave areas where the soils are wetter. These soils are mottled throughout the subsoil. They make up about 10 percent of most areas.

Permeability is moderate in the Loudonville soil. Runoff is medium. The available water capacity is low or moderate, depending on the depth to bedrock. Organic matter content is moderately low or moderate. Tilth is good. The capacity to store and release plant nutrients is moderate. The subsoil is commonly medium acid to very strongly acid. The rooting depth is limited by the bedrock at a depth of 20 to 40 inches.

Many areas are used as cropland. If properly managed, this soil is well suited to corn, soybeans, small grain, and fruit trees. If the soil is cultivated, erosion is a hazard. Also, the soil is somewhat droughty in the areas shallowest to bedrock. A system of conservation tillage that leaves crop residue on the surface helps to control erosion and conserves moisture. It is well suited to this soil. The long, smooth slopes are suited to contour stripcropping. A combination of stripcropping and conservation tillage commonly helps to keep erosion losses within tolerable limits. The plants respond well to applications of lime, fertilizer, and organic material.

Some areas are used for hay and pasture. This soil is well suited to forage crops. If a considerable amount of lime is applied, alfalfa can be grown. It withstands drought better than most other legumes. Intensive pasture management can be applied. The good natural drainage permits grazing early in spring. Grasses in unimproved pastures grow poorly during extended dry periods. Those in improved pastures, however, grow moderately well during these periods.

Some areas are used as woodland. This soil is well suited to trees. Because of the gentle slopes and the good natural drainage, intensive woodland management can be applied. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is moderately well suited to building site development and septic tank absorption fields. The good natural drainage and the gentle slopes favor these uses. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. In most areas the upper part of the underlying bedrock is shattered and can be excavated to a depth of 5 feet without blasting. The soil above the shattered rock is not thick enough to adequately filter effluent from septic tanks. The effluent can move a considerable distance in the shattered bedrock and thus can pollute ground water supplies. Installing the distribution lines in suitable fill material reduces the pollution hazard. The included soils that are subject to seepage should not be selected as sites for buildings or septic tank absorption fields.

Ponds dug in areas of this soil are very unlikely to hold water unless they are sealed. Many of the hilltop areas receive a limited amount of water.

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

LvC—Loudonville silt loam, 6 to 12 percent slopes. This sloping, moderately deep, well drained soil is on the tops and sides of hills. Slopes are commonly 100 to 650 feet long and are smooth. Most areas are 5 to 80 acres in size and vary in shape.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is about 29 inches thick. It is yellowish brown and strong brown. It is firm silt loam in the upper part and firm channery and very channery silt loam in the lower part. Sandstone bedrock is at a depth of about 37 inches. In wooded areas the surface layer is darker. In some eroded spots it is channery silt loam. In some severely eroded areas, the soil is gullied. In some areas bedrock is at a depth of 40 to 60 inches. In a few areas the lower part of the subsoil is yellowish red. In places the soil is moderately well drained and is mottled in the lower part of the subsoil.

Included with this soil in mapping are areas of soils that formed in material weathered from Black Hand Sandstone. These soils have more sand in the subsoil than the Loudonville soil and are droughty. Also included are small areas of somewhat poorly drained soils in depressions and small areas of springs and seeps on the lower parts of some slopes. Included soils make up about 15 percent of most areas, but the wetter inclusions make up about 25 percent of a few areas that are subject to seepage.

Permeability is moderate in the Loudonville soil. Runoff is rapid. The available water capacity is low or moderate, depending on the depth to bedrock. Organic matter content is moderately low or moderate. Tilth is good. The capacity to store and release plant nutrients is moderate. The subsoil is commonly medium acid to very strongly acid. The root zone is limited by the bedrock at a depth of 20 to 40 inches.

Some areas are used as cropland. If intensively managed for erosion control, this soil is moderately well suited to corn and small grain and to occasionally grown soybeans. Erosion is a severe hazard if the soil is cultivated. Contour stripcropping, applying a system of conservation tillage that leaves crop residue on the surface, including forage crops in the rotation, contour farming, and returning crop residue to the soil help to control erosion and conserve moisture. Natural drainage is adequate on most hillsides and ridgetops. A drainage system is needed, however, in many of the areas below the steeper slopes where wetter soils are included. Most of this wetness results from seepage out of the bedrock. Subsurface drains are not too effective in removing this water. Diversions along the base of the steeper slopes intercept some of the water. The soil is somewhat droughty in the areas shallowest to bedrock. Areas that do not have seepy spots are well suited to fruit trees.

Some areas are used for hay and pasture. This soil is well suited to forage crops. Intensive pasture management can be applied. The soil is well suited to grazing early in spring. Plants in well managed pastures grow moderately well during dry periods. Grasses in unimproved pastures, however, grow poorly during these periods. Hay and pasture plants respond well to additions of lime, fertilizer, and organic matter.

Some areas are used as woodland. This soil is well suited to trees. It is not too steep for intensive woodland management. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is moderately well suited to building site development. The good natural drainage favors this use, but the slope, the moderate depth to bedrock, and a moderate shrink-swell potential are limitations. In most areas the underlying rock is so shattered to a depth of about 6 feet that it can be excavated without blasting. The buildings should be designed so that they conform to the natural slope of the land. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Reseeding scalped areas as soon as possible helps to control erosion.

This soil is moderately well suited to septic tank absorption fields. The soil above the shattered bedrock is not thick enough to adequately filter the effluent from septic tanks. The effluent can move for a considerable distance in the shattered bedrock and thus can pollute ground water supplies. Installing the absorption fields in suitable fill material reduces the pollution hazard. The wetter included soils should not be selected as sites for buildings or absorption fields.

Ponds dug in areas of this soil are unlikely to hold water unless they are sealed.

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

LvD—Loudonville silt loam, 12 to 18 percent slopes. This moderately steep, moderately deep, well drained soil is on hillsides. Some areas are above steep or very steep soils. Most slope in only one direction, whereas some include both sides of a small valley. Most slopes are 100 to 500 feet long. Individual areas are 5 to 100 acres in size and generally are long and narrow.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is yellowish brown, firm silt loam and channery silt loam about 24 inches thick. Shattered sandstone bedrock is at a depth of about 31 inches. Solid bedrock is at a depth of about 38 inches. In places the surface layer is channery silt loam. In wooded areas it is darker. In some areas the soil is moderately well drained and is mottled in the lower part of the subsoil. In a few areas the surface layer and subsoil are sandy loam. In other areas hard bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Brownsville soils. These soils have more rock fragments in the subsoil than the Loudonville soil. They are in landscape positions similar to those of the Loudonville soil. Also included are seepy spots and springs around which the soils are somewhat poorly drained and are mottled throughout the subsoil and some severely eroded spots of soils that have a yellowish brown very channery silt loam surface layer. Included soils make up about 10 percent of most areas.

Permeability is moderate in the Loudonville soil. Runoff is rapid. The available water capacity is low or moderate, depending on the depth to bedrock. Organic matter content is moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. The subsoil is commonly medium acid to very strongly acid. The root zone is limited by the bedrock at a depth of 20 to 40 inches.

Some areas are used as cropland. Many areas formerly were used as cropland but are now pastured or left idle. This soil is poorly suited to a crop rotation in which corn, soybeans, and small grain are grown year after year. Erosion is a very severe hazard in cultivated areas. It reduces the depth to bedrock, thus reducing the thickness of the root zone. In many areas contour stripcropping and a system of conservation tillage that leaves crop residue on the surface help to control erosion and conserve moisture. The soil is moderately well suited to no-till corn grown as part of a rotation including forage crops. Such rotations are very commonly used to help control erosion. The soil is droughty during extended dry periods, especially in the shallower areas. Additions of fertilizer, lime, and organic material are needed. Because of runoff and leaching losses, frequent, light applications of plant nutrients are preferable to less frequent, heavier applications.

Many areas are used as pasture. This soil is well suited to grazing early in spring. Growth is slow during the dry part of the summer. Applications of lime and fertilizer are needed. No-till methods of seeding help to control erosion. Erosion is severe in pastures that are overgrazed.

Some areas are used as woodland or are idle. This soil is well suited to trees. Erosion is a hazard during logging periods if water collects and flows on skid trails and logging roads. Laying out the roads and trails across the slope and establishing water bars help to control erosion and facilitate the use of equipment. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is poorly suited to building site development. The good natural drainage favors this use, but the slope and the depth to bedrock are limitations. In most areas the underlying bedrock is shattered enough to be excavated to a depth of at least 6 feet without blasting. Erosion is a severe hazard during construction. It can be controlled by keeping as much plant cover on the site as possible. Driveways should be constructed across the slope and designed so that water does not collect and flow on them. The buildings should be designed so that they conform to the natural slope of the land.

This soil is poorly suited to septic tank absorption fields because of the slope and the moderate depth to bedrock. Downslope seepage of effluent is likely. Installing the distribution lines across the slope helps to prevent seepage of the effluent to the surface. The soil above the shattered bedrock is not thick enough to filter the effluent from septic tanks. The effluent can move a considerable distance in the shattered bedrock and thus can pollute ground water supplies. The absorption fields should be installed on the less sloping soils nearby.

The land capability classification is IVe. The woodland ordination symbol is 2r.

LvE—Loudonville silt loam, 18 to 25 percent slopes. This steep, moderately deep, well drained soil is on side slopes in valleys. Most areas slope in one direction, are long and narrow, and are 3 to 10 acres in size. Slopes are commonly 50 to 400 feet long.

Typically, the surface layer is dark brown, friable silt loam about 3 inches thick. The subsoil is yellowish brown, friable and firm silt loam and channery silt loam about 20 inches thick. Shattered sandstone bedrock is at a depth of about 23 inches. Hard bedrock is at a depth of about 36 inches. In some areas the depth to bedrock is 40 to 60 inches.

Included with this soil in mapping are seepy spots and springs where the soils are considerably wetter. Also included are small areas of very stony soils and rock outcrop on the upper part of side slopes. Inclusions make up about 10 percent of most areas.

Permeability is moderate in the Loudonville soil. Runoff is very rapid. The available water capacity is low. Organic matter content is moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. The subsoil is medium acid to very strongly acid.

A few areas are used as cropland. This soil generally is unsuited to crops because of the steep slope, a very severe erosion hazard, and the droughtiness.

Many areas are pastured. This soil is poorly suited to pasture. Forage species can be grazed early in the year, but they grow poorly during extended dry periods. The erosion hazard is severe. The slope limits some pasture improvement practices. Frequent, light applications of lime and fertilizer help to reduce runoff and leaching losses. No-till methods of seeding help to control erosion.

Many areas are used as woodland. This soil is well suited to trees. Erosion is a hazard during logging periods. Laying out logging roads and skid trails across the slope helps to control erosion and facilitates the use of equipment. Water bars also help to control erosion. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is poorly suited to building site development and generally is unsuited to septic tank absorption fields because of the steep slope and the moderate depth to bedrock. The buildings should be designed so that they conform to the natural slope of the land. Very few good pond sites are available in areas of this soil.

The land capability classification is VIe. The woodland ordination symbol is 2r.

Ly—Luray silty clay loam. This nearly level, deep, very poorly drained soil is primarily in shallow glacial lakebeds. Most areas are on the lowest part of the landscape. The soil is subject to ponding. Slope is 0 to 2 percent. Areas generally are 5 to 100 acres in size and are irregularly shaped.

Typically, the surface layer is very dark grayish brown, firm silty clay loam about 9 inches thick. The subsurface layer is very dark grayish brown, mottled, firm silty clay loam about 5 inches thick. The subsoil is grayish brown, dark grayish brown, and yellowish brown, mottled, firm silty clay loam about 32 inches thick. The substratum to a depth of about 60 inches is yellowish brown, mottled, friable silt loam that has thin layers of other textures. In places stones and pebbles are on the surface. In some areas the surface layer is silt loam. In other areas a thin layer of muck is on the surface.

Included with this soil in mapping are small areas of soils in which most of the lower part of the subsoil and most of the substratum are moderately rapidly permeable gravelly loam and sandy loam. A few included areas adjacent to streams are subject to flooding. Also included are soils that have poor structure in the subsoil and substratum, have a silty clay substratum, and are slowly permeable or very slowly permeable. Included soils make up about 10 percent of most areas.

Permeability is moderately slow in the Luray soil. Runoff is very slow or ponded. The available water capacity is high. The water table is near or above the surface for extended periods. It is high well into the growing season. Organic matter content is high. The capacity to store and release plant nutrients also is high. The subsoil is medium acid to neutral. Tilth is fair. The rooting depth is limited by the seasonal high water table.

Most areas are drained and are used as cropland. If adequately drained, this soil is well suited to corn, soybeans, and small grain. A drainage system that includes both surface and subsurface drains is needed in most areas. Adequate drainage for corn and soybeans is more easily attained than that needed for winter grain crops or alfalfa. Subsurface drains commonly are effective if outlets are available. In most areas plastic tile is preferable to clay tile, which is likely to shift. Many areas do not have good natural outlets. As a result, open ditches are needed to provide outlets for the subsurface drains and to remove excess surface water. In some areas, especially in Hilliar Township, the substratum is very unstable. Ditchbank stability is a problem in these areas. Ditches should be cleaned frequently. Tillage at optimum moisture content is important. If worked when wet and sticky, the soil becomes compacted and cloddy.

Some areas are used as pasture and hayland. This soil is well suited to hay and pasture. Alfalfa is suitable only in adequately drained areas. Pasture plants grow well in the dry part of the summer. Grazing early in spring, when the soil is soft and wet, can damage the plants and compact the soil. Reed canarygrass is a well suited species for seeded pastures in inadequately drained areas.

Some areas are used as woodland or are idle. This soil is moderately well suited to trees. The wetness interferes with the use of equipment. The trees can be logged during the drier parts of the year. Young trees can be damaged by ponded water in the lowest areas. Selecting species for planting that are tolerant of wetness helps to control seedling mortality. Frequent, light thinning and harvesting increase the vigor of the stand and reduce the windthrow hazard.

This soil generally is unsuited to building site development and septic tank absorption fields because of the ponding and the moderately slow permeability.

Some natural pond sites are available in the smaller areas of this soil, but a few are in the larger areas. Ponds dug in the soil vary in their capacity to hold water. Onsite investigation is needed to determine the suitability of each site. The site should receive enough runoff to fill the pond.

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

Md—Medway silt loam, occasionally flooded. This deep, nearly level, moderately well drained soil is on flood plains. It commonly is on the higher part of the flood plains and is not next to the stream channels. It is flooded for very brief periods in winter and spring. Slope is 0 to 2 percent. Individual areas are mainly 5 to 100 acres in size and are long and narrow.

Typically, the surface layer is very dark grayish brown, friable silt loam about 10 inches thick. The subsurface layer also is very dark grayish brown, friable silt loam. It is about 8 inches thick. The subsoil is yellowish brown, mottled, friable silt loam and loam about 16 inches thick. The substratum extends to a depth of about 60 inches. It is yellowish brown and grayish brown, mottled, friable and very friable, stratified loam, sandy loam, and silt loam in the upper part and brown, loose gravelly loamy sand in the lower part. In places the subsoil is mostly sandy loam or gravelly loam.

Included with this soil in mapping are small areas of the very poorly drained Sloan soils in abandoned stream channels. Some of these old channels have side slopes that are steep enough to interfere with cultivation. Included soils make up about 5 percent of most areas.

Permeability is moderate in the Medway soil. Runoff is slow. The available water capacity is high. The seasonal high water table is at a depth of 18 to 36 inches during extended wet periods. Organic matter content is moderate or high. Tilth is good. The capacity to store and release plant nutrients is high. The subsoil is slightly acid or neutral.

Many areas are used as cropland. This soil is well suited to corn, soybeans, and small grain. The hazard of erosion is slight. Natural drainage is generally adequate for crops, but randomly spaced subsurface drains may be needed in the wetter included soils. Flooding is the main hazard. Floodwater can wash away or bury seedlings, cut gullies, and remove recently applied plant nutrients. Corn, soybeans, and other crops that are planted after the normal period of flooding are less likely to be damaged.

Some areas are used for hay and pasture. This soil is well suited to forage crops. Pasture plants can be grazed early in the year. They grow moderately well in dry periods. The amount of lime needed for good alfalfa production is less than is needed on many other soils in the county. Bluegrass is a well suited pasture species in areas too dissected by old channels to be plowed and seeded. Hay and pasture seedlings are subject to flood damage.

A few areas are used as woodland. This soil is well suited to trees. Removing the less desirable trees, shrubs, and vines helps to control plant competition. Young trees are subject to flood damage.

This soil generally is unsuited to building site development and septic tank absorption fields because of the flooding and the wetness. Excavated ponds are unlikely to hold water. They are subject to flood damage.

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

OcA—Ockley silt loam, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on terraces. It commonly makes up an entire terrace level. The larger areas consist of a series of very low ridges and very shallow troughs. Most areas are 20 to 200 acres in size and are long and narrow.

Typically, the surface layer is brown, friable silt loam about 11 inches thick. The subsoil is about 38 inches thick. The upper part is yellowish brown, friable silt loam; the next part is brown and strong brown, firm silty clay loam; and the lower part is brown and dark brown, firm gravelly loam, gravelly coarse sandy loam, and gravelly sandy clay loam. The substratum to a depth of about 80 inches is yellowish brown, loose, calcareous very gravelly loamy coarse sand. In some areas the surface layer is darker. In other areas it is gravelly loam. In places the subsoil is silt loam or silty clay loam throughout. In a few areas the soil is moderately well drained.

Included with this soil in mapping are small areas of Fox soils on low knolls. These soils are more droughty than the Ockley soil. They make up less than 5 percent of most areas.

Permeability is moderate in the subsoil of the Ockley soil and very rapid in the substratum. Runoff is slow. The available water capacity is moderate. Organic matter content is moderately low or moderate. Tilth is good. The capacity to store and release plant nutrients is moderate or high. The subsoil is medium acid or strongly acid in the upper part and slightly acid to mildly alkaline in the lower part. The root zone is deep.

Most areas are used as cropland. This soil is well suited to corn, soybeans, small grain, and specialty crops. It is probably the best soil for crop production in the county. It crusts after hard rains. Controlling crusting and maintaining the organic matter content and fertility are the main management concerns. Erosion is a slight hazard. Natural drainage is adequate for crops. Some ponding occurs during rapid snowmelt when the soil is frozen, but it is of too short a duration to damage winter grain. The soil is well suited to irrigation; however, irrigation is rarely needed.

A few areas are pastured. This soil is well suited to forage crops. Most pastures are in a cropping system that includes row crops and small grain. The good natural drainage permits grazing early in spring. Pasture plants grow moderately well throughout the dry part of the summer. Intensive pasture management can be applied.

This soil is well suited to trees. Because the soil also is well suited to cropland, however, only a few areas are wooded. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is well suited to building site development and septic tank absorption fields. The nearly level slope and the good natural drainage favor these uses. A moderate shrink-swell potential is a limitation on building sites. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the damage caused by shrinking and swelling.

This soil is a probable source of sand and gravel. No natural pond sites are available. Excavated ponds are unlikely to hold water unless they are sealed.

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

OcB—Ockley silt loam, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on terraces. It makes up the entire area of small terraces and the low ridges and side slopes of old channels on the larger terraces. Areas generally are a series of low parallel ridges separated by shallow troughs. Most are 5 to 50 acres in size and are long and narrow.

Typically, the surface layer is dark brown, friable silt loam about 11 inches thick. The subsoil is about 34 inches thick. It is brown and firm. The upper part is silty clay loam, and the lower part is gravelly clay loam. The substratum to a depth of about 60 inches is yellowish brown, loose, calcareous very gravelly loamy coarse sand. In some places the surface layer is darker. In other places it is gravelly loam. In many narrow areas the soil is nearly level. In some areas it is moderately well drained. In other areas the surface layer is thicker.

Included with this soil in mapping are small areas of Fox soils on some of the higher, steeper ridges. These soils are more gravelly than the Ockley soil. They make up about 5 percent of most areas.

Permeability is moderate in the subsoil of the Ockley soil and very rapid in the substratum. Runoff is medium. The available water capacity is moderate. Organic matter content is moderately low or moderate. Tilth is good. The capacity to store and release plant nutrients is moderate or high. The subsoil is medium acid or strongly acid in the upper part and slightly acid to mildly alkaline in the lower part. The root zone is deep.

Most areas are used as cropland. This soil is well suited to corn, soybeans, small grain, specialty crops, and orchards. If the soil is cultivated, erosion is a hazard. Because of the short slopes, however, water does not attain a high velocity and thus does not cause extensive erosion. Returning crop residue to the soil and growing cover crops commonly reduce the erosion hazard. A system of conservation tillage that leaves crop residue on the surface is well suited to this soil. Controlling crusting and maintaining fertility, a sufficient amount of lime, and the organic matter content are management concerns. Natural drainage is adequate. If erosion is controlled, the soil can be irrigated, but irrigation is rarely needed.

A few areas are used for pasture. This soil is well suited to forage crops. Most pastures are in a cropping system that includes row crops and small grain. The good natural drainage permits grazing early in spring. Pasture plants grow moderately well during dry periods. Intensive pasture management can be applied.

This soil is well suited to trees. Because the soil also is well suited to cropland, however, only a few areas are wooded. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is well suited to building site development and septic tank absorption fields. The good natural drainage and the gentle slope favor these uses. The ridgetops should be favored over the troughs as building sites. A moderate shrink-swell potential is a limitation on building sites. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the damage caused by shrinking and swelling.

This soil is a probable source of sand and gravel. It generally is unsuited to ponds.

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

Or—Orrville silt loam, occasionally flooded. This nearly level, deep, somewhat poorly drained soil is on flood plains. It commonly makes up the entire width of the flood plains along small and medium streams. It is subject to flooding. Slope is 0 to 2 percent. Most areas are 5 to 200 acres in size and are long and narrow.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is dark grayish brown, brown, and grayish brown, mottled, friable silt loam and loam about 28 inches thick. The substratum to a depth of about 60 inches is strong brown and yellowish brown, very friable and friable, stratified loam, gravelly loam, and sandy loam. It is mottled in the upper part. In some areas the surface layer is gravelly loam or sandy loam. In other areas flagstones or boulders are on the surface. In some places bedrock is at a depth of 4 to 5 feet. In other places the subsoil and substratum have layers of sand and gravel.

Included with this soil in mapping are small areas of Holly and Lobdell soils. The poorly drained and very poorly drained Holly soils are in old stream channels and around springs. The moderately well drained Lobdell soils are slightly higher on the landscape than the Orrville soil. Also included are some low areas that are subject to ponding and some very short, steep slopes on the sides of old stream channels. Included soils make up about 15 percent of most areas.

Permeability is moderate in the Orrville soil. Runoff is slow. The available water capacity is moderate or high. A seasonal high water table is at a depth of 12 to 30 inches during extended wet periods. Organic matter content is moderate. Tilth is good. The capacity to store and release plant nutrients is high. The subsoil is medium acid or strongly acid. The rooting depth is restricted by the water table.

The use of this soil is determined to a large extent by the shape and accessibility of individual areas. Some of the wider areas are used as cropland. If adequately drained, the soil is well suited to corn and soybeans. It is better suited to these crops than to winter wheat or oats. The flooding hazard and the seasonal wetness are the major concerns. If they can be properly outleted and protected from flood damage, subsurface drains lower the seasonal high water table. Ditches can be used as outlets in some areas. Water is likely to back up into the subsurface drains when streams are high. Floodwater can cut gullies, damage subsurface drains, bury seedlings, and remove recently applied plant nutrients.

Many areas that are too narrow, too inaccessible, or too dissected to be used as cropland can be pastured. This soil is well suited to pasture. It is better suited to grasses than to legumes. Bluegrass is a suitable species. Grasses grow rather well throughout the dry part of the summer. Grazing early in spring, when the soil is wet, can damage the plants. Most undrained areas are too wet for deep rooted legumes.

Some areas are used as woodland or are idle. This soil is moderately well suited to trees. The species that can tolerate some wetness should be selected for planting. Floodwater and severe competition from grasses and shrubs can damage young trees. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil generally is unsuited to building site development and septic tank absorption fields because of the seasonal wetness and the hazard of flooding. Ponds dug in areas of this soil are unlikely to hold water. They are subject to flood damage.

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

Pc—Pewamo silty clay loam. This nearly level, deep, very poorly drained soil is on till plains. It is on flats and in closed depressions that commonly are on the lowest part of the landscape. It is subject to ponding. Slope is 0 to 2 percent. Individual areas range from 2 to 200 acres in size and vary in shape.

Typically, the surface layer is very dark grayish brown, firm silty clay loam about 9 inches thick. The subsurface layer is black, mottled, firm silty clay about 5 inches thick. The subsoil is dark gray, yellowish brown, and gray, mottled, very firm and firm silty clay loam and silty clay about 42 inches thick. The substratum to depth of about 60 inches is yellowish brown, mottled, firm clay loam. In some areas the surface layer is silt loam. In a few places light colored sediments are on the surface. In some areas layers of friable loam or gravelly loam are at a depth of 4 to 6 feet.

Included with this soil in mapping are small areas of the somewhat poorly drained Bennington soils on low knolls. These areas are 0.1 acre to 3.0 acres in size. The knolls are very distinct in plowed fields. Included soils make up about 10 percent of most areas.

Permeability is moderately slow in the Pewamo soil. Runoff is very slow or ponded. The available water capacity is high. The seasonal high water table is near or above the surface during extended wet periods. Organic matter content is moderately high. The capacity to store and release plant nutrients is high. The subsoil is medium acid to neutral in the upper part and neutral or mildly alkaline in the lower part. Tilth is fair. The rooting depth is limited by the water table.

Most of the large areas are used as cropland. Corn and soybeans are the principal crops in these areas. Some smaller areas also are used as cropland along with the surrounding, more extensive soils. If drained, this soil is well suited to corn, soybeans, and small grain. Subsurface drains are effective if outlets are available. Many areas do not have natural outlets. Open ditches are needed in these areas. In areas receiving runoff from higher slopes nearby, both surface and subsurface drains are needed. The most difficult areas to drain are closed depressions. Many such areas are not used for crops in wet years. Once adequate drainage is established, tilling at the optimum moisture content and applying plant nutrients are the main management concerns. If worked when wet and sticky, the soil becomes compacted and cloddy.

Some small areas are used for hay and pasture. This soil is well suited to forage crops, especially if it is drained. Most pastured areas are not adequately drained and are too wet for alfalfa. Alsike clover and birdsfoot trefoil are better suited legumes in these areas. Grazing early in spring, when the soil is soft and wet, can damage the plants. Forage production is relatively good during dry periods.

Only a few small areas are wooded. This soil is moderately well suited to trees. Ponding is likely to damage or kill young seedlings. Frequent, light thinning and harvesting increase the vigor of the stand and reduce the windthrow hazard. The trees can be logged during the drier parts of the year. Planting seedlings that have been transplanted once or mulching helps to control seedling mortality. Many undrained areas are better suited to habitat for wetland wildlife than to woodland.

This soil generally is unsuited to building site development and septic tank absorption fields because of the ponding and the moderately slow permeability. Good natural pond sites are available in the smaller closed depressions. Excavated ponds are likely to hold water. Since refill from underground aquifiers is moderately slow, a sufficient amount of runoff is needed to fill the ponds.

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

Pg—Pits, gravel. This map unit consists of areas from which gravel has been excavated. The gravel pits generally are in areas dominated by Chili, Fox, and Ockley soils. They commonly have nearly vertical sidewalls and a gently sloping floor. The sidewalls consist of gravel and sand. The floor is sand and gravel in some pits but is loamy where the entire gravel deposit has been removed.

The bottom of the pits generally is unsuited to crops for a variety of reasons. It is droughty in some areas and excessively wet in others. Organic matter content and natural fertility commonly are very low. Tilth is poor. The only suitable plants are those that can tolerate the adverse soil conditions.

The sidewalls of the gravel pits tend to be erosive and unstable, especially when they are wet. They can cave in. Some back cutting may be needed to make the slopes suitable for seeding. Drought-resistant grasses are the best suited species for seeding on the sidewalls.

Abandoned gravel pits are better suited to recreation uses and wildlife habitat than to most other uses. If they still have some gravel, they can be graded and seeded and then used as parks, playgrounds, or picnic areas. Pits excavated to or below the seasonal high water table can be developed as habitat for wetland wildlife.

No land capability classification or woodland ordination symbol is assigned.

Pu—Pits, quarry. This map unit consists of surface-mined areas from which sandstone has been removed for use in construction or as a source of sand. The unit commonly is on uplands or stream terraces. Most quarries are irregularly shaped and range from 10 to 150 acres in size. Most have a high wall on one or more sides.

Before the sandstone is quarried, the overburden generally is scalped and stockpiled. This material commonly is acid and is poorly suited to plants.

Both the overburden and the mined areas generally are unsuited to plants. Extensive reclamation is needed before seeding. The hard rock sidewalls are difficult to cut back. Some sidewalls can be covered if enough spoil material is available. Plant growth can be improved by leveling the spoil material, blanketing the spoil with topsoil and subsoil material, and applying lime and fertilizer. Planting grasses or legumes helps to control erosion. Some areas can be developed for recreation uses and habitat for wildlife.

No land capability classification or woodland ordination symbol is assigned.

RgB—Rigley sandy loam, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on unglaciated hilltops. Some areas are on the tops of very high, narrow ridges. Some are on benches below the ridges. Most are 2 to 20 acres in size and vary in shape.

Typically, the surface layer is dark brown, very friable sandy loam about 8 inches thick. The subsoil is about 49 inches thick. It is yellowish brown and strong brown. The upper part is very friable sandy loam, and the lower part is loose loamy sand that has bands of friable sandy loam. The substratum to a depth of about 60 inches is brownish yellow, loose loamy sand. In wooded areas the surface layer is thinner and darker. In places the surface layer and the upper part of the subsoil are loam. In a few areas the lower part of the subsoil is mottled.

Included with this soil in mapping are small areas of very stony soils and areas of soils that have shale or sandstone bedrock at a depth of 30 to 60 inches. Included soils make up about 10 percent of most areas.

Permeability is moderately rapid in the Rigley soil. Runoff is slow. The available water capacity is low or moderate. Organic matter content is moderately low. Tilth is good. The capacity to store and release plant nutrients is low or moderate. Unless the soil has been limed, the subsoil is strongly acid to extremely acid.

Some areas are used as cropland. This soil is moderately well suited to corn, soybeans, and small grain. Returning crop residue to the soil and growing cover crops help to control erosion. Droughtiness is a limitation, especially if crops that have shallow root systems are grown. Erosion-control practices that favor the buildup of organic matter improve the available water capacity. The soil is well suited to nursery stock; however, growth rates are slow. The texture in the upper part of the profile favors digging and balling of nursery stock.

Some areas are used for pasture and hay. This soil is moderately well suited to forage crops. The good natural drainage permits grazing early in spring. Grasses in unimproved pastures do not grow well throughout the dry part of the summer. Deep rooted legumes, such as alfalfa, are less affected by drought, but the soil is too acid for alfalfa to grow well. Timely applications of lime and fertilizer are needed because of the loss of plant nutrients through leaching. Intensive pasture management can be applied. Additions of organic material are especially beneficial in conserving moisture and maintaining productivity.

Some areas are used as woodland. This soil is well suited to trees. Because of the gentle slopes, intensive woodland management can be applied. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is well suited to building site development and septic tank absorption fields. The gentle slopes and the good natural drainage favor these uses. Some areas are very scenic. Because of the droughtiness, grasses in lawns grow poorly during dry periods. The included soils that have shale or sandstone bedrock at a depth of 30 to 60 inches are not so well suited to building site development or septic tank absorption fields.

Ponds excavated in areas of this soil are very unlikely to hold water unless they are sealed.

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

RgC—Rigley sandy loam, 6 to 12 percent slopes. This sloping, deep, well drained soil is on unglaciated sandstone hills. It is on ridge crests, benches, and the upper parts of hillsides. Slopes are mainly 50 to 250 feet long. They are uniform. Some areas slope in only one direction and some in several directions. Most are 5 to 30 acres in size and vary in shape.

Typically, the surface layer is dark brown, very friable sandy loam about 8 inches thick. The subsoil is about 49 inches thick. It is dark yellowish brown, yellowish brown, and strong brown. The upper part is very friable and friable sandy loam, and the lower part is loose channery loamy sand and loamy sand and has sandy loam bands. The substratum to a depth of about 60 inches is brownish yellow, loose loamy sand. In wooded areas the surface layer is thinner and darker. In places the surface layer and the upper part of the subsoil are loam. In parts of some bench areas, the soil is slightly wetter.

Included with this soil in mapping are small areas of very stony soils and areas of moderately well drained soils that have shale or sandstone bedrock at a depth of 30 to 60 inches. Included soils make up about 15 percent of the areas on benches and 5 percent of other areas.

Permeability is moderately rapid in the Rigley soil. Runoff is medium. The available water capacity is low or moderate. Organic matter content is moderately low. Tilth is good. The capacity to store and release plant nutrients is low or moderate. Unless the soil has been limed, the subsoil is strongly acid to extremely acid.

Some areas are used as cropland. This soil is moderately well suited to corn and small grain and to occasionally grown soybeans. If cultivated crops are grown, erosion is a hazard. Crop yields are reduced by droughtiness. A system of conservation tillage that leaves crop residue on the surface and cover crops help to control erosion and conserve moisture. Cross-slope cultivation should be used where practical. The soil is suited to nursery stock; however, growth rates are slow. The texture in the upper part of the profile favors digging and balling of nursery stock.

Some areas are used for hay and pasture. This soil is moderately well suited to alfalfa and to other deep rooted forage crops that can withstand droughtiness. The good natural drainage permits grazing early in spring. Grasses in unimproved pastures grow poorly during extended dry periods. The soil is too acid for alfalfa to grow well. Timely applications of lime and fertilizer are needed because of the loss of plant nutrients through leaching. More frequent, light applications are preferable on both cropland and pasture. Additions of organic material conserve moisture and increase growth rates.

Many areas are used as woodland. This soil is well suited to trees. It is not too steep for intensive woodland management. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is moderately well suited to building site development and septic tank absorption fields. The good natural drainage favors these uses, but the slope is a limitation. Buildings should be designed so that they conform to the natural slope of the land. Lawns may be difficult to establish in areas where the substratum is exposed during construction. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of the effluent to the surface. The included soils that have shale or sandstone bedrock at a depth of 30 to 60 inches are not so well suited to building site development or septic tank absorption fields.

Ponds constructed in areas of this soil are unlikely to hold water.

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

RgD—Rigley sandy loam, 12 to 18 percent slopes. This moderately steep, deep, well drained soil is on unglaciated hills. Most areas slope uniformly in one direction. Slopes are 75 to 400 feet long. Individual areas are 5 to 50 acres in size. Most are long and narrow.

Typically, the surface layer is very dark grayish brown, very friable sandy loam about 3 inches thick. The subsoil is about 37 inches thick. It is yellowish brown. The upper part is very friable sandy loam, and the lower part is very friable and loose loamy sand. The substratum to a depth of about 60 inches is strong brown, loose loamy sand. In places the surface layer is loamy sand. In some areas on colluvial slopes, the soil is moderately well drained. In some areas bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of the very droughty, moderately deep Schaffenaker soils on high ridges and on the steeper parts of slopes. In some small included areas on the lower parts of some colluvial slopes, the soils have clay shale at a depth of 3 to 5 feet. Also included are some very stony areas and rock outcrop on shoulder slopes. Inclusions make up about 15 percent of most areas.

Permeability is moderately rapid in the Rigley soil. Runoff is rapid. The available water capacity is low or moderate. Organic matter content is low or moderately low. Tilth is good. The capacity to store and release plant nutrients is low or moderate. Unless the soil has been limed, the subsoil is strongly acid to extremely acid.

Only a few small areas are used as cropland. Because of the erosion hazard, droughtiness, acidity, and the low or moderate capacity to store and release plant nutrients, this soil is poorly suited to cultivated crops. Small areas in fields dominated by other soils that are better suited to crop production require large applications of organic material, lime, and fertilizer. A system of conservation tillage that leaves crop residue on the surface and inclusion of meadow crops in the cropping system help to control erosion and conserve moisture. The soil is well suited to no-till planting.

Some areas are used as hayland and pasture. This soil is moderately well suited to hay and pasture. The good natural drainage permits grazing early in spring. Grasses in native pastures grow poorly during the dry part of the summer. Alfalfa can withstand drought better than most other legumes. Because of the acidity, however, applications of lime are needed. Timely applications of lime and fertilizer are needed because of the loss of plant nutrients through leaching. Stones on the surface interfere with pasture improvement in some areas. Additions of organic material conserve moisture and increase growth rates.

Most areas are used as woodland. This soil is well suited to trees. Growth rates are best on north-facing slopes. Constructing logging roads and skid trails across the slope facilitates the use of equipment and helps to control erosion. Water bars also help to control erosion. Seedling mortality on south aspects can be controlled by planting seedlings that have been transplanted once or by mulching. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is poorly suited to building site development and septic tank absorption fields. The good natural drainage favors these uses, but the slope is a limitation. Considerable excavation commonly is needed on building sites. The buildings should be designed so that they conform to the natural slope of the land. Installing the distribution lines in septic tank absorption fields across the slope helps to prevent seepage of the effluent to the surface. The soil is poorly suited to ponds.

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

RhE—Rigley-Coshocton complex, 18 to 25 percent slopes. These deep, steep soils are on valley side slopes. The well drained Rigley soil commonly is on the upper part of the slopes, and the moderately well drained Coshocton soil is on the lower part. Most areas are below less sloping hilltops or benches and above the steeper valley side slopes. Some include both sides of a small valley, whereas others include only one side. Slopes commonly are smooth and are 50 to 500 feet long. Individual areas are 5 to 30 acres in size and generally are long and narrow. Most are about 40 percent Rigley loam and 30 percent Coshocton channery silt loam. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Rigley soil has a surface layer of very dark brown, very friable loam about 2 inches thick. The subsurface layer is brown, very friable loam about 4 inches thick. The subsoil is about 31 inches thick. It is yellowish brown and very friable. The upper part is loam, and the lower part is channery loam. The substratum to a depth of about 60 inches is yellowish brown, very friable channery loam. In places the surface layer and subsoil are sandy loam or channery sandy loam. In some areas firm silty clay loam is below a depth of 4 feet.

Typically, the Coshocton soil has a surface layer of very dark brown, friable channery silt loam about 2 inches thick. The subsurface layer is dark brown, friable channery silt loam about 6 inches thick. The subsoil is about 40 inches thick. It is yellowish brown. The upper part is friable channery loam, and the lower part is mottled, very firm silty clay loam. The substratum to a depth of about 60 inches is olive, mottled, very firm silty clay loam. In places the surface layer and subsurface layer are sandy loam or loam.

Included with these soils in mapping are small areas of soils on foot slopes. The content of sandstone fragments in the subsoil of these included soils is 40 to 70 percent. Also included are soils that are sandy loam to a depth of 2 to 4 feet and silty clay loam below. Included soils make up about 30 percent of most areas.

Permeability is moderately rapid in the Rigley soil. Runoff is rapid. The available water capacity is low or moderate. Organic matter content is low or moderately low. Tilth is good. The capacity to store and release plant nutrients is low or moderate. Where the soil is unlimed, the subsoil is strongly acid to extremely acid. The root zone is deep.

Permeability is slow or moderately slow in the Coshocton soil. Runoff is rapid. The available water capacity is moderate. Organic matter content is moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. A perched seasonal high water table is at a depth of 18 to 42 inches during extended wet periods. Where the soil is unlimed, the subsoil is strongly acid to extremely acid. The root zone is deep.

Some areas formerly were used as cropland or pasture, but only a few are still farmed. These soils generally are unsuited to cultivated crops. If the soils are cultivated, erosion is a very severe hazard. Also, the Rigley soil is droughty. The slope limits the use of farming equipment.

A few areas are pastured. These soils are poorly suited to forage crops. Pasture plants can be grazed early in the year, but they grow poorly on the Rigley soil during extended dry periods. No-till seeding methods help to control erosion. Some pasture improvement practices can be applied.

Most areas are used as woodland. These soils are moderately well suited to trees. Tree growth is faster on the Coshocton soil than on the Rigley soil. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and a lower evapotranspiration rate because of less exposure to the prevailing wind and the sun. Constructing logging roads and skid trails across the slope facilitates the use of equipment and helps to control erosion. Water bars also help to control erosion. Mulching and planting seedlings that have been transplanted once help to control seedling mortality on south-facing slopes.

Numerous oil wells are in areas of these soils. Erosion along and on access roads to these wells is a major problem. Building such roads across the slope and constructing water bars help to control erosion.

Because of the steep slope of both soils and the seasonal wetness of the Coshocton soil, this map unit is poorly suited to building site development. The buildings should be designed so that they conform to the natural slope of the land. Considerable excavation is needed. Erosion is a serious hazard during construction. It can be controlled by keeping as much vegetation on the site as possible. Installing drains at the base of footings in the Coshocton soil helps to keep basements dry.

This map unit generally is unsuited to septic tank absorption fields because of the steep slope of both soils and the seasonal wetness and slow or moderately slow permeability of the Coshocton soil.

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

RmB—Rittman silt loam, 2 to 6 percent slopes. This gently sloping, deep, moderately well drained soil is on till plains. Most areas are on ridgetops that are surrounded by steeper slopes. Slopes are long and uniform in most areas. Areas generally are 2 to 100 acres in size and are irregularly shaped.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is about 44 inches thick. It is yellowish brown. It is mottled below a depth of about 18 inches. The upper part is firm silty clay loam; the next part is a fragipan of mottled, very firm, dense clay loam and loam; and the lower part is mottled, firm loam. The substratum to a depth of about 70 inches is yellowish brown and dark yellowish brown, firm, calcareous clay loam and loam glacial till. It is mottled within a depth of about 60 inches. In eroded spots in most cultivated fields, the surface layer is yellowish brown. In areas on the wider ridgetops, the slope is commonly less than 2 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Wadsworth soils on the concave parts of the landscape and around the head of drainageways. Also included are spots of severely eroded soils that have a yellowish brown silty clay loam surface layer. These spots are commonly on the higher, steeper knolls. Included soils make up about 5 percent of most areas.

Permeability is moderate above the fragipan of the Rittman soil and slow in the fragipan. Runoff is medium. The root zone is restricted by the dense fragipan at a depth of 18 to 36 inches. The available water capacity is low above the fragipan. A perched seasonal high water table is at a depth of 18 to 36 inches during extended wet periods. Organic matter content is moderate. Tilth is good. The capacity to store and release plant nutrients is moderate. Where the soil is not limed, the upper part of the subsoil is strongly acid or very strongly acid.

Many areas are used as cropland. If properly managed, this soil is well suited to corn, soybeans, and small grain. If the soil is cultivated, erosion is a moderate hazard. It reduces the depth to the fragipan and results in poorer tilth. Most areas have uniform slopes that are well suited to erosion-control practices. Cross-slope cultivation, cover crops, and inclusion of forage crops in the rotation help to control erosion. A system of conservation tillage that leaves crop residue on the surface is suited to this soil. In most areas natural drainage is adequate for crops, but randomly spaced subsurface drains are needed in troublesome wet spots and the wetter included soils. Excessive wetness is more likely to damage alfalfa and winter grain than other crops. Additions of manure help to restore the productivity of the included eroded spots.

Some areas are used for pasture and hay. This soil is well suited to permanent and rotation pasture and to hay. Intensive pasture management can be applied. Cultivated crops can be grown occasionally to aid in seedling establishment and weed control. Pasture plants can be grazed rather early in spring.

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

This soil is moderately well suited to building site development. The seasonal high water table is a limitation late in winter and early in spring. During these periods water seeps along the top of the fragipan. Installing drains at the base of footings removes this water. The wetness is likely to be less severe on the higher knolls. Distinctly low or concave areas should not be selected as building sites. Coating the exterior of basement walls helps to keep basements dry.

Because of the slow permeability and the seasonal wetness, this soil is only moderately well suited to septic tank absorption fields. Enlarging the absorption field and installing the distribution lines as shallow as possible help to overcome the restricted permeability. Distinctly low or concave spots should not be selected as sites for absorption fields. Installing perimeter drains around the absorption field lowers the seasonal high water table. Excavated ponds are likely to hold water.

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

RmC2—Rittman silt loam, 6 to 12 percent slopes, eroded. This sloping, deep, moderately well drained soil is on till plains. It is on the tops and sides of hills and on the side slopes of small valleys. Many areas include both sides of the valleys and the narrow bottom. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the surface layer. Slopes are smooth in some areas and irregular in others. They commonly are 75 to 450 feet long. Most areas are 3 to 20 acres in size and are long and narrow.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. It has chunks of yellowish brown silty clay loam subsoil material. The subsoil is about 40 inches thick. It is yellowish brown. The upper part is mottled, firm silty clay loam; the next part is a fragipan of mottled, very firm, dense clay loam and loam; and the lower part is firm loam. The substratum to a depth of about 70 inches is yellowish brown and dark yellowish brown, firm, calcareous loam glacial till. In some areas the soil is not eroded.

Included with this soil in mapping are small areas of the somewhat poorly drained Wadsworth soils along the base of slopes and on the concave parts of the landscape. Also included are areas of severely eroded soils that have a yellowish brown silty clay loam surface layer. These soils are on the upper part of slopes. Also included are some springs and seeps and, in valleys, very narrow strips of soils that do not have a fragipan and are commonly wetter than the Rittman soil. Inclusions make up about 10 percent of most areas.

Permeability is moderate above the fragipan of the Rittman soil and slow in the fragipan. Runoff is rapid. The root zone is restricted by the dense fragipan at a depth of 18 to 36 inches. The available water capacity is low above the fragipan. A perched seasonal high water table is at a depth of 18 to 36 inches during extended wet periods. Water moves laterally along the top of the fragipan and surfaces in springs and seepy spots on the slopes. Organic matter content is moderately low. Tilth is good or fair. The capacity to store and release plant nutrients is moderate. Where the soil is not limed, the upper part of the subsoil is strongly acid or very strongly acid.

Many areas are used for cultivated crops. If carefully managed for erosion control, this soil is moderately well suited to corn and small grain and to occasionally grown soybeans. If the soil is cultivated, erosion is a severe hazard. Significant erosion losses have already occurred and will continue to occur unless the surface is protected. Erosion reduces the depth to the fragipan and productivity and results in poorer tilth. Cultivating across the slope, returning crop residue to the soil, and growing forage crops help to control erosion. Grassed waterways help to control erosion in concave areas where water collects and flows. A system of conservation tillage that leaves crop residue on the surface is well suited to the soil. It increases the organic matter content. Natural drainage is generally adequate for farming, but randomly spaced subsurface drains are needed in springs, seeps, and the wetter included soils.

Some areas are used for hay and pasture. This soil is well suited to forage crops. Pasture plants can be grazed early in spring. Intensive pasture management can be applied. A cultivated crop can be grown occasionally to aid in seedling establishment and weed control. Erosion is a hazard in overgrazed pastures.

Some areas are used as woodland. This soil is well suited to trees. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

Because of the seasonal wetness and the slope, this soil is only moderately well suited to building site development. Water seeps along the top of the fragipan in winter and in spring. As a result, basements can be wet during these periods. Installing drains at the base of footings removes the excess water. These drains are especially needed on the upslope side of the basement. Erosion is a hazard in areas scalped during construction. It can be controlled by reseeding as soon as possible after construction. Wet spots, springs, and natural drainage courses should not be selected as building sites.

This soil is poorly suited to septic tank absorption fields. The slow permeability and the seasonal wetness are limitations. Downslope seepage of effluent along the top of the fragipan is a major problem. It can be controlled by enlarging the absorption field and by installing the distribution lines as close to the surface as possible. Installing the distribution lines across the slope helps to prevent seepage of the effluent to the surface. Installing perimeter drains around the absorption fields lowers the seasonal high water table.

Good natural pond sites are available in areas where this soil is on both sides of a small natural drainageway. Excavated ponds are likely to hold water.

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

ScD—Schaffenaker loamy sand, 12 to 25 percent slopes. This moderately steep and steep, moderately deep, well drained soil is on high, narrow ridges and on valley side slopes. Some areas include only one side slope of the ridge. Others include both sides and the narrow, less sloping ridgetop. The valley sides slope in one direction. Slopes are 50 to 300 feet long. Most areas are 5 to 30 acres in size and are long and narrow

Typically, the surface layer is very dark brown, very friable loamy sand about 1 inch thick. The subsurface layer is brown, very friable loamy sand about 2 inches thick. The subsoil is brownish yellow and reddish yellow, loose loamy sand about 21 inches thick. The substratum is brownish yellow, loose channery sand about 11 inches thick. Sandstone bedrock is at a depth of about 35 inches. In some areas the depth to bedrock is more than 40 inches. In other areas the subsoil is sandy loam. In places the soil is less droughty.

Included with this soil in mapping are soils on narrow ridgetops that have a slope of 2 to 12 percent, some small very stony areas, and a few rock outcrops. Inclusions make up about 5 percent of most areas.

Permeability is rapid or very rapid in the Schaffenaker soil. Runoff is medium. The available water capacity is very low. Organic matter content is low. Tilth is fair. The capacity to store and release plant nutrients is very low. The subsoil is strongly acid to extremely acid. The rooting depth is limited by the bedrock at a depth of 20 to 40 inches.

A few areas are used as pasture. This soil generally is unsuited to cropland and is poorly suited to pasture because of droughtiness, the slope, and low fertility. No-till seeding methods help to control erosion. Conservation of moisture is very important. Because nutrients are rapidly leached, plants generally respond better to smaller, more frequent or timely applications of fertilizer than to one large application.

Most areas are used as woodland. This soil is poorly suited to trees. Growth rates are very slow because of the droughtiness. Even though the equipment limitation is moderate, the soil is not too steep for most woodland management practices. Constructing logging roads and skid trails on the contour facilitates the use of equipment. Mulching or planting seedlings that have been transplanted once helps to control seedling mortality. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and a lower evapotranspiration rate because of less exposure to the prevailing wind and the sun.

This soil is poorly suited to building site development and septic tank absorption fields. The good natural drainage favors these uses, but the slope, a poor filtering capacity, and the depth to bedrock are severe limitations. The best building sites are the ridgetops in the included areas where the slope is 2 to 12 percent. Structures can be built into the hillside in some of these areas. The buildings should be designed so that they conform to the natural slope of the land. The soil is better suited to buildings without basements than to buildings with basements. Installing the distribution lines in septic tank absorption fields across the slope helps to prevent seepage of the effluent to the surface. Some of the nearby soils are better sites for the absorption fields. The soil generally is unsuitable as a pond site.

The land capability classification is VIs. The woodland ordination symbol is 4s on north aspects, 5s on south aspects.

SdF—Schaffenaker very bouldery loamy sand, 25 to 60 percent slopes. This very steep, moderately deep, well drained soil is on the sides of high, narrow ridges and on the side slopes of valleys that are cut into medium and coarse grained sandstone. The ridges are very high. Boulders and large stones, 1 to 20 feet in diameter, cover about 3 to 8 percent of the surface. Slopes on the ridges are mainly 50 to 200 feet long. Most areas on the sides of ridges are 5 to 20 acres in size, are U-shaped, and extend around the nose of the ridge. The areas on valley sides are 10 to 80 acres in size, slope in one direction, and are long and narrow. Slopes in these areas are 100 to 400 feet long.

Typically, the surface layer is dark brown, very friable very bouldery loamy sand about 1 inch thick. The subsurface layer is brownish yellow and brown, very friable loamy sand about 5 inches thick. The subsoil is yellowish brown, loose loamy sand about 15 inches thick. The substratum is brownish yellow, loose sand about 11 inches thick. Sandstone bedrock is at a depth of about 32 inches. In some areas the depth to bedrock is 40 to 60 inches.

Included with this soil in mapping are some areas on very narrow ridgetops that have a slope of 2 to 12 percent. Also included are nearly vertical exposures of bedrock on the upper part of side slopes and on the sides of ridges. Inclusions make up 1 to 5 percent of most areas.

Permeability is rapid or very rapid in the Schaffenaker soil. Runoff is very rapid. The available water capacity is very low. Organic matter content is low. Tilth is fair. The capacity to store and release plant nutrients is very low. The subsoil is strongly acid to extremely acid. The soil is very infertile and droughty.

Because of the very steep slopes, the surface boulders, and droughtiness, this soil generally is unsuitable as cropland and pasture.

Most areas support trees of poor quality. This soil is poorly suited to trees. Growth rates are very slow because of the droughtiness and the very limited root zone. The slope and the boulders interfere with woodland improvement and harvesting. Constructing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars also help to control erosion. Mulching or planting seedlings that have been transplanted once helps to control seedling mortality. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and a lower evapotranspiration rate because of less exposure to the prevailing wind and the sun.

This soil generally is unsuited to building site development and septic tank absorption fields because of the very steep slope, the bedrock at a depth of 20 to 40 inches, and a poor filtering capacity.

The land capability classification is VIIs. The woodland ordination symbol is 4s on north aspects, 5s on south aspects.

Se—Sebring silt loam. This nearly level, deep, poorly drained soil is mainly on slack water terraces along streams and in former lakebeds. Some areas are in upland draws. Most are on the lowest part of the landscape and are surrounded by better drained soils. Some areas have a lower lying flood plain on one side, whereas others are completely surrounded by higher lying soils. The soil is subject to flooding. Slope is 0 to 2 percent. Most areas are 2 to 15 acres in size and vary in shape.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 43 inches thick. It is mottled. The upper part is dark grayish brown, friable silt loam, and the lower part is dark gray, grayish brown, and gray, firm silty clay loam. The substratum to a depth of about 60 inches is grayish brown, mottled, firm silty clay loam that has thin layers of sandier material. In uncultivated areas the surface and subsurface layers are thin. In some areas the surface layer is thicker because it receives sediment from the higher lying adjacent soils. In a few areas pebbles are on the surface.

Included with this soil in mapping are small areas of moderately permeable soils that are gravelly loam throughout or are dominantly gravelly loam or sandy loam below a depth of about 30 inches. These soils are in landscape positions similar to those of the Sebring soil. Some narrow included strips near streams are subject to flooding during periods of extremely high water. Also included are small areas of the very poorly drained Luray soils on the lowest part of the landscape. Included soils make up about 15 percent of most areas.

Permeability is moderately slow in the Sebring soil. Runoff is very slow or ponded. The available water capacity is high. The seasonal high water table is near or above the surface during extended wet periods. Organic matter content is moderate. Tilth is good. The capacity to store and release plant nutrients is high. The subsoil is medium acid or strongly acid in the upper part and neutral to strongly acid in the lower part. The rooting depth is restricted by the seasonal high water table.

The use of this soil depends largely on the degree to which the severe natural wetness has been overcome. If adequately drained, this soil is moderately well suited to corn, soybeans, and small grain. The degree of difficulty in establishing adequate drainage differs considerably from area to area. Open ditches commonly are used to remove excess surface water. They are rather easily installed in some areas but require considerable excavation in closed depressions. Subsurface drains are effective in lowering the seasonal high water table if properly outleted. Good natural outlets are not available in many areas. Open ditches are commonly used as outlets. Adequate drainage for corn and soybeans is more easily attained than that needed for winter grain or crops planted early in spring.

Some areas are used as pasture and hayland. This soil is moderately well suited to hay and pasture. A drainage system is needed in pastured areas. Few pastures are adequately drained. Undrained areas are best suited to native grass pasture since these areas are too wet for most legumes. Grazing early in spring, when the soil is very soft, can damage the sod. Pasture plants grow relatively well throughout the dry part of the summer.

Some undrained areas are used as woodland. This soil is moderately well suited to trees. Planting seedlings that have been transplanted once or mulching helps to control seedling mortality. Frequent, light thinning and harvesting increase the vigor of the stand and reduce the windthrow hazard. The soil is too soft to support heavy equipment in winter and spring. The trees can be planted and logged during the drier parts of the year. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil generally is unsuited to building site development and septic tank absorption fields because of the ponding and the moderately slow permeability.

Good natural pond sites are available in some areas of this soil that are in closed depressions. Seepage, however, is a limitation. Excavated ponds vary widely in their capacity to hold water because of the wide range of textures in the substratum. Onsite investigation is needed to determine the suitability of each site. Most areas receive enough runoff to fill a pond.

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

Sh—Shoals silt loam, occasionally flooded. This nearly level, deep, somewhat poorly drained soil is on flood plains. It makes up the entire width of narrow flood plains and is in low areas on the wider flood plains. It is subject to flooding. Slope is 0 to 2 percent. Most areas are 10 to 200 acres in size and are long and narrow.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The substratum to a depth of about 60 inches is grayish brown, yellowish brown, and brown, mottled, friable and very friable, stratified silt loam, loam, and sandy loam. In places the surface layer is gravelly loam or is darker. In some areas the part of the substratum within a depth of 40 inches has layers of sand and gravel.

Included with this soil in mapping are small areas of the poorly drained and very poorly drained Holly soils in depressions and in old stream channels. The nearly vertical side slopes of some of these channels interfere with the use of machinery. Also included are some very low areas of soils that are subject to ponding. Included soils make up about 10 percent of most areas.

Permeability is moderate in the Shoals soil. Runoff is slow. The available water capacity is high. The seasonal high water table is at a depth of 6 to 18 inches during extended wet periods. Organic matter content is moderate. Tilth is good. The capacity to store and release plant nutrients is high. The soil is slightly acid to mildly alkaline in the upper part and neutral or mildly alkaline in the lower part. The rooting depth is restricted by the water table.

The use of this soil is determined to a large extent by the shape and accessibility of individual areas. Some of the smoother and more accessible areas are used as cropland. If adequately drained, this soil is well suited to corn and soybeans. The major management concerns are the hazard of flooding and the seasonal wetness. If they can be properly outleted and protected from flood damage, subsurface drains are used. Some areas do not have suitable natural outlets. Water is likely to back up into subsurface drains when streams are high. Corn and soybeans are better suited to this soil than winter wheat and oats. Floodwater can cut gullies, damage subsurface drains, bury seedlings, and remove recently applied plant nutrients.

Many areas that are narrow, inaccessible, or dissected by old stream channels are pastured. This soil is well suited to pasture. Bluegrass is a well suited species. If fertilizer is applied, bluegrass grows well throughout the dry part of the summer. Grazing early in spring, when the soil is wet and soft, is likely to damage the plants. Undrained areas are too wet for deep rooted legumes.

Some areas are used as woodland. This soil is moderately well suited to trees. Removing the less desirable trees, shrubs, and vines helps to control plant competition. Young trees can be damaged by floodwater. The species tolerant of some wetness should be selected for planting.

This soil generally is unsuited to building site development and septic tank absorption fields because of the flooding hazard and the seasonal wetness. Ponds are subject to flood damage. Excavated ponds are unlikely to hold water.

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

Sn—Sloan silt loam, occasionally flooded. This nearly level, deep, very poorly drained soil is on flood plains. It commonly is in old stream channels and on other low lying parts of the flood plains. It is subject to flooding. Some areas receive water from springs near the flood plains. Slope is 0 to 2 percent. Most areas range from 5 to 20 acres in size and are long and narrow.

Typically, the surface layer is black, friable silt loam about 9 inches thick. The subsurface layer also is black, friable silt loam. It is about 5 inches thick. The subsoil is about 18 inches thick. It is very dark grayish brown and grayish brown, mottled, friable silt loam and very friable loam. The substratum to a depth of about 60 inches is grayish brown, light olive brown, and dark gray, very friable, calcareous, stratified loam, sandy loam, and gravelly loam. It is mottled in the upper part. In some places a thin layer of light colored sediment overlies the black surface layer. In other places the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Linwood and Medway soils. Linwood soils have muck in the upper part and are in closed depressions. The moderately well drained Medway soils are in the higher positions on the flood plains. Also included are some areas of soils that are subject to ponding. Included soils make up about 10 percent of most areas.

Permeability commonly is moderate in the Sloan soil but is moderately slow in some areas. Runoff is very slow. The available water capacity is high. The water table is near the surface during extended wet periods. Organic matter content is high. Tilth is good. The capacity to store and release plant nutrients is very high. The surface layer and the subsoil are slightly acid to mildly alkaline. The rooting depth is limited by the water table.

Some areas are used as cropland. If adequately drained, this soil is well suited to corn and soybeans. The flooding hazard and prolonged wetness are the management concerns. The soil is sufficiently permeable to be drained by subsurface drains, but many areas do not have suitable outlets. Open ditches are beneficial in such areas, but even these are not fully effective in the lowest areas. Areas that are wet because of water from springs are especially difficult to drain. Flooding can damage drains. Corn and soybeans are better suited to this soil than winter wheat and oats. Tillage and harvesting at optimum moisture levels help to maintain tilth.

Some areas are pastured. This soil is well suited to pasture grasses. Bluegrass and reed canarygrass are well suited species. They grow well even during dry periods. Grazing early in spring, when the soil is soft and wet, is likely to damage the plants. Undrained areas commonly are too wet for most pasture mixtures that include legumes.

A few areas are wooded. This soil is moderately well suited to trees. The species that are tolerant of prolonged wetness should be selected for planting. The wetness limits the use of equipment during winter and spring. The trees can be logged during the drier parts of the year. Planting seedlings that have been transplanted once or mulching helps to control seedling mortality. Frequent, light thinning and harvesting increase the vigor of the stand and reduce the windthrow hazard.

Because of the prolonged wetness and the hazard of flooding, this soil generally is unsuited to building site development and septic tank absorption fields. Some natural pond sites are available, especially in spring-fed areas. Excavated ponds are not likely to hold water. Flood damage is a hazard.

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

Tg—Tioga fine sandy loam, occasionally flooded. This nearly level, deep, well drained soil is on flood plains. It commonly is on the highest part of the flood plains adjacent to the stream channel. It is flooded for brief periods in winter and spring. Slope is 0 to 2 percent. Most areas range from 10 to 150 acres in size and are long and narrow.

Typically, the surface layer is dark brown, very friable fine sandy loam about 9 inches thick. The subsoil is yellowish brown, very friable silt loam and loam about 29 inches thick. The substratum to a depth of about 60 inches is yellowish brown and dark yellowish brown, very friable, stratified fine sandy loam, silt loam, and loam. In some areas the surface layer is loam, sandy loam, or gravelly loam. In other areas the soil has a dark buried surface layer, which is 2 to 10 inches thick. In a few areas the surface layer is darker. In a few places the soil is wetter and is mottled in the lower part of the subsoil.

Included with this soil in mapping are some long, winding abandoned stream channels having side slopes that interfere with cultivation. Narrow included strips of Holly and Shoals soils are in these abandoned channels. These soils are wetter than the Tioga soil. Some included areas are in the flood pool of the Mohawk Dam. These areas are subject to controlled flooding. Also included are very droughty soils that have a very gravelly sandy loam surface layer and a gravelly loamy sand subsoil. Spots of these included soils are in most areas, but they dominate in some 10- to 20-acre areas along the Kokosing River upstream from Mt. Vernon. Included soils make up about 10 percent of most areas.

Permeability is moderate or moderately rapid in the subsoil of the Tioga soil and rapid in the substratum. Runoff is slow. The available water capacity is moderate. The seasonal high water table is at a depth of 36 to 72 inches during extended wet periods. Organic matter content is moderate. Tilth is fair. The capacity to store and release plant nutrients is low or moderate. The subsoil is medium acid to neutral.

The use of this soil is determined to a large extent by the degree to which areas are dissected by old stream channels. Some of the smoother areas are used as cropland. This soil is well suited to corn, small grain, and soybeans, but it is somewhat droughty and is subject to flooding. Brief shortages of available moisture occur during most growing seasons. They are most common in the coarser textured included soils. All areas are subject to flooding and many to streambank erosion (fig. 5). Floodwater can wash away seedlings, damage crops, and remove recently applied plant nutrients. Corn and soybeans, which are planted after the normal period of flooding, are less likely to be damaged than other crops. The soil is irrigable.

Some of the more dissected areas are pastured. This soil is well suited to pasture. It is best suited to alfalfa-bromegrass and other drought-resistant pasture mixtures. Forage plants grow extremely well early in spring. They grow more slowly during extended dry periods. Old stream channels interfere with seeding and fertilizing in many areas. Pasture seedlings are subject to flood damage.

A few areas are wooded. This soil is moderately well suited to trees. The flooding interferes with the establishment of new plantings. Young trees are likely to be washed out or buried before they are large enough to withstand the swift floodwater.

Because of the hazard of flooding, this soil generally is unsuited to building site development and to septic tank absorption fields. It is a probable source of sand and gravel. Excavated ponds are very unlikely to hold water. They are subject to flood damage.

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

TvB—Titusville silt loam, 2 to 6 percent slopes. This gently sloping, deep, moderately well drained soil is on till plains. The larger areas, 20 to 300 acres in size, are on broad hilltops between the steeper sided valleys. They slope smoothly outward from a dome or ridge line and are irregularly shaped. The smaller areas, 3 to 10 acres in size, are on the distinctly concave parts of hilltops dominated by better drained soils. These areas commonly are fan shaped. The point of the fan extends into the head of a steep-sided draw. Some areas below the steeper slopes are subject to seepage. These areas commonly are long and narrow and slope in one direction.

Typically, the surface layer is dark brown, friable silt loam about 9 inches thick. The subsoil to a depth of about 60 inches is yellowish brown. It is mottled below a depth of about 18 inches. It is friable and firm silt loam and loam in the upper part; a fragipan of firm and very firm, dense clay loam and loam in the next part; and firm loam in the lower part. In some areas below the steeper slopes, the surface layer is thicker. In some small areas shattered sandstone or siltstone bedrock is at a depth of 36 to 60 inches. In other small areas lenses or pockets of water-laid silt and fine sand are below a depth of about 48 inches.

Included with this soil in mapping are small areas of Coshocton and Gresham soils. Coshocton soils formed in colluvium and residuum on high hilltops. They do not have a fragipan. The somewhat poorly drained Gresham soils are in natural drainageways and in closed depressions. Included soils make up about 10 percent of most areas.

Permeability is slow in the Titusville soil. Runoff is medium. The root zone is restricted by the dense fragipan at a depth of 18 to 28 inches. The available water capacity is low above the fragipan. A perched

Figure 5.—Streambank erosion in an area of Tioga fine sandy loam, occasionally flooded.

seasonal high water table is at a depth of 1.5 to 3.0 feet during extended wet periods. Organic matter content is moderately low or moderate. Tilth is good. The capacity to store and release plant nutrients is moderate. Where the soil is not limed, the upper part of the subsoil is strongly acid to extremely acid.

Most areas are used as cropland. If properly managed, this soil is well suited to corn, soybeans, and small grain. If the soil is cultivated, erosion is a moderate hazard, especially where slopes are long. It can be controlled by cultivating across the slope and returning crop residue to the soil. A system of conservation tillage that leaves crop residue on the surface also helps to control erosion. Many of the longer slopes, where the erosion hazard is greatest, are suited to contour stripcropping. A drainage system is needed in most areas. In some areas, a few randomly spaced subsurface drains help to remove the excess water; in others, a complete subsurface drainage system is needed. Good outlets generally are available. Seepy spots are the most difficult areas to drain. Heavy applications of lime and fertilizer are needed. Additions of organic material help to maintain tilth and control crusting.

Some areas are used for hay and pasture. This soil is well suited to forage crops. Pasture plants can be grazed early in spring. Intensive pasture management can be applied. Growing small grain helps to control erosion during seedling establishment. Heavy applications of lime are needed if the forage mixture includes alfalfa. Some included areas are too wet for the optimum growth of alfalfa. Birdsfoot trefoil is well suited to this soil.

A few areas are wooded. This soil is well suited to a variety of trees. The rooting depth is restricted by the dense fragipan. As a result, the trees are subject to windthrow during very wet periods. Frequent, light thinning and harvesting increase the vigor of the stand and reduce the windthrow hazard. Planting seedlings that have been transplanted once or mulching helps to control seedling mortality. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

Because of the seasonal wetness, this soil is only moderately well suited to building site development. Water seeps along the top of the fragipan. Installing drains at the base of footings removes this water and helps to keep basements dry.

This soil is only moderately well suited to septic tank absorption fields because of the slow permeability and the seasonal wetness. Increasing the size of the absorption field and installing the distribution lines as shallow as possible help to overcome the restricted permeability. Installing perimeter drains around the absorption field lowers the seasonal high water table. Distinctly concave areas and seepy spots should not be included in the absorption field.

Excavated ponds in areas of this soil are likely to hold water. Onsite investigation is needed.

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

TvC—Titusville silt loam, 6 to 12 percent slopes. This sloping, deep, moderately well drained soil is on till plains. Most areas are on foot slopes and the lower part of back slopes. They are subject to seepage. Slopes commonly are smooth, are oriented in one direction, and are 75 to 500 feet long. Areas range from 2 to 50 acres in size and vary in shape.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil to a depth of about 60 inches is yellowish brown and mottled. It is firm silt loam and loam in the upper part; a fragipan of very firm, dense loam in the next part; and firm loam in the lower part. In a few areas the surface layer is sandy loam. In places shattered bedrock or water-laid silty material is at a depth of 4 to 5 feet.

Included with this soil in mapping are small areas of the somewhat poorly drained Gresham soils around springs and seeps. Also included are soils that are more clayey in the subsoil than the Titusville soil and have a calcareous silty clay loam substratum. Spots of these more clayey soils are in many areas, but they are dominant in some 10- to 40-acre areas in Brown and Jefferson Townships. Included soils make up about 10 percent of most areas; however, Gresham soils make up 20 to 30 percent of some areas in which seepy spots are numerous.

Permeability is slow in the Titusville soil. Runoff is rapid. The root zone is restricted by the dense fragipan at a depth of 18 to 28 inches. The available water capacity is low above the fragipan. A perched seasonal high water table is at a depth of 1.5 to 3.0 feet during extended wet periods. Organic matter content is moderately low or moderate. Tilth is good. The capacity to store and release plant nutrients is moderate. Where the soil is not limed, the upper part of the subsoil is strongly acid to extremely acid.

Some areas are used as cropland. This soil is moderately well suited to corn and small grain and to occasionally grown soybeans. If the soil is cultivated, erosion is a severe hazard. Cultivating across the slope, applying a system of conservation tillage that leaves crop residue on the surface, and returning crop residue to the soil are suitable erosion-control measures. Lateral seepage of water along the top of the dense fragipan causes seasonal wetness in most areas. Subsurface drains should be installed across the slope to intercept this seepage. The included Gresham soils around seeps and springs are very difficult to drain. Gullying is common in open ditches and surface drains. Heavy applications of lime and fertilizer are needed. Additions of organic material help to maintain tilth and control crusting.

Some areas are used for hay and pasture. This soil is well suited to forage crops. It can be grazed early in spring. Intensive pasture management can be applied. Because of the seasonal wetness and the acidity, birdsfoot trefoil is better suited than alfalfa.

A few areas are used as woodland. This soil is well suited to trees. The rooting depth is restricted by the dense fragipan. As a result, the trees are subject to windthrow during very wet periods. Frequent, light thinning and harvesting increase the vigor of the stand and reduce the windthrow hazard. Planting seedlings that have been transplanted once or mulching helps to control seedling mortality. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

Because of the seasonal wetness and the slope, this soil is only moderately well suited to building site development and is poorly suited to septic tank absorption fields. Water movement along the top of the fragipan can result in wet basements and damage to basement walls. Installing drains at the base of footings, especially on the uphill side of buildings, removes this water and helps to keep basements dry (fig. 6). The buildings should be designed so that they conform to the natural slope of the land. Increasing the size of the absorption field and installing the distribution lines as shallow as possible help to overcome the restricted permeability. Installing perimeter drains around the absorption field lowers the seasonal high water table. The included springs and seepy spots should not be selected as sites for buildings or absorption fields.

Ponds dug in areas of this soil are likely to hold water. Some natural pond sites are available where the soil is on both sides of a small valley.

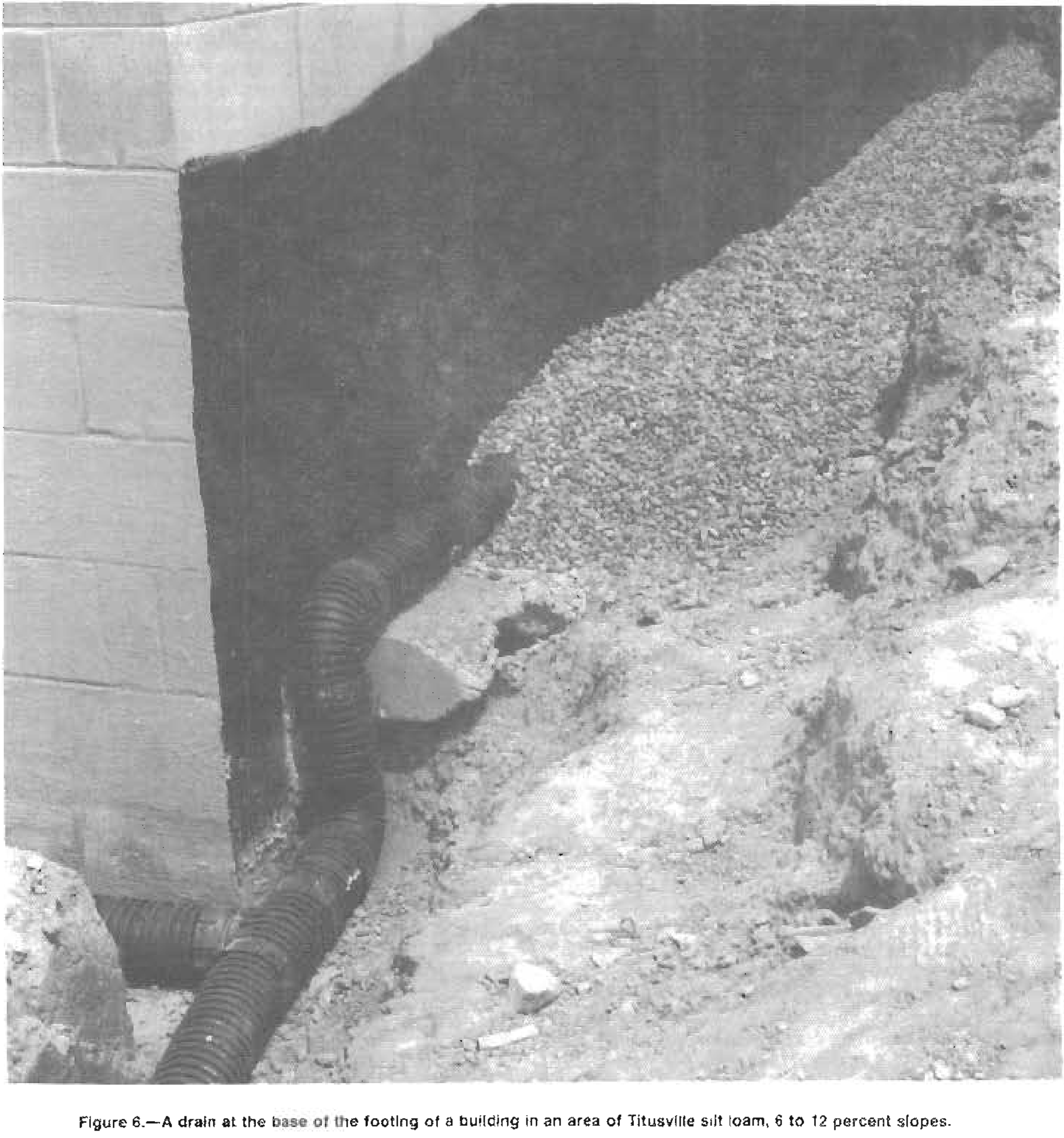

Figure 6.—A drain at the base of the footing of a building in an area of Titusville silt loam, 6 to 12 percent slopes.

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

Ud—Udorthents, loamy. These soils are in areas where the landscape has been altered by cutting, filling, or leveling. Most of the acreage is in the borrow area of the dam on the North Branch of the Kokosing River. In some areas material other than sand, gravel, or sandstone has been excavated from small pits.

Typically, the soil material is yellowish brown, firm loam and clay loam glacial till. This material is similar to that in the substratum of Wooster and Rittman soils.

Erosion in cut areas and on filled banks is the major concern in managing these soils. Planting grass is the most common method of controlling erosion. In some areas surface and subsurface drainage systems are needed. The suitability of these soils as sites for buildings, roads, and sanitary facilities varies. Onsite investigation is needed to determine the suitability and limitations.

No land capability classification or woodland ordination symbol is assigned.

WaB—Wadsworth silt loam, 1 to 4 percent slopes. This nearly level and gently sloping, deep, somewhat poorly drained soil is on till plains. It commonly is in depressions and other concave areas that receive runoff and seepage from higher lying areas nearby. Most areas are 3 to 20 acres in size and are irregularly shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 44 inches thick. It is mottled. The upper part is brown and yellowish brown, friable silt loam and firm silty clay loam; the next part is a fragipan of yellowish brown, very firm, dense clay loam; and the lower part is yellowish brown, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm loam glacial till. In numerous small areas the surface layer is darker. In other areas it is thicker because it receives sediment from adjacent slopes. In places silty lakebed sediment is in the substratum.

Included with this soil in mapping are small areas of Canfield, Condit, Holly, Rittman, and Shoals soils. The moderately well drained Canfield and Rittman soils are on knolls, and the poorly drained Condit soils are in depressions. Holly and Shoals soils formed in alluvium on narrow flood plains. Included soils make up about 15 percent of most areas.

Permeability is moderate or moderately slow above the fragipan in the Wadsworth soil and slow or very slow in the fragipan. Runoff is slow or medium. The root zone is restricted by the dense fragipan at a depth of 18 to 28 inches. The available water capacity is low above the fragipan. A perched seasonal high water table is at a depth of 12 to 24 inches during extended wet periods. Organic matter content is moderate. Tilth is good. The capacity to store and release plant nutrients is moderate. Where the soil is not limed, the upper part of the subsoil is strongly acid to extremely acid.

Many areas are used as cropland. If properly managed, this soil is moderately well suited to corn, soybeans, and small grain. It is difficult to manage. The fragipan restricts drainage, and the upper soil layers become waterlogged in wet periods. In dry periods a shortage of available water in the root zone is a limitation. Both surface and subsurface drainage systems are needed. Subsurface drains are only moderately effective. Some areas do not have suitable outlets. Lateral drains should be closely spaced because of the slow or very slow permeability of the fragipan below a depth of 18 to 28 inches. Water moves laterally along the top of the fragipan. Heavy applications of lime, fertilizer, and organic material are needed. Erosion is a hazard in the more sloping areas. It can be controlled by returning crop residue to the soil and planting cover crops. Some areas are good sites for grassed waterways.

Some areas are used for hay and pasture. This soil is moderately well suited to some forage crops. A drainage system is needed. Grazing early in spring, when the soil is soft, can damage the sod. Growth is poor to moderate during the dry part of the summer. Grasses are better suited than legumes in most pastures. Few areas are well enough drained for a mixture that includes alfalfa. Birdsfoot trefoil, however, can be grown.

A few areas are used as woodland. This soil is moderately well suited to trees. The dense fragipan restricts the rooting depth. As a result, the large trees are subject to windthrow during wet periods. Harvesting procedures that do not leave the remaining trees widely spaced reduce the windthrow hazard. Planting seedlings that have been transplanted once or mulching helps to control seedling mortality. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is poorly suited to building site development because of the seasonal wetness. Adequately draining sites for buildings is difficult. Landscaping helps to keep water away from foundations. Installing drains at the base of footings reduces the wetness. Diversions are used in some areas to control runoff from the adjacent slopes. Ditches may be needed because of a lack of suitable drainage outlets. Coating the exterior of basement walls helps to keep basements dry.

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

Excavated ponds in areas of this soil are likely to hold water. Many areas receive sufficient runoff to fill the ponds.

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

WeD—Westmoreland silt loam, 12 to 18 percent slopes. This moderately steep, deep, well drained soil is on unglaciated hillsides. Most areas are below less sloping ridgetops and above steeper valley side slopes. Slopes commonly are smooth and are oriented in one direction. Most areas are 10 to 150 acres in size and are long and narrow.

Typically, the surface layer is dark grayish brown, very friable silt loam about 3 inches thick. The subsoil is about 31 inches thick. It is dark yellowish brown and yellowish brown. It is friable and very friable loam and silt loam in the upper part and friable channery and very channery silt loam in the lower part. The substratum is yellowish brown, friable extremely channery silt loam about 14 inches thick. Olive brown sandstone and siltstone bedrock is at a depth of about 48 inches. In areas that have been plowed, the surface layer is brown or yellowish brown, depending on the degree of erosion. In some areas the surface layer and the upper part of the subsoil are sandy loam. In other areas boulders are on the surface. In places the slope is 18 to 25 percent.

Included with this soil in mapping are small areas of the moderately well drained Coshocton soils on the concave parts of the landscape and rock outcrop and the moderately deep Gilpin soils on shoulder slopes. Also included are some springs and seeps where the soils are wetter than the Westmoreland soil. Inclusions make up about 20 percent of most areas.

Permeability is moderate in the Westmoreland soil. Runoff is rapid. The available water capacity is low or moderate. Organic matter content is moderately low. Tilth is fair. The capacity to store and release plant nutrients is low or moderate. Where the soil is unlimed, the subsoil is very strongly acid to medium acid. The root zone is deep.

Most areas formerly were used as cropland, but only a few are still cropped. Because of a very severe erosion hazard, this soil is poorly suited to conventionally tilled corn and small grain and generally is unsuited to soybeans. Most cropping systems are dominated by forage crops. No-till corn can be grown occasionally in rotation with the forage crops. Contour stripcropping is used in many areas. A system of conservation tillage that leaves crop residue on the surface helps to control erosion and conserves moisture.

Many areas are used for hay and pasture. This soil is moderately well suited to forage crops. A cover of hay helps to control erosion. The good natural drainage permits grazing early in spring. Growth is slow throughout the dry part of the summer. Fairly large applications of lime are needed if the forage mixture includes alfalfa. Erosion is a serious hazard in overgrazed pastures. No-till methods of seeding help to control erosion.

Some areas are used as woodland. Some abandoned crop fields are reverting to woodland. This soil is moderately well suited to trees. The erosion hazard and the equipment limitation are moderate. Laying out logging roads and skid trails across the slope facilitates the use of equipment and helps to control erosion. Water bars also help to control erosion. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and a lower evapotranspiration rate because of less exposure to the prevailing wind and the sun. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is poorly suited to building site development because of the slope. The buildings should be designed so that they conform to the natural slope of the land. Erosion is a severe hazard during construction. It can be controlled by keeping as much vegetation on the site as possible. Considerable excavation commonly is needed on building sites. Deep excavation can expose the included seeps and springs. Installing drains at the base of footings helps to remove seepage and spring water.

Numerous oil wells are in areas of this soil. Erosion along and on access roads is a major problem. It can be controlled by constructing these roads across the slope and by establishing water bars.

This soil is poorly suited to septic tank absorption fields because of the slope. Seepage of the effluent downslope and into cracks in the underlying bedrock is likely. Effluent entering these cracks can travel a considerable distance and thus can contaminate springs and other ground water supplies. Installing the distribution lines across the slope helps to prevent seepage of the effluent to the surface.

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

WsB—Wooster silt loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is on till plains. Most areas are on hilltops that are surrounded by steeper slopes. Most slope uniformly outward from a central dome or a ridge line. Individual areas range from 5 to 80 acres in size and vary in shape.

Typically, the surface layer is dark brown, friable silt loam about 10 inches thick. The subsoil is about 50 inches thick. It is yellowish brown. The upper part is friable and firm silt loam and loam; the next part is a fragipan of mottled, very firm, dense loam; and the lower part is mottled, firm loam. In a few eroded areas, the surface layer has a higher content of coarse fragments. In a few places the soil is wetter and has gray mottles above the fragipan. In numerous small areas shattered bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are narrow strips of the moderately deep Loudonville soils on ridgetops. These soils make up about 10 percent of most areas.

Permeability is moderately slow in the fragipan of the Wooster soil. Runoff is medium. The root zone is restricted by the dense fragipan at a depth of 24 to 36 inches. The available water capacity is low or moderate above the fragipan. A perched seasonal high water table is at a depth of 2.5 to 4.0 feet during extended wet periods. Organic matter content is moderate or moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. Where the soil is not limed, the part of the subsoil above the fragipan is very strongly acid to medium acid.

Most areas are used as cropland. This soil is well suited to corn, soybeans, and small grain. It also is well suited to fruit trees but is not used extensively for this purpose because of climatic conditions. If the soil is cultivated, erosion is a moderate hazard. It is rather easily controlled, however, by cultivating across the slope and returning crop residue to the soil. The soil is very well suited to a system of conservation tillage that leaves crop residue on the surface. Natural drainage is adequate for farming; however, subsurface drains may be needed in the wetter areas on the lower parts of the landscape. Maintaining tilth, fertility, organic matter content, and a sufficient amount of lime is a management concern.

Some areas are used for hay and pasture. This soil is well suited to forage crops. Many pastured areas are also used as cropland part of the time. Rather large applications of lime are needed if the forage mixture includes alfalfa. The forage plants are suitable for grazing early in spring. Intensive pasture management can be applied. Cultivated crops can be grown to aid in seedling establishment and weed control.

Some small areas are used as woodland. This soil is well suited to many tree species. Because of the gentle slopes, intensive woodland management can be applied and harvesting is not hampered. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is well suited to building site development. The gentle slopes favor this use. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry.

Because of the seasonal wetness and the moderately slow permeability, this soil is only moderately well suited to septic tank absorption fields. Installing perimeter drains around the absorption fields lowers the seasonal high water table. Increasing the size of the absorption field helps to overcome the restricted permeability. Distinctly low or concave areas should not be selected as sites for absorption fields.

Ponds in areas of this soil vary considerably in their capacity to hold water. Onsite investigation is needed to identify layers that have excessive seepage rates.

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

WsC—Wooster silt loam, 6 to 12 percent slopes. This sloping, deep, well drained soil is on till plains. It is on rounded hilltops, hillsides, and the sides of small valleys. Some areas slope in several directions and others in only one. Slopes are smooth in some areas and are irregular in others. They are 75 to 450 feet long. Individual areas range from 2 to 100 acres in size and vary in shape.

Typically, the surface layer is dark brown, friable silt loam about 10 inches thick. The subsoil is about 50 inches thick. It is yellowish brown. The upper part is friable and firm loam and silt loam; the next part is a fragipan of mottled, very firm, dense loam; and the lower part is firm loam. In eroded spots the surface layer is gravelly silt loam. In some areas the soil is wetter and has gray mottles above the fragipan.

Included with this soil in mapping are very narrow strips of soils that do not have a fragipan. These soils are in narrow valleys and are commonly wetter than the Wooster soil. Also included are narrow strips of the moderately deep Loudonville soils on hilltops and side slopes. Included soils make up about 10 percent of most areas.

Permeability is moderately slow in the fragipan of the Wooster soil. Runoff is rapid. The root zone is restricted by the dense fragipan at a depth of 24 to 36 inches. The available water capacity is low or moderate above the fragipan. A perched seasonal high water table is at a depth of 2.5 to 4.0 feet during extended wet periods. Organic matter content is moderately low or moderate. Tilth is good. The capacity to store and release plant nutrients is moderate. Where the soil is not limed, the part of the subsoil above the fragipan is medium acid to very strongly acid.

Many areas are used as cropland. If managed properly, this soil is moderately well suited to corn and small grain and to occasionally grown soybeans. It is well suited to fruit trees but is commonly not used for this purpose because of climatic conditions. Erosion is a severe hazard if the soil is cultivated. Some areas with smooth slopes are suited to contour stripcropping. In most areas growing an occasional forage crop and returning crop residue to the soil help to control erosion. A system of conservation tillage that leaves crop residue on the surface also helps to control erosion. Measures that maintain tilth and applications of lime and fertilizer are needed. Natural drainage is generally adequate for farming, but randomly spaced subsurface drains may be needed in the wetter areas on the lower parts of the landscape. Grassed waterways help to prevent gullying in the included narrow valleys.

Some areas are used for hay and pasture. Some pastured areas are used as cropland part of the time. Others are used as permanent pasture. This soil is well suited to forage crops. The forage plants are suitable for grazing early in spring. Intensive pasture management can be applied. Cultivated crops can be grown to aid in seedling establishment and weed control. Rather large applications of lime are needed if the forage mixture includes alfalfa.

A few small areas are used as woodland. This soil is well suited to many tree species. Because of the gentle slopes, intensive woodland management can be applied and harvesting is not hampered. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

Because of the slope and the seasonal wetness, this soil is only moderately well suited to building site development. Erosion is a hazard during construction. It can be controlled by reseeding scalped areas. Erosion-control measures, such as settling basins, are needed in large developments. Gullying occurs where water collects and flows on streets and driveways before they are paved. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry.

This soil is moderately well suited to septic tank absorption fields. The seasonal wetness and the moderately slow permeability are limitations. Increasing the size of the absorption field helps to overcome the restricted permeability. Installing perimeter drains around the absorption field lowers the seasonal high water table. Distinct depressions should not be selected as sites for buildings or septic tank absorption fields.

Some good pond sites are available in areas where this soil is on both sides of a small valley. Onsite investigation is needed to determine the suitability of specific areas and to identify layers that have excessive seepage rates.

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

WsD2—Wooster silt loam, 12 to 18 percent slopes, eroded. This moderately steep, deep, well drained soil is on the sides of valleys on dissected till plains and moraines. Some areas include both sides of the valley, whereas others include only one. Slopes commonly are 50 to 350 feet long. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the surface layer. Most areas range from 2 to 20 acres in size and are long and narrow.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 42 inches thick. It is yellowish brown. The upper part is firm loam; the next part is a fragipan of mottled, very firm, dense loam; and the lower part is firm loam. The substratum to a depth of about 60 inches is yellowish brown, firm loam glacial till. In some areas thin layers of sandy or gravelly material are in the substratum. In numerous small areas shattered bedrock is at a depth of 40 to 60 inches. In places the soil is wetter and has gray mottles above the fragipan.

Included with this soil in mapping are narrow strips of the somewhat poorly drained Shoals and poorly drained and very poorly drained Holly soils on flood plains. Also included are severely eroded soils that have a yellowish brown gravelly loam surface layer, narrow strips of the moderately deep Loudonville soils on hillsides and side slopes, and some springs and seeps along the base of slopes. The severely eroded areas are on the steeper, more convex part of the slopes. They are commonly less than 2 acres in size, but some are considerably larger. Inclusions make up about 10 percent of most areas.

Permeability is moderately slow in the fragipan of the Wooster soil. Runoff is rapid. The root zone is restricted by the dense fragipan at a depth of 24 to 36 inches. The available water capacity is low or moderate above the fragipan. A perched seasonal high water table is at a depth of 2.5 to 4.0 feet during extended wet periods. Organic matter content is moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. Where the soil is not limed, the part of the subsoil above the fragipan is medium acid to very strongly acid.

Some areas are used as cropland. Because of a very severe erosion hazard, this soil is poorly suited to conventionally tilled crops. Corn and small grain can be grown if erosion is controlled. A system of conservation tillage that leaves crop residue on the surface helps to control erosion. Some areas are suited to contour stripcropping. Additions of organic material are needed. Strips of sod help to prevent gullying in concave areas.

Some areas are pastured. This soil is well suited to hay and pasture. Rather large applications of lime are needed if alfalfa is grown. Forage plants are well suited to grazing early in spring. An occasional row crop can be grown to aid in weed control and seedling establishment. No-till seeding methods help to control erosion.

Some areas are used as woodland. This soil is well suited to trees. Erosion is a hazard. It can be controlled by constructing logging roads and skid trails on or nearly on the contour and by establishing water bars. Constructing logging roads on the contour also facilitates the use of equipment.

Because of the slope, this soil is poorly suited to building site development. Considerable excavation is commonly needed on building sites. The buildings should be designed so that they conform to the natural slope of the land. Erosion is a severe hazard during construction. It can be controlled by seeding or mulching disturbed areas. Erosion-control measures, such as settling basins, are needed in large developments. Gullying occurs where water collects and flows on streets and driveways before they are paved.

This soil is poorly suited to septic tank absorption fields. The seasonal wetness, the moderately slow permeability, and the slope are limitations. Increasing the size of the absorption field helps to overcome the restricted permeability. Installing the distribution lines across the slope helps to prevent lateral seepage of the effluent to the surface. Perimeter drains that intercept the laterally moving water above the fragipan reduce the seasonal wetness.

Some good pond sites are available in areas where this soil is on both sides of a small valley. Soil conditions vary in the bottom of these valleys. Onsite investigation is needed to identify layers that have excessive seepage rates.

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

WsE2—Wooster silt loam, 18 to 40 percent slopes, eroded. This steep and very steep, deep, well drained soil is on the sides of stream valleys on dissected till plains and moraines. Most areas include only one side of the valley, but a few include both sides. Slopes are mainly 100 to 300 feet long and are irregular. Erosion has removed part of the original surface layer. It is most extensive in areas that have been cultivated, but pastured and wooded areas also are eroded to some extent. Most areas range from 2 to 10 acres in size and are long and narrow.

Typically, the surface layer is dark brown, friable silt loam about 3 inches thick. The subsoil is about 40 inches thick. It is yellowish brown. The upper part is friable and firm loam and silt loam; the next part is a fragipan of mottled, very firm, dense loam; and the lower part is firm loam. The substratum to a depth of about 60 inches is yellowish brown, firm loam glacial till. In some areas thin layers of sandy or gravelly material are in the substratum. In other areas shattered bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are very narrow strips of the moderately well drained Lobdell and somewhat poorly drained Shoals soils on flood plains and narrow strips of the moderately deep Loudonville soils on the upper part of side slopes. Also included are springs, seeps, and a few nearly vertical slopes. The soil around the seeps and springs is grayer than the Wooster soil and has more mottles. Inclusions make up about 10 percent of most areas.

Permeability is moderately slow in the fragipan of the Wooster soil. Runoff is very rapid. The root zone is restricted by the dense fragipan at a depth of 24 to 36 inches. The available water capacity is low or moderate above the fragipan. A perched seasonal high water table is at a depth of 2.5 to 4.0 feet during extended wet periods. Organic matter content is moderately low. Tilth is good. The capacity to store and release plant nutrients is moderate. The part of the subsoil above the fragipan is commonly medium acid to very strongly acid.

Few areas are used as cropland. This soil generally is unsuited to cultivated crops. The slope limits the use of many kinds of farm equipment. Also, erosion is a very severe hazard if the soil is cultivated.

Some areas are permanently pastured. This soil is moderately well suited to pasture. Forage plants are well suited to grazing early in spring. Native pasture grasses grow poorly during the dry part of the summer. No-till seeding methods help to control erosion. Proper stocking rates also help to control erosion. Water tends to concentrate and flow in indentations in the slope. Gullies form in these areas and extend into the less sloping, higher lying adjacent areas unless they are controlled.

Most areas are used as woodland. This soil is well suited to trees. The slope limits the use of some types of equipment. The erosion hazard is moderate. Gullies that form during logging periods can extend into farmland on the ridgetops. Constructing logging roads and skid trails across the slope facilitates the use of equipment and helps to control erosion. Water bars also help to control erosion. Removing the less desirable trees, shrubs, and vines helps to control plant competition.

This soil is poorly suited to building site development and generally is unsuited to septic tank absorption fields because of the steep and very steep slope, the moderately slow permeability, and the seasonal wetness. Considerable excavation is needed on building sites. The buildings should be designed so that they conform to the natural slope of the land. Seepage of water along the top of the fragipan can result in wet basements. Installing subsurface drains upslope from the buildings helps to keep basements dry.

Some pond sites are available in areas where this soil is on both sides of a small valley. Onsite investigation is needed to identify layers that have excessive seepage rates.

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

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops (*15*). It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

Somewhat less than 195,000 acres in Knox County, or 57 percent of the total acreage, meets the soil requirements for prime farmland. This land is throughout the county but is most extensive in the western part, where a high proportion of the landscape has gentle slopes. Some areas of many map units that qualify as prime farmland are urban or built-up areas. These areas are not included in the total acreage of prime farmland.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table qualify for prime farmland only in areas where this limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not this limitation has been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

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

Crops and Pasture

Raymond J. Adamski, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

New farming methods and management practices are likely to be introduced during the useful life of this soil survey. Information about the latest methods and practices is available in the "Agronomy Guide," which is published biannually by the Agronomy Department of Ohio State University, the Ohio Agricultural Research and Development Center, and the Cooperative Extension Service.

Trends in Land Use

Farming is the primary land use in Knox County. Only about 6 percent of the county is urban and built-up land (*13*). In 1967, a total of 183,722 acres was used as cropland and 47,927 acres was used as pasture.

The principal crops grown in the county are corn, soybeans, hay, and wheat. The acreage planted to soybeans increased markedly from 8,200 acres in 1966 to 27,200 acres in 1981 (*5, 8*). During the same period, the acreage planted to corn nearly doubled. The acreage used for small grain has declined. In 1981, it was slightly more than half of what it was in 1960 (*4*). The increase in the acreage used for row crops has resulted in a significantly greater susceptibility to erosion in the county. More careful management is needed to reduce this susceptibility. Management suggestions for each soil are provided in the map unit descriptions.

The acreage of cropland in the county is increasing, and that of pasture is decreasing. As land values rise, landowners are clearing small woodlots and small areas that are overgrown with brush. Livestock owners, especially dairymen, are finding that hauling green forage to cattle is more efficient than turning the cattle out to pasture. Much of the pasture that is being converted to cropland formerly was part of a crop rotation system and thus was cropland part of the time. Large acreages of permanent pasture are still used on beef cattle and sheep farms.

In the future some cropland and pasture can be expected to be converted to residential, industrial, or recreational areas. The extent to which this conversion reduces the food-producing potential of the county depends to a large extent on the soils in the converted areas.

Soil Management Problems

The paragraphs that follow describe the major problems in managing the cropland and pasture in Knox County.

Soil erosion is a major management problem on more than half of the cropland and pasture in the county. It is a hazard on all soils that have slopes of more than 2 percent. On some soils, such as Homewood silt loam, 6 to 12 percent slopes, it is the most serious problem. On other soils, such as Bennington silt loam, 2 to 6 percent slopes, both erosion and wetness are problems.

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

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

The rooting depth is restricted in Titusville, Canfield, and other soils in the county. This restriction is caused by a dense subsoil layer, or fragipan. In other soils, such as Loudonville and Gilpin, the restriction is caused by bedrock. Erosion reduces the depth to these root-restricting layers, thus reducing the volume of soil available for root development.

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

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

Contouring, or tilling across the slope, is quite effective on some gently sloping soils. For example, Homewood silt loam, 2 to 6 percent slopes, which is on long, smooth slopes, can be easily tilled across the slope. The soils on short, irregular slopes, such as Bennington silt loam, 2 to 6 percent slopes, cannot be uniformly tilled across the slope.

Contour stripcropping has been used extensively in the eastern part of the county for many years. Its use is most widespread on soils that have rather uniform slopes of 6 to 18 percent. Contour stripcropping is used in many areas of the sloping and moderately steep Loudonville and Homewood soils, which commonly are on smooth, uniform slopes. This practice is not well suited to soils in areas where slopes are short and irregular, such as many areas of the sloping Chili and Fox soils.

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

Grassed waterways can be constructed in low areas where runoff tends to collect and flow, especially if slopes are long. Gullies can form in such areas if water flows rapidly across a bare surface. Subsurface drains can carry off the normal flow in these areas. Any excess surface water can be carried off by grassed waterways. Besides preventing gullying, the grassed waterways help to prevent flooding and overwashing of crops. Water- and sediment-control basins that have underground outlets can be constructed in the drainageways as an alternative to grassed waterways. These basins can be effective in areas where sediment accumulation is high or where herbicides might damage the sod in grassed waterways.

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

Soil drainage is an important management problem in Knox County. A drainage system is the primary management need on nearly one-fourth of the cropland in the county (*13*). It is a secondary need in many other areas. Most plant roots do not grow without oxygen. Oxygen is not available in soils that are saturated with water. Wet soils also remain cold in the spring. Some of the excess water must be removed before the soil can warm early in the spring. Wetness also limits the movement of farm machinery. Livestock compact wet, soft soil, damaging pasture plants.

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

About 40 percent of the county is made up of well drained soils, in which the water table is deeper than 3 feet most of the time. The natural drainage of these soils is adequate for crop production. About one-sixth of these well drained soils, however, are not well suited to crops because they have a slope of more than 18 percent.

About one-third of the county consists of moderately well drained soils, in which the seasonal high water table is commonly at a depth of 18 to 36 inches during the wettest part of the year. The natural drainage of these soils generally is adequate for most crops, but a drainage system can increase crop production in low spots, springs, and seepy areas. A shift to an earlier planting date for corn has worsened the wetness problem on these soils. Titusville, Centerburg, and Glenford soils are among the most extensive moderately well drained soils in the county.

About one-sixth of the county consists of somewhat poorly drained soils. More than half of the acreage is Bennington soils. Somewhat poorly drained soils commonly have a seasonal high water table at a depth of 12 to 24 inches during the wettest part of the year. A drainage system is needed to increase yields of most crops.

The rest of the county consists of poorly drained and very poorly drained soils, in which the seasonal high water table is near or above the surface for extended periods under natural conditions. A drainage system is essential if these soils are used as cropland. Sebring silt loam and Condit silt loam are the most extensive poorly drained soils in the county. Luray silty clay loam and Pewamo silty clay loam are the most extensive very poorly drained soils. Holly silt loam, frequently flooded, is an extensive poorly drained and very poorly drained soil.

Most of the soils in Knox County are sufficiently permeable to be adequately drained by properly installed subsurface drains that have good outlets. In stable soils, such as Pewamo and Bennington, clay tile and plastic subsurface drains are equally effective. In the less stable soils, such as Fitchville and Luray, plastic drains are preferable because clay tile drains are likely to shift. The lack of suitable outlets for subsurface drains is a problem in numerous areas of the county. In areas where natural outlets are not available, open ditches are used as outlets. Many of these ditches cross the land of several different owners before they reach a suitable natural outlet.

Open ditches are commonly needed in the larger areas of Pewamo silty clay loam and Luray silty clay loam. To be effective, the ditches should be maintained after they are constructed. In some areas of Luray silty clay loam, especially those in Hilliar Township, ditchbank stability is a major problem and the ditches must be cleaned frequently.

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

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

Droughtiness is the main limitation on about 3 percent of the cropland in Knox County (*13*). The most droughty soils, Schaffenaker and Rigley, are used primarily as woodland. Occasional shortages of available moisture occur in many soils. They are most common in soils that have a gravelly surface layer, such as Chili and Fox, and in soils that have a limited depth to bedrock, such as Loudonville. Moisture shortages are also common in Rittman, Titusville, and other soils that have a fragipan, which restricts the rooting depth. Many of the more droughty soils are well suited to no-till planting or other systems of conservation tillage that leave crop residue on the surface. The crop residue conserves moisture for crop use. Some of the more droughty soils can be irrigated. The suitability for irrigation is mentioned in the map unit descriptions.

The effects of drought are more evident in pastures than in cultivated fields. Pasture grasses on most moderately steep and steep soils grow very slowly during the dry part of the summer. The growth rates can be increased on these soils by renovating the pasture and planting drought-tolerant legumes, such as alfalfa.

Soil fertility is affected by the content of plant nutrients, lime, and organic matter in the soil. Measures that maintain fertility are needed on all soils in the county, regardless of other problems. The productivity of a soil depends on the natural fertility, past use and management, and the long-term fertility history. These factors differ widely from farm to farm, even on the same soil. For this reason, differences in fertility are not used in mapping soils.

The amount and kind of fertilizer to be applied can differ widely among types of soil. Soils that have a high content of clay and organic matter have a high capacity to store and release plant nutrients. Luray silty clay loam is an example. Soils that have a low content of clay and organic matter, such as Schaffenaker loamy sand, 12 to 25 percent slopes, have a very low capacity to store and release plant nutrients. The plow layer of eroded soils is lower in organic matter content than that of uneroded soils. Thus, eroded soils commonly have a lower capacity to store and release plant nutrients.

On steep or very porous soils, large amounts of fertilizer or lime are likely to be lost through runoff or leaching. For this reason, frequent, light applications of fertilizer and lime are preferable to less frequent, heavier applications. On all soils a regular program of soil testing is needed to determine the kind and amount of lime and fertilizer to be applied.

Most of the soils in Knox County are acid in the root zone of most crops. Even Bennington soils, which are deep to carbonates, are very strongly acid to medium acid unless lime has been applied. Soils that formed in acid parent material, such as Homewood soils, are strongly acid or very strongly acid unless lime has been applied.

Most of the crops commonly grown in the county require a reaction of medium acid or higher in the root zone. An exception is alfalfa, which grows best in areas where reaction in the root zone is slightly acid or higher.

Soil reaction affects the availability of plant nutrients. Phosphorus is not readily available to plants if reaction is high or low. When applied to very acid soils, phosphate fertilizer combines with iron and aluminum and is not available to plants. Earthworms, which incorporate plant residue into the soils, are more active if reaction is nearly neutral. Their activity results in better soil structure and a higher organic matter content.

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

Tilth is good in most of the soils used as cropland in Knox County. The content of clay is about 15 percent and that of sand 15 to 25 percent in the silt loam surface layer of light colored soils that are uneroded or only slightly eroded. The clay content does not cause excessive stickiness. Soils that have more clay in the surface layer, such as Pewamo silty clay loam, are sticky when wet. If these soils are worked when they are too wet, the soil particles stick together and form clods. The surface layer of eroded soils also is higher in clay content and more likely to clod than that of uneroded soils. Additions of organic material help to maintain or improve tilth in these soils. Soils that have a high content of silt in the surface layer, such as Glenford and Fitchville soils, crust after hard rains. Leaving crop residue on the surface helps to prevent crusting on these soils.

Yields Per Acre

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

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

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

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

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit (*17*). Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

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

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

Woodland Management and Productivity

Harold E. Bower, service forester, Ohio Department of Natural Resources, Division of Forestry, helped prepare this section.

Woodland is an important land use in Knox County. In 1980, about 68,000 acres in the county, or 20 percent of the total acreage, was wooded. The largest acreage of woodland is in the eastern part of the county, where moderately steep to very steep, well drained soils are dominant. Many soils in this part of the county are better suited to woodland than to most other land uses. In the central and northwestern parts of the county, most farms include a woodlot. Maple syrup production in the county is concentrated in the areas of Rittman and Wooster soils in Middlebury Township. The southwestern part of the county has only a few small woodlots. It is dominated by soils that are too wet for the optimum growth of many species.

Much of the woodland in the county is of poor quality. Much of it has been grazed, and a considerable acreage is still used as wooded pasture. Selective cutting has left species of weed trees, such as beech, to repopulate logged areas.

Most of the trees planted in the county are conifers, especially white and red pine. A few farms have been planted to Christmas trees. Several soils in the county are suited to black walnut. Planting this valuable species is a good land use in small, inaccessible areas, such as areas of Lobdell silt loam, occasionally flooded.

The productivity of woodland varies greatly, depending on the soil properties. The properties influencing tree growth are almost the same as those influencing the growth of annual crops and pasture plants. The major difference is that tree roots penetrate the soil to a greater depth, especially around rock fragments in the lower part of the profile. Aspect and the position of the soil on the landscape are also important. Other important properties are the percent of slope, the degree of past erosion, and the levels of acidity and fertility.

Aspect is the direction in which a slope faces. North aspects are those slopes that have an azimuth of 355 to 95 degrees. South aspects have an azimuth of 96 to 354 degrees (*7*). Trees grow better on north aspects because of less exposure to the prevailing wind and the sun and because soil moisture is more abundant. Some of the factors that make south aspects less well suited to trees are a higher soil temperature resulting from more direct sunrays, a higher evaporation rate caused by the prevailing wind, earlier snowmelt, and a greater degree of freezing and thawing.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each suitable soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. It is based on the site index of the species listed first in the *common trees* column. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *r* indicates steep slopes; *x*, stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted rooting depth; *c*, clay in the upper part of the soil; *s*, sandy texture; and *f*, high content of coarse fragments in the soil profile. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: r, x, w, t, d, c, s, and f.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that few trees may be blown down by strong winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from a commercial nursery or from local offices of the Soil Conservation Service; the Ohio Department of Natural Resources, Division of Forestry; or the Cooperative Extension Service.

Recreation

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor (*1*). A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are foxtail, goldenrod, smartweed, ragweed, and fall panicum.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, maple, hawthorn, dogwood, hickory, blackberry, and black walnut. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are shrub honeysuckle, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, cattail, willow, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and shallow ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of toxic substances affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 13 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. 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, irrigation, 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.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 7). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

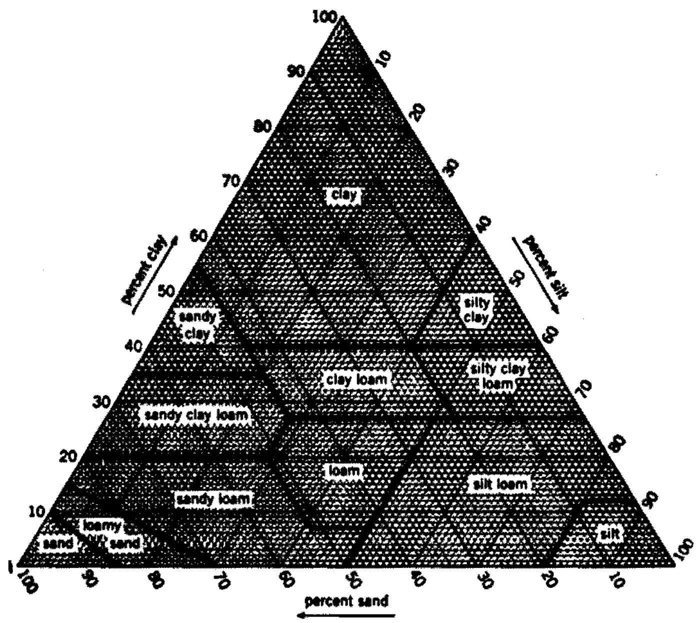

Figure 7.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Classification of the soils is determined according to the Unified soil classification system (*3*) and the system adopted by the American Association of State Highway and Transportation Officials (*2*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 18, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Some areas in Knox County are subject to controlled flooding. These areas are flood pools behind structures used for flood control. The flood pools are shown on the detailed soil maps. One area is in Middlebury Township, along the North Branch of the Kokosing River. A second area is upstream from the Mohawk Dam. This area is along the Mohican and Kokosing Rivers, in the eastern part of the county. Local flooding occurs when water is impounded in the flood pools during periods of high rainfall and runoff. Generally, this flooding occurs early in spring, but it can occur during other periods. The flooding hazard should be considered when a specific use of a particular site is planned.

The western part of Mt. Vernon is on a flood plain. It is now protected by levees. This flood plain was inundated in 1898, 1913, and 1959 (*11*).

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Physical and Chemical Analyses of Selected Soils

Many of the soils in Knox County were sampled by the Soil Characterization Laboratory, Department of Agronomy, Ohio State University, Columbus, Ohio. The physical and chemical data obtained from the samples include particle-size distribution, reaction, organic matter content, calcium carbonate equivalent, and extractable cations.

These data were used in classifying and correlating the soils and in evaluating their behavior under various land uses. Four pedons were selected as representative of their respective series and are described in the section "Soil Series and Their Morphology." These series and their laboratory identification numbers are Gilpin series (KX-43), Homewood series (KX-28), Loudonville series (KX-14), and Ockley series (KX-27).

In addition to the data from Knox County, laboratory data are also available from nearby counties that have many of the same soils. These data and the data from Knox County are on file at the Department of Agronomy, Ohio State University, Columbus, Ohio; the Ohio Department of Natural Resources, Division of Soil and Water Conservation, Columbus, Ohio; and the Soil Conservation Service, State Office, Columbus, Ohio.

Engineering Index Test Data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the Ohio Department of Transportation, Division of Highways, Bureau of Testing, Soils and Foundation Section.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*18*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aqualf (*Aqu*, meaning water, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Ochraqualfs (*Ochra*, meaning light colored surface layer, plus *aqualf*, the suborder of the Alfisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Ochraqualfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, illitic, mesic Typic Ochraqualfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*16*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*18*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Amanda Series

The Amanda series consists of deep, well drained soils on end moraines and the dissected parts of ground moraines. These soils formed in medium textured Wisconsin glacial till. Permeability is moderately slow. Slope ranges from 12 to 40 percent.

Amanda soils commonly are adjacent to Centerburg soils. Centerburg soils are less sloping than the Amanda soils and are moderately well drained. They commonly are on hillsides and ridgetops above the Amanda soils.

Typical pedon of Amanda silt loam, 12 to 18 percent slopes, eroded, about 0.25 mile southwest of Bangs; in an area of Liberty Township about 800 feet southwest along U.S. Route 36 from the intersection of Keys Road and U.S. Route 36, then about 280 feet north, T. 6 N., R. 14 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; weak fine granular structure; friable; few chunks of yellowish brown B horizon material; about 5 percent gravel; strongly acid; abrupt smooth boundary.

BA—7 to 11 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; few distinct brown (10YR 4/3) organic coatings on faces of peds; about 5 percent gravel; strongly acid; clear wavy boundary.

Bt1—11 to 17 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; about 10 percent light yellowish brown (2.5Y 6/4) sandstone fragments; very strongly acid; diffuse irregular boundary.

Bt2—17 to 23 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; about 5 percent gravel; very strongly acid; diffuse wavy boundary.

Bt3—23 to 29 inches; yellowish brown (10YR 5/6) clay loam; few fine distinct brown (10YR 5/3) mottles; weak medium subangular blocky structure parting to moderate medium platy; firm; common faint yellowish brown (10YR 5/4) clay films on faces of peds; about 10 percent gravel; strongly acid; clear wavy boundary.

Bt4—29 to 40 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct strong brown (7.5YR 5/8), many coarse distinct light yellowish brown (2.5Y 6/4), and few fine distinct gray (10YR 5/1) mottles; weak coarse subangular blocky structure parting to weak medium platy; firm; common distinct brown (10YR 5/3) clay films and grainy coatings on faces of peds; about 5 percent gravel; strongly acid; clear wavy boundary.

Bt5—40 to 46 inches; yellowish brown (10YR 5/6) clay loam; common fine and medium distinct gray (10YR 5/1) and common coarse faint strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; firm; common concretions (iron and manganese oxides); about 5 percent gravel; medium acid; diffuse wavy boundary.

BC—46 to 55 inches; yellowish brown (10YR 5/4) loam; common fine distinct gray (10YR 5/1) and few fine distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; firm; few distinct grayish brown (10YR 5/2) surfaces on peds; about 10 percent angular sandstone fragments 0.5 inch to 4.0 inches in diameter; slightly acid; diffuse wavy boundary.

C—55 to 60 inches; yellowish brown (10YR 5/4) loam; few fine distinct strong brown (7.5YR 5/6) mottles; massive; firm; about 5 percent sandstone fragments; neutral.

The thickness of the solum ranges from 40 to 60 inches. The depth to free carbonates ranges from 40 to 70 inches. Reaction is very strongly acid or strongly acid in the upper part of the Bt horizon, medium acid or slightly acid in the BC horizon, and neutral to moderately alkaline in the C horizon. The content of coarse fragments is 2 to 10 percent in the solum and 5 to 15 percent in the C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Some pedons have an A horizon. Pedons in severely eroded areas generally do not have a BA horizon. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It has mottles of low chroma in the lower part. The upper 20 inches of the Bt horizon is silty clay loam, clay loam, or loam and has a clay content of 25 to 35 percent. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is loam or silt loam in which the clay content is 15 to 25 percent.

Bennington Series

The Bennington series consists of deep, somewhat poorly drained, slowly permeable soils that formed in moderately fine textured and medium textured Wisconsin glacial till. These soils are on flats, low knolls, and low ridges on till plains. Slope ranges from 0 to 6 percent.

Bennington soils are similar to Condit soils and commonly are adjacent to Centerburg, Condit, and Pewamo soils. Centerburg soils are moderately well drained and are on hillsides and high knolls. Condit soils are poorly drained and commonly are lower on the landscape than the Bennington soils. Pewamo soils have a mollic epipedon. They are very poorly drained and are in closed depressions and on elongated flats.

Typical pedon of Bennington silt loam, 2 to 6 percent slopes, about 2 miles southwest of Centerburg; in an area of Hilliar Township about 1,750 feet south along Huffman Road from the intersection of Huffman Road and U.S. Route 36, then about 50 feet east, T. 5 N., R. 15 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; few small pebbles; neutral; abrupt smooth boundary.

BE—10 to 12 inches; yellowish brown (10YR 5/4) silt loam; many coarse distinct grayish brown (10YR 5/2) and few medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; common distinct pale brown (10YR 6/3) silt coatings on faces of peds; medium acid; clear irregular boundary.

Bt1—12 to 17 inches; yellowish brown (10YR 5/4 and 5/6) silty clay loam; common fine and medium distinct grayish brown (10YR 5/2) mottles; moderate fine subangular blocky structure; firm; many distinct grayish brown (10YR 5/2) silt coatings and common faint grayish brown (10YR 5/2) clay films on faces of peds; few small angular pebbles; medium acid; clear wavy boundary.

Bt2—17 to 26 inches; yellowish brown (10YR 5/6) silty clay loam; many fine distinct grayish brown (10YR 5/2) and many fine faint yellowish brown (10YR 5/4) mottles; moderate coarse subangular blocky structure parting to strong fine subangular blocky; firm; many distinct gray (10YR 5/1) and grayish brown (10YR 5/2) clay films and few distinct dark grayish brown (10YR 4/2) clay flows on faces of peds; about 5 percent gravel; medium acid; gradual irregular boundary.

Bt3—26 to 33 inches; yellowish brown (10YR 5/4) silty clay loam; many coarse distinct grayish brown (10YR 5/2) and common fine faint yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; many distinct grayish brown (10YR 5/2) coatings on vertical faces of peds; few faint grayish brown (10YR 5/2) clay films on faces of peds; about 5 percent gravel; neutral; clear irregular boundary.

C1—33 to 40 inches; yellowish brown (10YR 5/4) clay loam; common coarse distinct grayish brown (10YR 5/2) mottles; massive; firm; few distinct gray (10YR 5/1) vertical streaks; about 5 percent gravel; slight effervescence; mildly alkaline; gradual wavy boundary.

C2—40 to 60 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct grayish brown (10YR 5/2) mottles; massive; firm; about 6 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 50 inches and the depth to carbonates from 30 to 46 inches. Unless limed, the A horizon and the upper part of the B horizon are medium acid to very strongly acid. The lower part of the B horizon is medium acid to neutral, and the C horizon is mildly alkaline or moderately alkaline. The content of coarse fragments is 0 to 5 percent to a depth of 20 inches, 2 to 15 percent in the part of the solum below a depth of 20 inches, and 4 to 20 percent in the C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. Some pedons have A and E horizons. The A horizon is dominantly silt loam, but it is loam in some pedons. The BE or BA horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 3 to 6. It is silt loam or silty clay loam. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is silty clay loam or clay loam. The clay content in the upper 20 inches of this horizon is 35 to 42 percent. Individual subhorizons have a clay content of 30 to 42 percent. Some pedons have a BC horizon. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is clay loam or loam in which the clay content is 24 to 33 percent.

Bogart Series

The Bogart series consists of deep, moderately well drained soils on terraces and on outwash plains and fans. These soils formed in loamy glacial outwash deposits that commonly contain some gravel. Permeability is moderate or moderately rapid in the solum and rapid in the substratum. Slope ranges from 0 to 6 percent.

Bogart soils are similar to Glenford and Ockley soils and commonly are adjacent to Chili, Fox, Jimtown, and Ockley soils. The well drained Chili, Fox, and Ockley soils commonly are on the higher, more convex parts of the landscape. Glenford soils have less sand and more silt within a depth of 48 inches than the Bogart soils. The somewhat poorly drained Jimtown soils are in areas subject to seepage.

Typical pedon of Bogart silt loam, 0 to 2 percent slopes, near Monroe Mills; in an area of Monroe Township about 1,600 feet west along U.S. Route 36 from the intersection of U.S. Route 36 and Monroe Mills Road, then about 250 feet north, T. 7 N., R. 12 W.

Ap—0 to 10 inches; brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; weak fine granular structure; friable; about 2 percent gravel; slightly acid; abrupt smooth boundary.

BE—10 to 13 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; common distinct pale brown (10YR 6/3) silt coatings on faces on peds; about 1 percent gravel; medium acid; clear irregular boundary.

Bt1—13 to 24 inches; yellowish brown (10YR 5/6) silt loam; few coarse distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure parting to moderate fine subangular blocky; firm; few faint brown (10YR 5/3) clay films on faces of peds; about 1 percent gravel; medium acid; clear smooth boundary.

Bt2—24 to 32 inches; yellowish brown (10YR 5/6) loam; common coarse distinct grayish brown (2.5Y 5/2) and common coarse distinct yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; firm; very slightly brittle; brown (10YR 5/3) surfaces of peds; few faint yellowish brown (10YR 5/4) clay films on faces of peds; about 5 percent gravel; strongly acid; abrupt smooth boundary.

2BC—32 to 40 inches; yellowish brown (10YR 5/6) stratified gravelly loam and gravelly sandy loam; common medium distinct reddish yellow (5YR 6/6) and many coarse distinct grayish brown (10YR 5/2) and brown (10YR 5/3) mottles; massive; friable; few faint yellowish brown (10YR 5/4) clay films on coarse fragments; few distinct dark yellowish brown (10YR 4/4) clay bridges between coarse fragments; many bright stains; about 20 percent gravel; medium acid; gradual wavy boundary.

2C1—40 to 48 inches; yellowish brown (10YR 5/4) gravelly sandy loam; common medium distinct grayish brown (10YR 5/2) and strong brown (7.5YR 5/8) and common medium faint brown (10YR 5/3) mottles; massive; very friable; about 30 percent gravel; medium acid; clear smooth boundary.

2C2—48 to 60 inches; yellowish brown (10YR 5/4) very gravelly loamy sand; single grained; loose; many stains on pebbles; about 35 percent gravel; slightly acid.

The solum ranges from 36 to 50 inches in thickness. In unlimed areas it is slightly acid to strongly acid. The C horizon is slightly acid to mildly alkaline. The depth to carbonates is at least 50 inches. The content of coarse fragments is 0 to 10 percent within a depth of 24 inches, 5 to 35 percent between depths of 24 and 40 inches, and 10 to 60 percent below a depth of 40 inches. These are dominantly subrounded or flat sandstone fragments the size of pebbles. Some limestone pebbles are in the C horizon of some pedons.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. Some pedons have an A horizon. The B horizon dominantly has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam, loam, or silty clay loam in the upper part and sandy loam, loam, sandy clay loam, clay loam, or the gravelly analogs of these textures in the lower part. The BC horizon commonly is stratified with gravelly loamy sand to loam. The gravel varies in size and amount in individual strata. The C horizon is loamy sand, sandy loam, loam, or the gravelly or very gravelly analogs of these textures.

Brownsville Series

The Brownsville series consists of deep, well drained soils that formed in colluvium and residuum derived from siltstone and fine grained sandstone bedrock. These soils are on unglaciated hilltops and valley side slopes. Permeability is moderate or moderately rapid. Slope ranges from 6 to 60 percent.

Brownsville soils commonly are adjacent to Gilpin, Loudonville, and Westmoreland soils. The adjacent soils have an argillic horizon. Their solum has fewer rock fragments than that of the Brownsville soils. Gilpin and Loudonville soils commonly are in the higher positions on the landscape. Westmoreland soils are in positions on the landscape similar to those of the Brownsville soils.

Typical pedon of Brownsville channery silt loam, in an area of Brownsville-Westmoreland complex, 25 to 40 percent slopes, 2.5 miles east-southeast of Millwood; in an area of Union Township about 1,000 feet north-northeast along Shoemaker Road from the intersection of Shoemaker Road and State Route 715, then about 300 feet east, T. 7 N., R. 10 W.

A—0 to 2 inches; very dark grayish brown (10YR 3/2) channery silt loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; very friable; about 30 percent thin, flat, randomly oriented sandstone fragments; very strongly acid; diffuse irregular boundary.

BA—2 to 4 inches; brown (10YR 5/3) very channery silt loam; weak fine subangular blocky structure; very friable; few brown (10YR 4/3) stains; about 35 percent thin, flat, randomly oriented sandstone fragments; very strongly acid; diffuse wavy boundary.

Bw1—4 to 14 inches; yellowish brown (10YR 5/6) very channery silt loam; weak medium subangular blocky structure; very friable; about 40 percent thin, flat, randomly oriented, highly stained sandstone fragments; very strongly acid; gradual smooth boundary.

Bw2—14 to 23 inches; yellowish brown (10YR 5/4) very channery silt loam; weak medium subangular blocky structure parting to distinct platiness inherited from the bedding planes of the rock; very friable; about 55 percent thin, flat, randomly oriented sandstone fragments; slightly weathered surfaces on sandstone fragments; very strongly acid; gradual smooth boundary.

BC—23 to 34 inches; yellowish brown (10YR 5/4) extremely channery silt loam; weak medium subangular blocky structure; very friable; about 70 percent flat, randomly oriented sandstone fragments; very strongly acid; diffuse irregular boundary.

C—34 to 48 inches; yellowish brown (10YR 5/4) extremely channery silt loam; massive; very friable; about 75 percent flat, roughly horizontal sandstone fragments; cracks filled with silt loam; very strongly acid; diffuse wavy boundary.

R—48 to 50 inches; light yellowish brown (2.5Y 6/4) fractured fine grained sandstone and siltstone bedrock; beds 1.0 to 2.5 inches thick; vertical cleavage plains about 12 inches apart.

The thickness of the solum ranges from 24 to 48 inches and the depth to bedrock from 40 to 72 inches. Reaction is strongly acid or very strongly acid throughout the profile. The content of coarse fragments commonly increases with increasing depth. It is 15 to 35 percent in the A horizon, 25 to 60 percent in the lower part of the B horizon, and 50 to 80 percent in the C horizon. The coarse fragments are flat, angular sandstone and siltstone, mostly 1 to 10 inches across and 0.25 inch to 2.0 inches thick.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 2. Some pedons have an Ap horizon, which is lighter colored than the A horizon. The B and C horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. Stains that have a wide range of colors commonly are on the coarse fragments. Zones that have hue of 2.5Y are in some pedons where rock fragments have weathered into soil material. The fine earth material in the B and C horizons is silt loam in which the clay content is 8 to 18 percent.

Canfield Series

The Canfield series consists of deep, moderately well drained soils that have a dense fragipan. These soils formed in medium textured and moderately coarse textured Wisconsin glacial till on till plains. Permeability is moderate above the fragipan and slow in the fragipan. Slope ranges from 2 to 12 percent.

Canfield soils are similar to Rittman, Titusville, and Wooster soils and commonly are adjacent to Loudonville, Wadsworth, and Wooster soils. Loudonville soils are moderately deep over bedrock and do not have a fragipan. They commonly are on the steeper slopes. Rittman soils have more clay in the Bt horizon than the Canfield soils. Titusville soils formed in Illinoian glacial till. They typically have a solum and fragipan that are thicker than those of the Canfield soils. Wadsworth soils are somewhat poorly drained and are on the lower, more concave parts of the landscape. Wooster soils are well drained and are on the steeper, more convex slopes.

Typical pedon of Canfield silt loam, 2 to 6 percent slopes, about 3 miles east of Fredericktown; in an area of Morris Township about 1,500 feet north along Old Mansfield Road from the intersection of Old Mansfield and Montgomery Roads, then about 1,500 feet west, T. 7 N., R. 13 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; weak fine granular structure; friable; about 5 percent gravel; slightly acid; abrupt smooth boundary.

BE—8 to 12 inches; brown (10YR 5/3) silt loam; weak thin platy and fine subangular blocky structure; friable; many distinct light gray (10YR 6/1) and light brownish gray (10YR 6/2) silt coatings on faces of peds; about 4 percent gravel; strongly acid; clear irregular boundary.

Bt1—12 to 16 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; firm; many distinct light brownish gray (10YR 6/2) silt coatings and few faint brown (10YR 5/3) clay films on faces of peds; about 5 percent gravel; strongly acid; clear wavy boundary.

Bt2—16 to 21 inches; yellowish brown (10YR 5/4) loam; common medium and coarse distinct gray (10YR 5/1) and few coarse prominent yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; firm; common distinct pale brown (10YR 6/3) silt coatings and common faint brown (10YR 5/3) clay films on faces of peds; few concretions (iron and manganese oxides); about 5 percent gravel; strongly acid; clear irregular boundary.

Bt3—21 to 25 inches; yellowish brown (10YR 5/4) loam; few medium faint grayish brown (10YR 5/2) mottles; weak coarse prismatic structure parting to moderate thin platy; very firm; many distinct pale brown (10YR 6/3) silt coatings and common faint brown (10YR 5/3) clay films on faces of peds; about 5 percent pebbles; strongly acid; clear wavy boundary.

Btx1—25 to 32 inches; yellowish brown (10YR 5/4) loam; few medium faint grayish brown (10YR 5/2) mottles; weak very coarse prismatic structure parting to moderate thin platy; very firm; very brittle; common faint brown (10YR 5/3) clay films and distinct pale brown (10YR 6/3) silt coatings on faces of peds; common medium platelike concretions (iron and manganese oxides) on horizontal faces of peds; about 5 percent gravel; very strongly acid; clear wavy boundary.

Btx2—32 to 42 inches; yellowish brown (10YR 5/6) loam; many medium distinct gray (10YR 5/1) and common medium faint brown (10YR 5/3) mottles; weak very coarse prismatic structure parting to moderate medium platy; very firm; brittle; many distinct gray (10YR 5/1) and grayish brown (10YR 5/2) clay films on faces of peds; about 5 percent gravel; very strongly acid; clear wavy boundary.

BC1—42 to 47 inches; yellowish brown (10YR 5/6) loam; common medium distinct gray (10YR 5/1) mottles; weak coarse subangular blocky structure; firm; slightly brittle; many distinct gray (10YR 5/1) coatings and few faint gray (10YR 5/1) clay films on faces of peds; few medium distinct platelike concretions (iron and manganese oxides) on faces of peds; about 10 percent gravel; strongly acid; gradual smooth boundary.

BC2—47 to 54 inches; yellowish brown (10YR 5/6) loam; common medium distinct gray (10YR 5/1) and grayish brown (10YR 5/2) mottles; weak very coarse subangular blocky structure; firm; many distinct gray (10YR 5/1) coatings on faces of peds; about 10 percent gravel; medium acid; gradual irregular boundary.

C—54 to 60 inches; dark yellowish brown (10YR 4/4) loam; common medium distinct grayish brown (10YR 5/2) mottles; massive; firm; few dark concretions; about 5 percent gravel; medium acid.

The thickness of the solum ranges from 48 to 72 inches. The depth to the top of the fragipan ranges from 18 to 28 inches. The depth to carbonates is more than 60 inches. In unlimed areas the Bt and Btx horizons are strongly acid or very strongly acid. The BC horizon is strongly acid to neutral, and the C horizon is medium acid to neutral. The content of small, angular igneous and sandstone pebbles is 2 to 15 percent in the fragipan and in the C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Some pedons have A and E horizons. The BE horizon has hue of 10YR, value of 5, and chroma of 3 or 4. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam or loam in which the clay content is 18 to 27 percent. The Btx horizon is 15 to 24 inches thick. It has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is loam or sandy loam in which the clay content is 15 to 25 percent. The BC horizon has colors and textures similar to those of the Btx horizon, but it has finer structure and is not so brittle. The C horizon is loam or sandy loam glacial till.

Centerburg Series

The Centerburg series consists of deep, moderately well drained soils on ground moraines and end moraines. These soils formed in medium textured Wisconsin glacial till. Permeability is moderately slow. Slope ranges from 2 to 12 percent.

Centerburg soils commonly are adjacent to Amanda and Bennington soils. Amanda soils are steeper than the Centerburg soils and are well drained. They commonly are on hillsides below the Centerburg soils. Bennington soils are somewhat poorly drained and are on the more concave parts of the landscape.

Typical pedon of Centerburg silt loam, 2 to 6 percent slopes, about 4 miles west of Mt. Vernon; in an area of Liberty Township about 1,450 feet north along Cochran Road from the intersection of Cochran Road and State Route 229, then about 150 feet west, T. 6 N., R. 14 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; few small pebbles; slightly acid; abrupt smooth boundary.

BE—7 to 12 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; common faint brown (10YR 5/3) silt coatings on faces of peds; few small pebbles; strongly acid; clear irregular boundary.

Bt1—12 to 21 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; common distinct brown (10YR 5/3) clay films on faces of peds; few small pebbles; strongly acid; clear wavy boundary.

Bt2—21 to 27 inches; yellowish brown (10YR 5/6) clay loam; few medium distinct grayish brown (10YR 5/2) mottles; moderate fine subangular blocky structure; firm; common distinct brown (10YR 5/3) clay films and common faint yellowish brown (10YR 5/4) silt coatings on faces of peds; about 5 percent gravel; strongly acid; clear smooth boundary.

Bt3—27 to 36 inches; yellowish brown (10YR 5/6) clay loam; common fine distinct grayish brown (10YR 5/2) and few coarse distinct yellowish red (5YR 5/6) mottles; weak coarse subangular blocky structure parting to moderate fine subangular blocky; firm; common distinct brown (10YR 5/3) clay films on faces of peds; about 5 percent gravel; strongly acid; clear smooth boundary.

BC1—36 to 44 inches; yellowish brown (10YR 5/4) clay loam; many fine distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure parting to weak thin platy; firm; few distinct pale brown (10YR 6/3) grainy coatings on faces of peds; about 10 percent gravel; medium acid; gradual wavy boundary.

BC2—44 to 51 inches; yellowish brown (10YR 5/4) clay loam; many fine distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; about 5 percent gravel; slightly acid; clear wavy boundary.

C1—51 to 55 inches; yellowish brown (10YR 5/4) loam; common medium distinct grayish brown (10YR 5/2) and few coarse prominent yellowish red (5YR 5/6) mottles; massive; firm; about 5 percent flat sandstone fragments; neutral; clear irregular boundary.

C2—55 to 60 inches; yellowish brown (10YR 5/4) loam; common coarse prominent yellowish red (5YR 5/8) and common fine distinct gray (10YR 5/1) mottles; massive; firm; about 10 percent gravel; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to carbonates range from 30 to 52 inches. They do not coincide in most pedons. Both differ considerably within small areas. Reaction ranges from very strongly acid to neutral in the A horizon, from medium acid to very strongly acid in the upper part of the Bt horizon, from strongly acid to slightly acid in the lower part of the Bt horizon, from medium acid to neutral in the BC horizon, and from neutral to moderately alkaline in the C horizon. The content of coarse fragments is 2 to 10 percent in the solum and 3 to 15 percent in the C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The color varies, depending on the degree of erosion. Some pedons have an A horizon. Pedons in eroded areas commonly do not have a BE horizon. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is silty clay loam, clay loam, or loam. The content of clay in the upper 20 inches of this horizon is 26 to 35 percent. The BC horizon has hue of 10YR, value of 4 or 5, and chroma of

2 to 6. It is loam, clay loam, or silt loam. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It has a clay content of 15 to 25 percent.

Chili Series

The Chili series consists of deep, well drained soils that formed in acid glacial outwash. These soils are dominantly on terraces, fans, kames, and outwash plains but in a few areas are on moraines, in valley plugs, and on valley side slopes. Permeability is moderately rapid. Slope ranges from 0 to 25 percent.

Chili soils are similar to Fox soils and commonly are adjacent to Bogart and Homewood soils. Bogart soils are moderately well drained. They are on the lower, more concave parts of the landscape. Fox soils formed in calcareous glacial outwash and have carbonates within a depth of 40 inches. Homewood soils formed in glacial till and have a fragipan. They occur as areas closely intermingled with areas of the Chili soils on moraines, on kames, and in valley plugs.

Typical pedon of Chili silt loam, in an area of Chili-Homewood silt loams, 6 to 12 percent slopes, about 2 miles southwest of North Liberty; in an area of Pike Township about 1,910 feet east along Keller Road from the intersection of Keller and Divelbiss Roads, then about 200 feet north, T. 8 N., R. 12 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; about 10 percent gravel; medium acid; abrupt smooth boundary.

BA—7 to 12 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; about 5 percent gravel; strongly acid; clear wavy boundary.

Bt1—12 to 18 inches; yellowish brown (10YR 5/6) loam; weak medium subangular blocky structure; friable; common faint yellowish brown (10YR 5/4) clay films on faces of peds; about 10 percent gravel; strongly acid; clear wavy boundary.

Bt2—18 to 25 inches; yellowish brown (10YR 5/6) gravelly loam; weak medium subangular blocky structure; very friable; few faint yellowish brown (10YR 5/4) clay films on faces of peds; pebbles lightly coated and bridged with clay; about 15 percent gravel; strongly acid; clear wavy boundary.

Bt3—25 to 40 inches; yellowish brown (10YR 5/6) gravelly sandy loam; massive; very friable; pebbles and sand grains coated and bridged with clay; about 20 percent gravel; strongly acid; diffuse wavy boundary.

BC—40 to 52 inches; yellowish brown (10YR 5/6) gravelly sandy loam; massive; very friable; sand grains and pebbles lightly bridged with clay, heavily bridged in thin bands; about 25 percent gravel; strongly acid; diffuse wavy boundary.

C—52 to 60 inches; yellowish brown (10YR 5/4) gravelly loamy sand; single grained; loose; about 25 percent gravel; strongly acid.

The thickness of the solum ranges from 40 to 80 inches. The depth to carbonates is more than 60 inches. In unlimed areas the A and BA horizons and the upper part of the Bt horizon are strongly acid or medium acid. The lower part of the Bt horizon and the BC and C horizons are strongly acid to slightly acid. The content of coarse fragments ranges from 5 to 30 percent within a depth of 20 inches, from 15 to 40 percent between depths of 20 and 40 inches, and from 25 to 40 percent below a depth of 40 inches. The coarse fragments include rounded pebbles and cobbles and angular sandstone channers. The channers are most common in areas of the Chili-Homewood complexes.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is dominantly silt loam or gravelly loam, but it is loam in some pedons.

The Bt horizon has hue of 7.5YR of 10YR, value of 4 or 5, and chroma of 3 to 6. It is dominantly loam, clay loam, or the gravelly or very gravelly analogs of these textures. In some pedons, however, it has subhorizons of silt loam or silty clay loam within a depth of 24 inches. Also, in many pedons it has subhorizons of sandy loam or gravelly sandy loam in the lower part. The content of clay in this horizon is 18 to 25 percent. Individual subhorizons have a clay content of 10 to 35 percent. The subhorizons commonly differ in content and size of pebbles.

The BC horizon has a color range similar to that of the Bt horizon, but it shows less evidence of clay accumulation. In the upper part of this horizon, thin bands that have considerable clay bridging are common. They become thinner and farther apart with increasing depth. The BC horizon is the gravelly or very gravelly analogs of loamy sand, sandy loam, or loam. The C horizon is the gravelly or very gravelly analogs of loamy sand or sand.

Condit Series

The Condit series consists of deep, poorly drained, slowly permeable soils on till plains. These soils commonly are on flats, in depressions, and along small natural drainageways. They formed in moderately fine textured and medium textured Wisconsin glacial till. Slope is 0 to 2 percent.

Condit soils are similar to Bennington and Sebring soils and commonly are adjacent to Bennington and Pewamo soils. Bennington soils are somewhat poorly drained and commonly are higher on the landscape than the Condit soils. Pewamo soils have a mollic epipedon. They are on flats and in closed depressions. Sebring soils formed in water-laid deposits and contain less clay and more silt in the Bt horizon than the Condit soils.

Typical pedon of Condit silt loam, about 8 miles west of Mt. Vernon; in an area of Liberty Township about 4,000 feet south along Braddock Road from the intersection of Braddock and Green Valley Roads, then about 1,300 feet west, T. 6 N., R. 14 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; weak fine granular structure; friable; few pebbles; neutral; abrupt smooth boundary.

BAg—9 to 13 inches; grayish brown (2.5Y 5/2) silty clay loam; few fine prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; few pebbles; medium acid; clear wavy boundary.

Btg1—13 to 16 inches; grayish brown (10YR 5/2) silty clay loam; few fine prominent yellowish brown (10YR 5/6) mottles; moderate medium and coarse subangular blocky structure; firm; gray (10YR 5/1) faces of peds with dark gray (10YR 4/1) streaks; common faint gray (10YR 5/1) clay films on faces of peds; few pebbles; medium acid; clear wavy boundary.

Btg2—16 to 27 inches; gray (10YR 5/1) silty clay loam; few fine prominent yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; gray (5Y 5/1) faces of peds with dark gray (5Y 4/1) streaks; many faint gray (10YR 5/1) clay films on faces of peds; few pebbles; slightly acid; gradual wavy boundary.

Btg3—27 to 38 inches; dark gray (10YR 4/1) silty clay loam; common coarse distinct yellowish brown (10YR 5/4) and few medium prominent yellowish brown (10YR 5/6) mottles; moderate fine and medium subangular blocky structure; firm; gray (5Y 5/1) faces of peds with dark gray (5Y 4/1) streaks; many faint gray (10YR 5/1) clay films on faces of peds; few pebbles; neutral; clear wavy boundary.

BC—38 to 48 inches; yellowish brown (10YR 5/4) silty clay loam; common coarse distinct gray (10YR 5/1) and common coarse faint yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; grayish brown (10YR 5/2) faces of peds; very few faint grayish brown (10YR 5/2) clay films on faces of peds; about 5 percent gravel; neutral; gradual wavy boundary.

Cg—48 to 60 inches; gray (10YR 5/1) silty clay loam; many coarse distinct yellowish brown (10YR 5/4) and few medium prominent yellowish brown (10YR 5/6) mottles; massive; firm; about 5 percent gravel; slight effervescence; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 35 to 55 inches. Reaction is medium acid or strongly acid in the upper part of the Btg horizon and slightly acid or neutral in the lower part of the solum. The content of small angular pebbles is 1 to 5 percent in the solum and 2 to 10 percent in the C horizon.

The Ap horizon has hue of 10YR, value of 4, and chroma of 1 or 2. Some pedons have A and BE horizons. The BA horizon has numerous, small, dark iron and manganese concretions in some pedons. The upper part of the Bt horizon, to a depth of at least 30 inches, has hue of 5Y to 10YR, value of 4 or 5, and chroma of 1 or 2. The part below a depth of 30 inches has chroma of 3 or 4 in many pedons. The Bt horizon is silty clay loam or clay loam. The content of clay in the upper 20 inches of this horizon is 35 to 42 percent. The C horizon has hue 10YR or 2.5Y, value 4 or 5, and chroma of 1 to 4. It is clay loam, silty clay loam, or loam.

Coshocton Series

The Coshocton series consists of deep, moderately well drained, slowly permeable or moderately slowly permeable soils on uplands. These soils formed in colluvium and residuum derived from shale, sandstone, and siltstone bedrock. Slope ranges from 2 to 25 percent.

Coshocton soils commonly are adjacent to the well drained Gilpin, Rigley, and Westmoreland soils. Gilpin and Westmoreland soils commonly are lower on the landscape than the Coshocton soils, and Rigley soils are higher. Rigley soils have less clay in the subsoil than the Coshocton soils. Gilpin soils are moderately deep over bedrock.

Typical pedon of Coshocton silt loam, 6 to 12 percent slopes, about 4 miles southeast of Millwood; in an area of Butler Township about 250 feet southeast along Rabbit Ridge Road from the intersection of Rabbit Ridge and Busenberg Roads, then about 100 feet east, T. 6 N. R. 10 W.

Ap—0 to 6 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common faint dark brown (10YR 3/3) organic coatings on faces of peds; about 10 percent sandstone fragments; strongly acid; abrupt smooth boundary.

BA—6 to 10 inches; yellowish brown (10YR 5/4) loam; weak fine subangular blocky structure; friable; about 5 percent coarse fragments; very strongly acid; clear irregular boundary.

Bt1—10 to 18 inches; yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; firm; few faint yellowish brown (10YR 5/4) clay films on faces of peds; about 5 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt2—18 to 27 inches; yellowish brown (10YR 5/6) channery clay loam; few medium distinct grayish brown (2.5Y 5/2) mottles; moderate medium subangular blocky structure; firm; common distinct brown (10YR 5/3) clay films on faces of peds; about

20 percent angular sandstone fragments; very strongly acid; abrupt wavy boundary.

Bt3—27 to 33 inches; yellowish brown (10YR 5/6) clay loam; common coarse faint brownish yellow (10YR 6/6), few medium distinct gray (10YR 5/1), and common medium distinct yellowish red (5YR 5/8) mottles; moderate fine prismatic structure parting to moderate very fine subangular blocky; very firm; common distinct light yellowish brown (10YR 6/4) silt coatings and clay films on faces of peds; about 10 percent coarse fragments; extremely acid; clear smooth boundary.

Bt4—33 to 48 inches; light yellowish brown (2.5Y 6/4) silty clay loam; many coarse prominent yellowish red (5YR 5/6) and common coarse distinct grayish brown (2.5Y 5/2) mottles; weak coarse prismatic structure parting to moderate fine angular blocky; very firm; many distinct pale olive (5Y 6/3) coatings and few faint pale olive (5Y 6/3) clay films on faces of peds; about 5 percent coarse fragments; very strongly acid; clear wavy boundary.

C—48 to 58 inches; olive (5Y 5/3) silty clay loam; common medium distinct light olive brown (2.5Y 5/6) mottles; very weak coarse subangular blocky structure parting to moderate thin platy structure inherited from bedding in the parent shale; very firm; about 10 percent olive gray (5Y 4/2) shale fragments; very strongly acid; clear smooth boundary.

Cr—58 to 60 inches; olive gray (5Y 4/2) thinly bedded weathered shale bedrock; very firm; few olive yellow (2.5Y 6/6) stains.

The thickness of the solum ranges from 36 to 50 inches and the depth to bedrock from 40 to 72 inches. The colluvium ranges from 30 to 60 inches in thickness. It is typically derived from sandstone and siltstone. In unlimed areas the solum is strongly acid to extremely acid. The C horizon is very strongly acid to medium acid. The content of coarse fragments of sandstone, siltstone, and shale is 2 to 20 percent in the A and BA horizons, 5 to 25 percent in the Bt horizon, and 10 to 60 percent in the C horizon. Most of the shale fragments can be crushed.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The top inch has value of 3 in some areas that have not been plowed for many years. The Ap horizon is typically silt loam or channery silt loam, but it is loam in some pedons. Some pedons have an E horizon.

The part of the Bt horizon that formed in colluvium has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It has a clay content of 25 to 35 percent. It is silt loam, clay loam, silty clay loam, loam, or sandy clay loam. The part of the Bt horizon below the colluvium has a wide range of colors and is highly variegated in many pedons. It is silty clay loam or clay loam and has a clay content of 27 to 35 percent.

The Cr horizon is shale that breaks down to silty clay loam or silty clay when rubbed. It varies widely in color. In some pedons this shale rests on sandstone bedrock at a depth of 40 to 72 inches.

Crane Series

The Crane series consists of deep, somewhat poorly drained soils that formed in silty material and in the underlying outwash deposits. These soils are on stream terraces and outwash plains. Permeability is moderately slow in the solum and very rapid in the substratum. Slope is 1 to 4 percent.

Crane soils commonly are adjacent to Bogart soils. The adjacent soils are moderately well drained and are slightly higher on the landscape than the Crane soils. They do not have a mollic epipedon.

Typical pedon of Crane silt loam, 1 to 4 percent slopes, about 6 miles west of Mt. Vernon; in an area of Liberty Township about 770 feet east along State Route 229 from the intersection of State Route 229 and Campbell Road, then about 200 feet north, T. 6 N., R. 14 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; few pebbles; neutral; abrupt smooth boundary.

A—9 to 14 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak very fine subangular blocky structure; friable; few pebbles; slightly acid; clear irregular boundary.

Bt1—14 to 24 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure parting to moderate medium subangular blocky; firm; common distinct grayish brown (10YR 5/2) silt coatings and common distinct brown (10YR 5/3) clay films on faces of peds; many root channels filled with very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) A horizon material; about 5 percent gravel; medium acid; clear wavy boundary.

2Bt2—24 to 34 inches; yellowish brown (10YR 5/4) clay loam; common fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; many distinct grayish brown (10YR 5/2) clay films on faces of peds; few distinct clay films on pebbles; few large root channels filled with very dark grayish brown (10YR 3/2) A horizon material; about 10 percent gravel; slightly acid; clear wavy boundary.

2Bt3—34 to 42 inches; dark yellowish brown (10YR 4/4) gravelly loam; few fine distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; friable, sticky; many faint yellowish brown (10YR 5/4) clay films on coarse fragments and clay bridges between coarse fragments; about 30 percent fine gravel; neutral; gradual wavy boundary.

2BC—42 to 52 inches; yellowish brown (10YR 5/4) gravelly loam; massive; friable; few faint brown (10YR 5/3) clay bridges between pebbles; about 30 percent gravel; neutral; clear wavy boundary.

2C—52 to 60 inches; yellowish brown (10YR 5/4) gravelly loamy sand; many coarse distinct strong brown (7.5YR 5/6) mottles; single grained; loose; about 20 percent gravel; slight effervescence; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 40 to 60 inches. Reaction is medium acid to neutral in the solum and mildly alkaline or moderately alkaline in the C horizon. The content of coarse fragments is 0 to 15 percent in the A horizon, 2 to 30 percent in the B horizon, and 10 to 40 percent in the C horizon.

The thickness of the Ap horizon combined with that of the A horizon is 10 to 16 inches. These horizons have hue of 10YR, value of 2 or 3, and chroma of 1 or 2. When dry, they have hue of 10YR, value of 4 or 5, and chroma of 2. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 6. The 2Bt horizon is silty clay loam, clay loam, loam, or the gravelly analogs of these textures. The content of clay in the upper 20 inches of the B horizon is 22 to 35 percent. The C horizon is dominantly loamy sand, sand, or the gravelly or very gravelly analogs of these textures. In some pedons, however, it has thin strata of sandy loam, loam, or the gravelly or very gravelly analogs of these textures.

Fitchville Series

The Fitchville series consists of deep, somewhat poorly drained soils that formed in glacial meltwater deposits having a high content of silt. These soils are in former lakebeds and on slack water terraces along streams. Permeability is moderately slow. Slope ranges from 0 to 6 percent.

Fitchville soils are similar to Jimtown and Sebring soils and commonly are adjacent to Bogart, Glenford, Luray, and Sebring soils. Bogart and Glenford soils are moderately well drained and are on the higher parts of the landscape. Jimtown soils have more sand and less silt in the B and C horizons than the Fitchville soils. Luray and Sebring soils are lower on the landscape than the Fitchville soils. Luray soils are very poorly drained and have a mollic epipedon. Sebring soils are poorly drained.

Typical pedon of Fitchville silt loam, 0 to 2 percent slopes, about 2.5 miles northeast of Millwood; in an area of Union Township about 250 feet north along Flat Run Road from the intersection of Flat Run and Boeshart Roads, then about 900 feet east, T. 7 N., R. 10 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

B/E—8 to 13 inches; brown (10YR 5/3) silt loam (B); many coarse distinct yellowish brown (10YR 5/6) mottles; weak thick platy structure parting to weak very fine subangular blocky; friable; many distinct light brownish gray (10YR 6/2) silt coatings (E) on faces of peds; medium acid; clear irregular boundary.

Bt1—13 to 22 inches; yellowish brown (10YR 5/4 and 5/6) silt loam; common coarse distinct gray (10YR 5/1) mottles; moderate medium subangular blocky structure; firm; common distinct grayish brown (10YR 5/2) clay films and many distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; medium acid; clear wavy boundary.

Bt2—22 to 32 inches; yellowish brown (10YR 5/4) silt loam; many coarse distinct strong brown (7.5YR 5/6) and grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; many distinct gray (10YR 5/1) silt coatings and common faint gray (10YR 5/1) clay films on faces of peds; medium acid; clear wavy boundary.

Bt3—32 to 37 inches; dark yellowish brown (10YR 4/4) silty clay loam; many coarse distinct strong brown (7.5YR 5/6) and common coarse distinct grayish brown (2.5Y 5/2) mottles; moderate coarse subangular blocky structure; firm; many distinct gray (10YR 5/1) coatings and common faint gray (10YR 5/1) clay films on faces of peds; common distinct rounded dark concretions (iron and manganese oxides); medium acid; clear smooth boundary.

BC—37 to 47 inches; yellowish brown (10YR 5/4) silt loam; common medium faint yellowish brown (10YR 5/6) and common medium distinct gray (10YR 5/1) mottles; moderate thick platy structure parting to weak very fine subangular blocky; friable; few distinct dark gray (10YR 4/1) clay films on faces of peds; few thin strata of silty clay loam; neutral; clear smooth boundary.

C—47 to 60 inches; variegated grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) silt loam; massive; friable, very soft; laminated; thin strata of very fine sandy loam; neutral.

The thickness of the solum ranges from 40 to 60 inches. The depth to carbonates is more than 60 inches. In unlimed areas the upper part of the solum ranges from medium acid to very strongly acid. The lower part of the solum ranges from medium acid to neutral and the C horizon from slightly acid to mildly alkaline. The solum has virtually no coarse fragments. In some pedons the content of coarse fragments ranges from 0 to 5 percent in thin strata below a depth of 4 feet.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. Some pedons have A and E horizons. Some have a BA horizon rather than a B/E horizon. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is silt loam or silty clay loam in which the clay content is 24 to 35 percent. The BC horizon has colors similar to those of the Bt horizon, but it commonly has a lower clay content. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is dominantly stratified silt loam, silty clay loam, or very fine sandy loam.

Fox Series

The Fox series consists of deep, well drained soils on kames and terraces. These soils formed in glaciofluvial deposits underlain by calcareous sand and gravel at a depth of 24 to 40 inches. Permeability is moderate in the solum and rapid or very rapid in the substratum. Slope ranges from 0 to 25 percent.

Fox soils are similar to Chili soils and commonly are adjacent to Ockley and Tioga soils. Chili soils have a solum that is thicker and more acid than that of the Fox soils. Ockley soils are more than 40 inches deep to calcareous sand and gravel. They are on the higher terraces. Tioga soils are on flood plains and are subject to flooding. They do not have an argillic horizon.

Typical pedon of Fox gravelly loam, 12 to 25 percent slopes, near Lucerne; in an area of Wayne Township about 250 feet southwest along Bryant Road from the intersection of Bryant and Lucerne Roads, then about 120 feet south, T. 7 N., R. 14 W.

Ap—0 to 6 inches; brown (10YR 4/3) gravelly loam, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; about 20 percent gravel; slightly acid; abrupt smooth boundary.

BA—6 to 10 inches; yellowish brown (10YR 5/4) loam; weak medium subangular blocky structure; very friable; about 10 percent gravel; slightly acid; clear irregular boundary.

Bt1—10 to 24 inches; brown (7.5YR 5/4) gravelly loam; moderate medium subangular blocky structure; firm, sticky; many distinct dark yellowish brown (10YR 4/4) clay bridges between coarse fragments; about 20 percent gravel; slightly acid; gradual wavy boundary.

Bt2—24 to 34 inches; brown (7.5YR 5/4) gravelly clay loam; moderate medium subangular blocky structure; firm, sticky; many distinct dark yellowish brown (10YR 4/4) clay bridges between coarse fragments; about 15 percent gravel; neutral; clear irregular boundary.

BC—34 to 37 inches; brown (7.5YR 4/4) stratified gravelly loam and gravelly sandy loam; massive; very friable; very few faint brown (7.5YR 5/4) clay bridges between coarse fragments; about 20 percent gravel; slight effervescence; mildly alkaline; clear irregular boundary.

2C1—37 to 47 inches; dark yellowish brown (10YR 4/4) gravelly loamy sand; single grained; loose; tongues of gravelly sandy loam from the BC horizon; about 20 percent gravel; slight effervescence; mildly alkaline; gradual irregular boundary.

2C2—47 to 60 inches; yellowish brown (10YR 5/4) gravelly sand; single grained; loose; about 30 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 24 to 40 inches. Reaction ranges from slightly acid to strongly acid in the upper part of the solum and is neutral or mildly alkaline in the lower part. The coarse fragments are mostly rounded sandstone, limestone, and igneous pebbles and cobblestones. The content of coarse fragments is 15 to 25 percent in the Ap or A horizon, 15 to 30 percent in the Bt and BC horizons, and 20 to 60 percent in the C horizon.

The Ap horizon has hue 10YR, value of 3 or 4, and chroma of 2 or 3. It commonly is gravelly loam, but it is gravelly silt loam in some pedons. The Bt horizon has hue 10YR or 7.5YR, value of 3 to 5, and chroma of 4 to 6. It commonly is gravelly loam or gravelly clay loam, but it has subhorizons of loam in some pedons. The content of clay in the upper 20 inches of this horizon is 20 to 35 percent, but individual subhorizons have a clay content of 20 to 40 percent. The C horizon typically is gravelly or very gravelly sand, but in some pedons it is gravelly loamy sand in the upper part.

Gilpin Series

The Gilpin series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils generally are on ridgetops but in a few areas are on benches. They formed in material weathered from siltstone and fine grained sandstone. Slope ranges from 2 to 12 percent.

Gilpin soils are similar to Loudonville soils and commonly are adjacent to the deep Brownsville, Coshocton, Rigley, and Westmoreland soils. Brownsville and Westmoreland soils are on hillsides below the Gilpin soils. Coshocton soils are moderately well drained. Their positions on the landscape are similar to those of the Gilpin soils. Loudonville soils formed mainly in glacial till. Their solum has a higher content of rounded coarse fragments than that of the Gilpin soils. Rigley soils have more sand throughout than the Gilpin soils. They are on the higher ridges.

Typical pedon of Gilpin silt loam, 2 to 6 percent slopes, about 4 miles northwest of Danville; in an area of Brown Township about 780 feet west along Breckler Road from the intersection of Breckler and Wildcat Roads, then about 1,250 feet south, T. 8 N., R. 11 W.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam; weak very fine granular structure; friable; about 6 percent rock fragments; neutral; abrupt smooth boundary.

BA—9 to 13 inches; yellowish brown (10YR 5/6) silt loam; weak fine subangular blocky structure; friable; about 10 percent rock fragments; slightly acid; clear irregular boundary.

Bt1—13 to 19 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common faint yellowish brown (10YR 5/4) clay films on faces of peds; about 5 percent rock fragments; medium acid; clear irregular boundary.

Bt2—19 to 25 inches; yellowish brown (10YR 5/6) silt loam; weak very coarse subangular blocky structure parting to moderate fine subangular blocky; firm; common faint yellowish brown (10YR 5/4) clay films on faces of peds; common olive yellow (2.5Y 6/6) pockets of soil material weathered from sandstone fragments; about 10 percent rock fragments; very strongly acid; clear irregular boundary.

Bt3—25 to 33 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; firm; few faint yellowish brown (10YR 5/6) clay films on faces of peds; common light yellowish brown (10YR 6/4) pockets of soil material weathered from sandstone fragments; about 5 percent rock fragments; very strongly acid; clear smooth boundary.

BC—33 to 37 inches; yellowish brown (10YR 5/4) channery loam; weak fine subangular blocky structure; firm; about 30 percent light yellowish brown (2.5Y 6/4) sandstone fragments; very strongly acid; abrupt smooth boundary.

R—37 to 39 inches; brownish yellow (10YR 6/6) hard fractured fine grained sandstone; beds 0.25 to 0.5 inch thick in the upper part, increasing to 0.75 inch to 1.5 inches thick with increasing depth.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. In unlimed areas the solum is strongly acid or very strongly acid. The content of thin, flat sandstone fragments is 5 to 30 percent in the Bt horizon and 30 to 60 percent in the BC and C horizons.

Pedons in uncultivated areas have A and E horizons. The Bt horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 4 to 6. It is loam, silt loam, silty clay loam, or the channery analogs of these textures. The content of clay in this horizon is 18 to 30 percent. Highly weathered sandstone fragments are common in the Bt horizon, especially in the lower part, and in the BC horizon. They have hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 4 to 8. Some pedons have a C horizon. The BC and C horizons are the channery or very channery analogs of loam or silt loam.

Glenford Series

The Glenford series consists of deep, moderately well drained soils that formed in material deposited by still or slowly moving glacial meltwater. These soils are on slack water terraces along streams and in former lakebeds. Permeability is moderately slow. Slope ranges from 0 to 12 percent.

Glenford soils are similar to Bogart soils and commonly are adjacent to Fitchville and Chili soils. Bogart soils contain more sand and gravel in the B and C horizons than the Glenford soils. Fitchville soils are somewhat poorly drained and are on flats and the more concave parts of the landscape. Chili soils are well drained and are on terrace breaks and knolls on terraces. They have more gravel throughout than the Glenford soils.

Typical pedon of Glenford silt loam, 2 to 6 percent slopes, about 3 miles northwest of Danville; in an area of Brown Township about 2,600 feet south-southeast along Workman Road from the intersection of Workman and Breckler Roads, then about 40 feet east, T. 8 N., R. 11 W.

Ap—0 to 11 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; medium acid; abrupt smooth boundary.

BE—11 to 14 inches; yellowish brown (10YR 5/6) silt loam; weak fine subangular blocky structure; very friable; many distinct brown (10YR 5/3) silt coatings on faces of peds; few distinct dark brown (10YR 4/3) root channel fillings; strongly acid; clear irregular boundary.

Bt1—14 to 23 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; firm; few distinct brown (10YR 5/3) clay films on faces of peds; strongly acid; clear smooth boundary.

Bt2—23 to 32 inches; yellowish brown (10YR 5/4) silt loam; common coarse distinct light brownish gray (2.5Y 6/2) and few fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; very slightly brittle; few distinct rounded concretions (iron and manganese oxides); few faint brown (10YR 5/3) clay films on faces of peds; strongly acid; clear wavy boundary.

BC—32 to 44 inches; yellowish brown (10YR 5/6) silt loam; common fine distinct light brownish gray (10YR 6/2) and common medium distinct strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; friable; weakly laminar; about 10 percent thin strata of very friable very fine sandy loam; medium acid; clear smooth boundary.

C—44 to 60 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct grayish brown (10YR 5/2) and few fine distinct yellowish brown (10YR 5/8) mottles; massive; very friable; laminated; thin strata of very fine sandy loam and very fine sand; medium acid.

The thickness of the solum ranges from 36 to 60 inches. The depth to carbonates is more than 48 inches. In unlimed areas the upper part of the solum is medium acid or strongly acid. The lower part of the solum is medium acid to neutral, and the C horizon is medium acid to mildly alkaline. The upper 48 inches has virtually no coarse fragments. In some pedons the content of pebbles is 5 to 15 percent in thin strata below a depth of 48 inches.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. Some pedons have A and E horizons. The BE horizon has hue of 10YR, value of 5, and chroma of 3 to 6. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is dominantly silt loam or silty clay loam in which the clay content is 20 to 30 percent. In some pedons it has thin strata of loam and fine sandy loam in the lower part. The C horizon is dominantly silt loam, silty clay loam, or very fine sandy loam, but it has thin strata of loam, sandy loam, very fine sand, or silty clay in some pedons. It typically has hue of 10YR, value of 4 or 5, and chroma of 3 to 6, but the thin strata have colors outside these ranges.

Gresham Series

The Gresham series consists of deep, somewhat poorly drained soils that have a dense fragipan. These soils are in concave areas on till plains. They formed in Illinoian glacial till. Permeability is moderate or moderately slow above the fragipan and slow in the fragipan. Slope ranges from 2 to 6 percent.

Gresham soils are similar to Wadsworth soils and commonly are adjacent to Titusville soils. Titusville soils are moderately well drained and are on the higher, more convex parts of the landscape. Wadsworth soils formed in Wisconsin glacial till and are less acid in the lower part than the Gresham soils.

Typical pedon of Gresham silt loam, 2 to 6 percent slopes, about 5 miles east of Bladensburg; in an area of Jackson Township about 4,100 feet east along Bailey Road from the intersection of Bailey and Woods Church Roads, then about 400 feet north, T. 5 N., R. 10 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; about 5 percent pebbles; slightly acid; abrupt smooth boundary.

BEg—9 to 13 inches; grayish brown (10YR 5/2) silt loam; many medium distinct yellowish brown (10YR 5/4 and 5/6) mottles; weak medium subangular blocky structure; friable; many faint light brownish gray (10YR 6/2) silt coatings on faces of peds; about 5 percent pebbles; very strongly acid; clear irregular boundary.

Bt1—13 to 19 inches; yellowish brown (10YR 5/4) silt loam; many coarse distinct strong brown (7.5YR 5/6) and gray (10YR 5/1) mottles; moderate very coarse subangular blocky structure parting to weak fine subangular blocky; firm; common distinct grayish brown (10YR 5/2) silt coatings and few faint grayish brown (10YR 5/2) clay films on faces of peds; about 5 percent pebbles; very strongly acid; clear smooth boundary.

Bt2—19 to 25 inches; yellowish brown (10YR 5/6) loam; common coarse distinct gray (10YR 5/1) mottles; moderate coarse prismatic structure parting to weak very fine subangular blocky; firm; many distinct light brownish gray (10YR 6/2) silt coatings and common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; about 5 percent gravel; very strongly acid; gradual smooth boundary.

Bt3—25 to 33 inches; yellowish brown (10YR 5/6) loam; many coarse distinct gray (10YR 5/1) mottles; moderate coarse prismatic structure parting to moderate thin platy; very firm; distinct grayish brown (10YR 5/2) silt coatings, few on faces of prisms and common on faces of plates; thick dark gray (10YR 4/1) clay films on faces of prisms; thin patchy grayish brown (10YR 5/2) clay films on faces of plates; about 6 percent gravel; very strongly acid; gradual irregular boundary.

Btx1—33 to 44 inches; yellowish brown (10YR 5/6) loam; many coarse distinct gray (10YR 5/1) mottles; moderate very coarse prismatic structure parting to moderate medium platy; very firm; brittle; common distinct light brownish gray (10YR 6/2) silt coatings and common distinct dark gray (10YR 4/1) clay films on faces of peds; about 8 percent gravel; very strongly acid; clear wavy boundary.

Btx2—44 to 52 inches; yellowish brown (10YR 5/6) loam; common medium distinct gray (10YR 5/1) mottles; weak very coarse prismatic structure; very firm; brittle; common distinct gray (10YR 5/1) and few distinct dark gray (10YR 4/1) clay films on faces of peds; about 8 percent gravel; strongly acid; gradual wavy boundary.

BC—52 to 66 inches; yellowish brown (10YR 5/6) loam; few coarse distinct gray (10YR 5/1) and few fine distinct yellowish red (5YR 5/6) mottles; weak very coarse subangular blocky structure; firm; common distinct gray (10YR 5/1) coatings on faces of peds; about 5 percent coarse fragments; medium acid; clear wavy boundary.

Cg—66 to 73 inches; grayish brown (10YR 5/2) channery loam; many medium distinct yellowish brown (10YR 5/6) and common fine faint brown (10YR 5/3) mottles; massive; firm; about 15 percent small, flat rock fragments; medium acid;

The thickness of the solum ranges from 60 to 84 inches. The depth to bedrock is more than 60 inches.

The depth to the top of the fragipan ranges from 24 to 35 inches. In unlimed areas reaction is strongly acid or very strongly acid above the fragipan. The part of the profile below the fragipan is medium acid or strongly acid to a depth of 60 inches. The content of coarse fragments is 2 to 10 percent above the fragipan, 5 to 20 percent in the fragipan, and 5 to 25 percent below the fragipan. These are granitic pebbles and sandstone fragments.

Some pedons have A and E horizons. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is loam, silt loam, silty clay loam, or clay loam. The content of clay in this horizon is 24 to 32 percent. The Btx horizon is 14 to 30 inches thick. It has a color range similar to that of the Bt horizon. The Btx and BC horizons are loam, clay loam, or the gravelly or channery analogs of these textures. The C horizon has hue of 10YR or 2.5Y, value 4 or 5, and chroma 2 to 4. It is loam, silt loam, clay loam, or the gravelly or channery analogs of these textures.

Holly Series

The Holly series consists of deep, poorly drained and very poorly drained soils on flood plains. These soils formed in alluvium. Permeability is moderate or moderately slow in the upper part of the profile and moderate or moderately rapid in the lower part. Slope is 0 to 2 percent.

Holly soils are similar to Sloan soils and commonly are adjacent to Lobdell, Orrville, and Shoals soils. The adjacent soils are better drained than the Holly soils and are on the higher parts of the flood plains. Sloan soils have a mollic epipedon.

Typical pedon of Holly silt loam, frequently flooded, about 2 miles south of Bladensburg; in an area of Jackson Township about 40 feet north along Henpeck Road from the intersection of Henpeck and Divan Roads, then 830 feet east, T. 5 N., R. 10 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; yellowish brown (10YR 5/4) root channel fillings and undecomposed fibers; few pebbles; slightly acid; abrupt smooth boundary.

BAg—6 to 13 inches; grayish brown (10YR 5/2) silt loam; common fine and medium distinct strong brown (7.5YR 5/6) mottles; weak thick platy structure parting to weak fine subangular blocky; friable; few pebbles; slightly acid; clear smooth boundary.

Bg1—13 to 22 inches; grayish brown (10YR 5/2) silt loam; common medium distinct dark yellowish brown (10YR 4/4) and few medium prominent strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; firm; slightly acid; gradual smooth boundary.

Bg2—22 to 35 inches; gray (10YR 5/1) silt loam; many coarse distinct yellowish brown (10YR 5/6) and few medium distinct brown (7.5YR 5/4) mottles; weak medium subangular blocky structure; firm; common dark grayish brown (10YR 4/2) stains; about 5 percent gravel; neutral; clear smooth boundary.

Cg1—35 to 45 inches; gray (5Y 5/1) silt loam; common coarse prominent yellowish brown (10YR 5/6) mottles; massive; firm; neutral; clear smooth boundary.

Cg2—45 to 60 inches; dark gray (N 4/0) and gray (5Y 5/1) stratified silt loam, loam, and fine sandy loam; few coarse prominent yellowish brown (10YR 5/4) mottles; massive; very friable; few layers of thin, flat stones; about 10 percent gravel; neutral.

The solum ranges from 24 to 40 inches in thickness. It is slightly acid or neutral. The C horizon is neutral or mildly alkaline. In some pedons it has carbonates below a depth of 40 inches. The content of coarse fragments is 0 to 15 percent in the solum and 0 to 25 percent in the C horizon.

The Ap horizon has hue of 10YR, value of 4, and chroma of 1 or 2. Some pedons have an A horizon, and some have a thin Ab horizon. The Bg horizon has hue of 10YR to 5Y or is neutral in hue. It has value of 4 or 5 and chroma of 2 or less. It is dominantly loam or silt loam, but in some pedons it has thin layers of sandy loam or silty clay loam. The content of clay between depths of 10 and 40 inches is 18 to 25 percent. The part of the C horizon within a depth of 40 inches is dominantly silt loam, loam, fine sandy loam, sandy loam, or the gravelly analogs of these textures. Thin strata of sand, loamy sand, or the gravelly analogs of these textures are below a depth of 40 inches in many pedons.

Homewood Series

The Homewood series consists of deep, well drained and moderately well drained soils that have a thick, strongly expressed fragipan. These soils formed in medium textured and moderately fine textured Illinoian glacial till on till plains and moraines. They generally are on the tops and sides of hills and on the sides of stream valleys. In a few areas they are in valley plugs. Permeability is moderate above the fragipan and slow in and below the fragipan. Slope ranges from 2 to 25 percent.

Homewood soils are similar to Titusville and Wooster soils and commonly are adjacent to Chili, Loudonville, and Titusville soils. Chili soils have more sand and gravel in the substratum than the Homewood soils and do not have a fragipan. They are in valley plugs and on recessional moraines. Loudonville soils are moderately deep over bedrock. They are on hillsides. Titusville soils are moderately well drained and are on the more concave hilltops. Wooster soils have a fragipan that is thinner and more weakly expressed than that of the Homewood soils. Also, they formed in younger glacial till.

Typical pedon of Homewood silt loam, 2 to 6 percent slopes, about 3.5 miles north of Martinsburg; in an area of Harrison Township about 1,060 feet west along Beckholt Road from the intersection of Beckholt and Grove Church Roads, then about 660 feet north, T. 6 N., R. 11 W.

Ap—0 to 10 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; about 5 percent gravel; slightly acid; abrupt smooth boundary.

BE—10 to 13 inches; yellowish brown (10YR 5/6) silt loam; weak fine subangular blocky structure; friable; dark brown (10YR 4/3) root channel fillings; few faint light yellowish brown (10YR 6/4) silt coatings on faces of peds; few pebbles; medium acid; clear wavy boundary.

Bt1—13 to 23 inches; yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; firm; common faint yellowish brown (10YR 5/4) clay films on faces of peds; few dark concretions; about 5 percent gravel; strongly acid; gradual wavy boundary.

Bt2—23 to 29 inches; yellowish brown (10YR 5/6) clay loam; common fine faint brownish yellow (10YR 6/8) and few medium faint brown (10YR 5/3) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; very firm; very slightly brittle; common distinct and few prominent dark yellowish brown (10YR 4/4) clay films on faces of peds; many coarse distinct rounded concretions (iron and manganese oxides); about 5 percent gravel; very strongly acid; clear wavy boundary.

Btx1—29 to 40 inches; yellowish brown (10YR 5/6) clay loam; common fine and medium distinct grayish brown (10YR 5/2) and few fine prominent yellowish red (5YR 5/8) mottles; moderate very coarse prismatic structure parting to moderate thick platy; very firm; brittle; many distinct brown (10YR 5/3) silt coatings on faces of prisms, with distinct zones of gray (10YR 5/1) and grayish brown (10YR 5/2); common faint and few distinct yellowish brown (10YR 5/4) clay films on faces of peds; common coarse prominent black (10YR 2/1) concretions (iron and manganese oxides), mainly on horizontal faces of peds; about 5 percent gravel; very strongly acid; diffuse wavy boundary.

Btx2—40 to 67 inches; yellowish brown (10YR 5/4) clay loam; common coarse distinct grayish brown (10YR 5/2) and gray (10YR 5/1) mottles; moderate very coarse prismatic structure parting to moderate thick platy; very firm; brittle; many prominent light brownish gray (10YR 6/2) silt coatings on faces of prisms, with zones of brown (10YR 5/3); many distinct clay films on vertical faces of peds and common faint clay films on horizontal faces; many fine and medium dark concretions and few yellowish red (5YR 5/8) stains (iron and manganese oxides), mainly on horizontal faces of peds; about 5 percent coarse fragments; very strongly acid; clear wavy boundary.

C—67 to 80 inches; yellowish brown (10YR 5/4) silt loam; massive; firm; common fine dark concretions (iron and manganese oxides); about 5 percent coarse fragments, mainly sandstone, shale, and some crystalline rocks; very strongly acid.

The solum ranges from 50 to 90 inches in thickness. In many pedons it is terminated by shattered or broken rock below a depth of 60 inches. The depth to the Btx horizon ranges from 20 to 36 inches. In unlimed areas the solum is strongly acid or very strongly acid. The content of coarse fragments is 0 to 10 percent in the Ap and Bt horizons and 2 to 25 percent in the Btx and C horizons. Most of the coarse fragments are small angular pebbles, but some are larger channers, especially below the fragipan.

Unless it is significantly eroded, the Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. Some pedons have A and E horizons. The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2.

The Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. It is loam, silt loam, clay loam, or silty clay loam. The content of clay in this horizon is 24 to 32 percent. The Btx horizon ranges from 24 to 40 inches in thickness. It has hue of 10YR or 7.5YR and value and chroma of 4 or 5. It is loam, clay loam, or the gravelly analogs of these textures. The content of clay in this horizon is 24 to 30 percent.

Some pedons have a BC horizon, which has colors and textures similar to those of the Btx horizon but lacks the firmness and brittleness of that horizon. The C horizon is loam, silt loam, clay loam, or the gravelly analogs of these textures.

Jimtown Series

The Jimtown series consists of deep, somewhat poorly drained, moderately permeable soils on stream terraces, fans, and outwash plains. These soils formed in glacial outwash that commonly contains some gravel. Slope ranges from 0 to 6 percent

Jimtown soils are similar to Fitchville soils and commonly are adjacent to Bogart and Ockley soils. The adjacent soils are better drained than the Jimtown soils and are on the higher, more convex parts of the landscape. Fitchville soils contain less sand and gravel and more silt in the solum than the Jimtown soils.

Typical pedon of Jimtown silt loam, 0 to 2 percent slopes, about 3 miles south of Jelloway; in an area of Brown Township about 1,750 feet west along Orange Hill Road from the intersection of Orange Hill Road and

State Route 205, then about 1,300 feet north, T. 8 N., R. 11 W.

Ap—0 to 12 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; about 5 percent gravel; neutral; abrupt smooth boundary.

BE—12 to 15 inches; yellowish brown (10YR 5/4) loam; many coarse distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; common distinct light brownish gray (10YR 6/2) degradational coatings on faces of peds; few pebbles; strongly acid; clear wavy boundary.

Bt1—15 to 22 inches; yellowish brown (10YR 5/4) loam; common coarse prominent strong brown (7.5YR 5/8) and many coarse distinct gray (10YR 5/1) mottles; moderate medium subangular blocky structure; friable; common faint grayish brown (10YR 5/2) clay films and common distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; about 5 percent gravel; medium acid; diffuse wavy boundary.

Bt2—22 to 32 inches; yellowish brown (10YR 5/4) very gravelly loam; few medium distinct grayish brown (2.5Y 5/2) mottles; weak fine subangular blocky structure; friable; many distinct grayish brown (10YR 5/2) coatings and few faint grayish brown (10YR 5/2) clay films on faces of peds; few faint brown (10YR 5/3) clay bridges between coarse fragments; many prominent strong brown (7.5YR 5/8) stains on pebbles; few thin strata of sandy loam; about 40 percent gravel; pebble line along the lower boundary; medium acid; clear wavy boundary.

Bt3—32 to 39 inches; yellowish brown (10YR 5/4) very gravelly loam; few medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; very friable; many faint grayish brown (10YR 5/2) coatings on faces of peds; many brown (10YR 5/3) clay films on pebbles and clay bridges between pebbles; common prominent strong brown (7.5YR 5/8) stains on pebbles; about 40 percent gravel; strongly acid; clear wavy boundary.

Bt4—39 to 46 inches; dark yellowish brown (10YR 4/4) very gravelly loam; massive; friable; many faint dark yellowish brown (10YR 4/4) clay films on coarse fragments and clay bridges between coarse fragments; thin strata of very gravelly clay loam; few prominent strong brown (7.5YR 5/6) stains on pebbles; about 45 percent gravel; slightly acid; clear wavy boundary.

C—46 to 60 inches; yellowish brown (10YR 5/6) very gravelly loam; massive; friable; many prominent strong brown (7.5YR 5/8) stains on pebbles; about 35 percent gravel; slightly acid.

The thickness of the solum ranges from 30 to 48 inches. The depth to carbonates is more than 48 inches. In unlimed areas the upper part of the solum is very strongly acid to slightly acid. The lower part of the solum is strongly acid to neutral, and the C horizon is strongly acid to mildly alkaline. The content of gravel is commonly 0 to 30 percent in the part of the Bt horizon within a depth of 22 inches, 15 to 50 percent between depths of 22 and 40 inches, and 15 to 60 percent below a depth of 40 inches.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. Some pedons have A and E horizons. The BE horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. Some pedons have a B/E horizon rather than a BE horizon. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. The brown and strong brown stains in the typical pedon are local and are not in all areas. They are caused by iron-rich spring water. The Bt horizon is loam, silt loam, clay loam, sandy loam, silty clay loam, or the gravelly or very gravelly analogs of these textures. The lower part is stratified in many pedons. The C horizon commonly is gravelly or very gravelly loam or sandy loam, but it has thin strata of other textures in many pedons.

Landes Series

The Landes series consists of deep, well drained soils that formed dominantly in moderately coarse textured and coarse textured alluvium. These soils are on the higher parts of flood plains. Permeability is rapid. Slope is 0 to 2 percent.

These soils have more gravel in the substratum than is definitive for the Landes series. This difference, however does not affect the usefulness or behavior of the soils.

Landes soils are commonly adjacent to Medway and Tioga soils. Medway soils are moderately well drained and have more clay in the subsoil than the Landes soils. They are commonly on the lower parts of the flood plains. Tioga soils do not have a mollic epipedon. They are closer to the stream channel than the Landes soils.

Typical pedon of Landes fine sandy loam, occasionally flooded, about 2.5 miles southeast of Millwood; in an area of Butler Township about 260 feet west along Zuck Road from the intersection of Zuck and Staats Roads, then about 400 feet north, T. 6 N., R. 10 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) fine sandy loam, brown (10YR 4/3) dry; weak fine granular structure; very friable; about 10 percent pebbles; neutral; abrupt smooth boundary.

A—10 to 22 inches; very dark grayish brown (10YR 3/2) fine sandy loam, brown (10YR 4/3) dry; weak fine subangular blocky structure; very friable; few pebbles; neutral; diffuse irregular boundary.

Bw1—22 to 29 inches; brown (10YR 4/3) fine sandy loam; weak medium subangular blocky structure; very friable; many faint very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) organic coatings on faces of peds; few pebbles; neutral; clear irregular boundary.

Bw2—29 to 39 inches; dark yellowish brown (10YR 4/4) sandy loam; weak coarse subangular blocky structure; very friable; thin strata of loamy sand and loam; about 5 percent pebbles; neutral; clear wavy boundary.

C1—39 to 46 inches; dark yellowish brown (10YR 4/4) stratified sandy loam and loamy sand; single grained; very friable; about 5 percent pebbles; neutral; abrupt smooth boundary.

C2—46 to 60 inches; yellowish brown (10YR 5/4) stratified gravelly sand and gravelly loamy sand; single grained; loose; about 25 percent fine gravel; neutral.

The thickness of the solum ranges from 25 to 40 inches. The depth to carbonates is typically more than 60 inches. Reaction ranges from slightly acid to mildly alkaline throughout the profile. The content of coarse fragments is 0 to 10 percent in the solum and 5 to 35 percent in the C horizon.

The thickness of the Ap horizon combined with that of the A horizon is 10 to 24 inches. These horizons have hue of 10YR, value of 2 or 3, and chroma of 1 or 2. They are typically fine sandy loam but are loam, silt loam, or very fine sandy loam in some pedons. The B and C horizons have hue of 10YR, value of 4 to 6, and chroma of 3 or 4. The B horizon is commonly loamy fine sand, sandy loam, fine sandy loam, or very fine sandy loam. The part of the C horizon below a depth of 40 inches is sandy loam to fine sand or is the gravelly analogs of these textures.

Linwood Series

The Linwood series consists of deep, very poorly drained soils in closed depressions on till plains, on outwash terraces, in former lakebeds, and, in some areas, on flood plains. These soils formed in 20 to 50 inches of the well decomposed remains of a mixture of woody and herbaceous plants. They are underlain by loamy material. Permeability is moderately slow to moderately rapid in the organic layers and moderate in the loamy material. Slope is 0 to 2 percent.

Linwood soils are commonly adjacent to Luray and Sloan soils. The adjacent soils formed in mineral material and have a mollic epipedon. They are slightly higher on the landscape than the Linwood soils.

Typical pedon of Linwood muck, 1 mile west-northwest of Mt. Vernon; in an area of Clinton Township about 1,880 feet north along Lower Green Valley Road from the intersection of Lower Green Valley Road and State Route 229, then about 990 feet east, T. 6 N., R. 13 W.

Op—0 to 9 inches; black (10YR 2/1), broken face and rubbed, sapric material; about 10 percent fiber, 2 percent rubbed; moderate medium granular structure; very friable; about 15 percent mineral material; neutral; abrupt smooth boundary.

Oa1—9 to 24 inches; very dark brown (10YR 2/2), broken face and rubbed, sapric material; about 10 percent fiber, 2 percent rubbed; moderate fine subangular blocky structure; firm; about 5 percent mineral material; neutral; gradual wavy boundary.

Oa2—24 to 29 inches; black (10YR 2/1), broken face, sapric material, very dark brown (10YR 2/2) rubbed, very dark grayish brown (10YR 3/2) dry; about 20 percent coarse yellowish brown (10YR 5/6) fibers, 5 percent rubbed; moderate medium subangular blocky structure; friable; about 10 percent mineral material; few woody coarse fragments; neutral; clear wavy boundary.

Oa3—29 to 44 inches; very dark grayish brown (10YR 3/2), broken face and rubbed, sapric material; about 10 percent fiber, 2 percent rubbed; weak coarse subangular blocky structure; friable; about 20 percent mineral material; common woody fragments; neutral; clear irregular boundary.

2Cg—44 to 60 inches; gray (5Y 5/1) stratified silt loam, sandy loam, and very fine sandy loam; common medium prominent dark yellowish brown (10YR 4/4) mottles; massive; very friable; common medium distinct light gray (10YR 7/2) lime nodules; thin strata of loamy fine sand and gravelly sandy loam; about 5 percent gravel; slight effervescence; mildly alkaline.

The thickness of the organic material ranges from 20 to 50 inches. Reaction is neutral or mildly alkaline throughout the profile. The depth to carbonates ranges from 40 to 60 inches.

The surface and subsurface tiers have hue of 10YR or 2.5Y or are neutral in hue. They have value of 2 or 3 and chroma of 2 or less. The content of fibers is less than 10 percent after rubbing. Woody coarse fragments are in some subhorizons. The 2Cg horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 or 2. It is dominantly silt loam, loam, sandy loam, or very fine sandy loam. In some pedons, however, it has thin strata of gravelly loamy sand, loamy fine sand, or silty clay loam.

Lobdell Series

The Lobdell series consists of deep, moderately well drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slope is 0 to 2 percent.

Lobdell soils are similar to Tioga soils and commonly are adjacent to Orrville, Shoals, and Tioga soils. Orrville and Shoals soils are somewhat poorly drained. They are on the lower parts of the flood plains and commonly are farther from streams than the Lobdell soils. Tioga soils are well drained and have less clay in the solum than the

Lobdell soils. They are on natural levees and are closer to the stream channels than the Lobdell soils.

Typical pedon of Lobdell silt loam, occasionally flooded, about 1.5 miles north of Greer; in an area of Jefferson Township about 260 feet south along Vess Road from the intersection of Vess and Walley Roads, then about 160 feet east, T. 9 N., R. 10 W.

A—0 to 3 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common faint dark grayish brown (10YR 4/2) coatings on faces of peds; few black (10YR 2/1) fillings in root channels; medium acid; clear irregular boundary.

Bw1—3 to 16 inches; yellowish brown (10YR 5/4) silt loam; weak medium and coarse subangular blocky structure; friable; common faint dark yellowish brown (10YR 4/4) coatings on faces of peds; few coarse fragments; medium acid; clear irregular boundary.

Bw2—16 to 26 inches; yellowish brown (10YR 5/4) silt loam; common coarse distinct dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; friable; few coarse fragments; medium acid; gradual smooth boundary.

BC—26 to 42 inches; yellowish brown (10YR 5/4) stratified loam and silt loam; common coarse distinct dark grayish brown (10YR 4/2) and few fine distinct strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; very friable; few thin layers of fine sandy loam; few coarse fragments; medium acid; gradual wavy boundary.

C—42 to 60 inches; yellowish brown (10YR 5/4) stratified silt loam, loam, and very fine sandy loam; many coarse distinct gray (10YR 5/1) and common medium distinct strong brown (7.5YR 5/6) mottles; massive; friable; slightly acid.

The thickness of the solum ranges from 24 to 50 inches. Reaction ranges from slightly acid to strongly acid in the upper part of the solum and from medium acid to neutral in the lower part and in the C horizon. The content of coarse fragments, mainly of gravel size, is 0 to 15 percent in the B and C horizons, except for thin layers below a depth of 40 inches. Fragments the size of channers and cobbles are below a depth of 40 inches in many pedons.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. Some pedons have an Ap horizon. The A and Ap horizons commonly are silt loam but are loam in some pedons. The Bw and BC horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. A thin Ab horizon that has darker colors is between the subhorizons of the Bw horizon in some pedons. The Bw horizon commonly is silt loam or loam, but it has thin subhorizons of sandy loam in many pedons. The content of clay in the Bw horizon is 18 to 25 percent.

The C horizon commonly is stratified. The strata differ in color, texture, and gravel content. The thicker strata have hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The most common textures are loam or silt loam. In some pedons strata of very fine sandy loam, sandy loam, gravelly loam, or channery loam are in the lower part of this horizon.

Loudonville Series

The Loudonville series consists of moderately deep, well drained, moderately permeable soils on the tops and sides of hills. These soils formed in 20 to 40 inches of Wisconsin and Illinoian glacial till and in the underlying sandstone and siltstone residuum. Slope ranges from 2 to 25 percent.

These soils are slightly lower in base saturation than is definitive for the Loudonville series. This difference, however, does not affect the usefulness or behavior of the soils.

Loudonville soils are similar to Gilpin and Westmoreland soils and commonly are adjacent to the deep Amanda, Homewood, and Wooster soils. The adjacent soils typically are on the less sloping, less convex parts of the landscape. Homewood and Wooster soils have a fragipan. Gilpin and Westmoreland soils have flat, angular fragments throughout. Also, Westmoreland soils are deep over bedrock.

Typical pedon of Loudonville silt loam, 2 to 6 percent slopes, about 4 miles east of Gambier; in an area of Harrison Township about 1,100 feet north along Pipesville Road from the intersection of Pipesville and Zion Roads, then about 750 feet west, T. 6 N., R. 11 W.

Ap—0 to 10 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; about 5 percent gravel; medium acid; abrupt smooth boundary.

BA—10 to 13 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; about 10 percent gravel; medium acid; clear irregular boundary.

Bt1—13 to 21 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure parting to weak fine subangular blocky; firm; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; about 10 percent gravel and sandstone fragments; very strongly acid; clear wavy boundary.

Bt2—21 to 26 inches; strong brown (7.5YR 5/6) silt loam; weak coarse subangular blocky structure parting to moderate very fine subangular blocky; firm; very slightly brittle; common distinct yellowish brown (10YR 5/4) clay films and common dark concretions and stains (iron and manganese oxides) on faces of peds; about 10 percent gravel and sandstone fragments; very strongly acid; diffuse wavy boundary.

Bt3—26 to 32 inches; strong brown (7.5YR 5/6) channery silt loam; moderate coarse subangular blocky structure parting to weak very thin platy; firm; few distinct yellowish brown (10YR 5/4) clay films and few concretions (iron and manganese oxides) on faces of peds; about 20 percent sandstone fragments and fine gravel; very strongly acid; clear wavy boundary.

2BC—32 to 37 inches; yellowish brown (10YR 5/6) very channery silt loam; weak coarse subangular blocky structure; firm; few prominent concretions (iron and manganese oxides); about 35 percent olive yellow (2.5Y 6/6) fine grained sandstone fragments with reddish stains; very strongly acid; clear wavy boundary.

2R—37 to 39 inches; olive yellow (2.5Y 6/6) fine grained sandstone; thinly bedded.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. In unlimed areas the solum is medium acid to very strongly acid. The content of coarse fragments, mostly angular sandstone, is 2 to 15 percent in the Ap horizon, 5 to 25 percent in the Bt horizon derived from glacial till, and 10 to 60 percent in the 2BC horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is dominantly silt loam but is loam in some pedons. Some pedons have A and E horizons. The BA and Bt horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The BA horizon is silt loam or loam. The Bt horizon is silt loam, loam, silty clay loam, clay loam, or the channery analogs of these textures. It has a clay content of 18 to 30 percent. The BC horizon and the C horizon, if it occurs, are silt loam, loam, sandy loam, or the channery or very channery analogs of these textures.

Luray Series

The Luray series consists of deep, very poorly drained soils that formed in glacial meltwater deposits having a high content of silt. These soils generally are in the beds of former shallow glacial lakes. Permeability is moderately slow. Slope is 0 to 2 percent.

Luray soils are similar to Pewamo soils and commonly are adjacent to Fitchville, Linwood, Sebring, and Sloan soils. Fitchville and Sebring soils have an ochric epipedon. They commonly are slightly higher on the landscape than the Luray soils. Linwood soils have a histic epipedon. They are in closed depressions. Pewamo soils formed in glacial till and are not stratified. Sloan soils are on flood plains and are occasionally flooded. They do not have an argillic horizon.

Typical pedon of Luray silty clay loam, about 3 miles south of Mt. Vernon; in an area of Clinton Township about 3,600 feet north along Blackjack Road from the intersection of Blackjack and Jennings Roads, then about 60 feet east, T. 6 N., R. 13 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; firm; very dark brown (10YR 2/2) organic coatings; neutral; abrupt smooth boundary.

AB—9 to 14 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark gray (10YR 4/1) dry; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium granular and subangular blocky structure; firm; many distinct dark gray (10YR 4/1) organic coatings on faces of peds; neutral; clear irregular boundary.

Btg1—14 to 24 inches; dark grayish brown (10YR 4/2) silty clay loam; many medium distinct yellowish brown (10YR 5/4), common fine faint gray (10YR 5/1), and few medium distinct strong brown (7.5YR 5/6) mottles; moderate medium angular blocky structure; firm; dark grayish brown (10YR 4/2) faces of peds; few faint grayish brown (10YR 5/2) clay films on faces of peds; few cracks filled with material from the A horizon; neutral; clear irregular boundary.

Btg2—24 to 38 inches; grayish brown (10YR 5/2) silty clay loam; many coarse distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; grayish brown (10YR 5/2) faces of peds; few faint grayish brown (10YR 5/2) clay films on faces of peds; few cracks filled with material from the A horizon; neutral; gradual smooth boundary.

BC—38 to 46 inches; yellowish brown (10YR 5/6) silty clay loam; many coarse distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; weakly laminar; firm; grayish brown (10YR 5/2) faces of peds; few thin strata of silt loam; neutral; gradual wavy boundary.

C—46 to 60 inches; yellowish brown (10YR 5/6) silt loam; many coarse faint yellowish brown (10YR 5/4) and many coarse distinct grayish brown (10YR 5/2) mottles; massive; friable; laminated; thin strata of silty clay loam and very fine sandy loam; neutral.

The solum ranges from 30 to 48 inches in thickness. It is medium acid to neutral. The C horizon is neutral to moderately alkaline. The upper 40 inches has virtually no coarse fragments. Some pedons have iron and manganese concretions that are hard enough to resemble pebbles.

The thickness of the A horizon combined with that of the AB horizon is 10 to 18 inches. Whether the soil material is crushed or uncrushed, these horizons have hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The A horizon commonly is silty clay loam but is silt loam in some pedons.

The upper part of the Btg horizon, to a depth of at least 30 inches, has hue of 10YR to 5Y or is neutral in hue. It has value of 4 or 5 and chroma of 2 or less. The part of the Btg horizon below a depth of 30 inches and the BC horizon have hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 6. The B horizon is dominantly silty clay loam or silt loam in which the clay content is 25 to 35 percent. It has thin strata of other textures in some pedons.

The C horizon commonly is stratified and varies in color. It is dominantly silt loam, very fine sandy loam, or silty clay loam, but it has thin strata of loam, fine sandy loam, or sandy loam in some pedons.

Medway Series

The Medway series consists of deep, moderately well drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slope is 0 to 2 percent.

Medway soils commonly are adjacent to Landes, Lobdell, and Tioga soils. The adjacent soils commonly are closer to the stream channels than the Medway soils. Landes and Tioga soils are well drained. They have more sand in the subsoil than the Medway soils. Lobdell and Tioga soils do not have a mollic epipedon.

Typical pedon of Medway silt loam, occasionally flooded, about 3 miles northwest of Mt. Vernon; in an area of Morris Township about 2,450 feet west along Green Valley Road from the intersection of Green Valley Road and State Route 13, then about 1,050 feet south, T. 7 N., R. 13 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak medium granular structure; friable; many faint very dark brown (10YR 2/2) organic coatings on faces of peds; few pebbles; neutral; abrupt smooth boundary.

A—10 to 18 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 4/3) dry; weak medium subangular blocky structure; friable; many distinct black (10YR 2/1) organic coatings on faces of peds; slightly acid; clear irregular boundary.

Bw1—18 to 28 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; friable; common distinct very dark grayish brown (10YR 3/2) root channel fillings and coatings on faces of peds; neutral; gradual wavy boundary.

Bw2—28 to 34 inches; yellowish brown (10YR 5/4) loam; many fine distinct grayish brown (10YR 5/2) and brownish yellow (10YR 6/6) mottles; weak medium subangular blocky structure; friable; few distinct very dark grayish brown (10YR 3/2) root channel fillings; neutral; diffuse wavy boundary.

C1—34 to 43 inches; yellowish brown (10YR 5/6) stratified loam and sandy loam; many medium faint yellowish brown (10YR 5/4) and common medium distinct grayish brown (10YR 5/2) mottles; massive; friable; few dark root channel fillings; neutral; abrupt smooth boundary.

C2—43 to 50 inches; grayish brown (2.5Y 5/2) stratified sandy loam, loam, and silt loam; few medium distinct dark yellowish brown (10YR 4/4) mottles; massive; very friable; few thin gravelly lenses; about 5 percent pebbles; slight effervescence; mildly alkaline; clear smooth boundary.

C3—50 to 60 inches; brown (10YR 4/3) gravelly loamy sand; single grained; loose; about 20 percent gravel; strong effervescence; moderately alkaline.

The solum ranges from 28 to 40 inches in thickness. It is slightly acid or neutral. The C horizon is neutral to moderately alkaline. The depth to carbonates ranges from 36 to 50 inches. The content of coarse fragments is 0 to 15 percent in the solum and 0 to 25 percent in the C horizon. It is 25 to 50 percent in some strata in the C horizon.

The thickness of the Ap horizon combined with that of the A horizon is 10 to 24 inches. These horizons have hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The Bw horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is dominantly loam or silt loam, but it has thin strata of sandy loam or fine sandy loam in some pedons. It has a clay content of 18 to 24 percent. The C horizon ranges from gravelly sandy loam to silt loam within a depth of 40 inches and from very gravelly loamy sand to silt loam below that depth.

Ockley Series

The Ockley series consists of deep, well drained soils on terraces. These soils formed in silty deposits and loamy outwash. They are underlain by calcareous, sandy and gravelly glacial outwash at a depth of 40 to 60 inches. Permeability is moderate in the solum and very rapid in the substratum. Slope ranges from 0 to 6 percent.

Ockley soils are similar to Bogart soils and commonly are adjacent to Bogart, Fox, Jimtown, and Tioga soils. Bogart and Jimtown soils are wetter than the Ockley soils and are in lower, more concave areas on terraces. Fox soils are on high kames and terrace breaks. They have a solum that is thinner than that of the Ockley soils and have a more gravelly subsoil. Tioga soils are subject to flooding and are on flood plains.

Typical pedon of Ockley silt loam, 0 to 2 percent slopes, about 3 miles northwest of Mt. Vernon; in an area of Morris Township about 1,600 feet east along Beckley Road from the intersection of Beckley Road and State Route 13, then 300 feet south, T. 7 N., R. 13 W.

Ap—0 to 11 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; few pebbles; slightly acid; abrupt smooth boundary.

Bt1—11 to 15 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure;

friable; many distinct dark brown (10YR 4/3) clay films on faces of peds; common distinct dark brown (10YR 4/3) root channel fillings; few pebbles; slightly acid; clear irregular boundary.

Bt2—15 to 23 inches; brown (7.5YR 5/4) silty clay loam; moderate fine subangular blocky structure; firm; common distinct yellowish brown (10YR 5/4) clay films on faces of peds; few distinct dark brown (10YR 4/3) organic coatings; about 2 percent gravel; medium acid; diffuse wavy boundary.

Bt3—23 to 27 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; common faint brown (7.5YR 5/4) clay films on faces of peds; about 5 percent gravel; medium acid; clear wavy boundary marked by a line of flat sandstone fragments.

2Bt4—27 to 34 inches; brown (7.5YR 5/4) gravelly loam; weak medium and coarse subangular blocky structure; firm; common faint brown (7.5YR 4/4) clay films on faces of peds and on sand grains and pebbles; common faint brown (7.5YR 4/4) clay bridges between sand grains and pebbles; about 25 percent gravel; few cobbles; medium acid; clear irregular boundary.

2Bt5—34 to 46 inches; brown (7.5YR 5/4) gravelly coarse sandy loam; weak coarse subangular blocky structure; firm; common faint brown (7.5YR 5/4) clay films on sand grains and pebbles; clay bridges between sand grains and pebbles; pockets and lenses of gravelly clay loam and gravelly sandy loam; about 30 percent gravel; slightly acid; clear wavy boundary.

2Bt6—46 to 49 inches; dark brown (7.5YR 4/4) gravelly sandy clay loam; massive; firm; many faint dark brown (7.5YR 4/4) clay films on sand grains and pebbles; clay bridges between sand grains and pebbles; about 30 percent gravel; slight effervescence; mildly alkaline; abrupt irregular boundary.

3C1—49 to 64 inches; yellowish brown (10YR 5/4) very gravelly loamy coarse sand; single grained; loose; few distinct very pale brown (10YR 7/3) soft accumulations of lime; few tongues of sandy clay loam from the 2Bt horizon; about 60 percent gravel; strong effervescence; moderately alkaline; gradual wavy boundary.

3C2—64 to 80 inches; yellowish brown (10YR 5/4) very gravelly loamy coarse sand; single grained; loose; about 50 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 40 to 60 inches. In unlimed areas the upper part of the solum is medium acid or strongly acid. The lower part is slightly acid to mildly alkaline. The content of gravel is 0 to 15 percent within a depth of 27 inches and 18 to 30 percent in the part of the solum below that depth. It is 30 to 60 percent in the C horizon.

Some pedons have A and E horizons. The B horizon has hue of 10YR or 7.5YR, value of dominantly 4 or 5, and chroma of 3 to 6. In some pedons the Bt horizon has value of 3 in the lower few inches. It is loam, clay loam, silt loam, silty clay loam, or the gravelly analogs of these textures. The silt loam and silty clay loam are confined to the part of the horizon within a depth of 30 inches. The content of clay in the Bt horizon is 20 to 30 percent. Individual subhorizons have a clay content of 15 to 35 percent. The subhorizons commonly differ in the amount, size, and distribution of pebbles. The C horizon is stratified gravelly or very gravelly sand or gravelly or very gravelly loamy coarse sand.

Orrville Series

The Orrville series consists of deep, somewhat poorly drained, moderately permeable soils that formed in alluvium on flood plains. Slope is 0 to 2 percent.

Orrville soils are similar to Shoals soils and commonly are adjacent to Holly and Lobdell soils. Holly soils are poorly drained and very poorly drained and are in low lying areas on the flood plains. Lobdell soils are moderately well drained and are higher on the landscape than the Orrville soils. Shoals soils are less acid in the solum than the Orrville soils.

Typical pedon of Orrville silt loam, occasionally flooded, about 4 miles northeast of Millwood; in an area of Union Township about 930 feet west along Flat Run Road from the intersection of Flat Run and Stone Quarry Roads, then about 90 feet south, T. 7 N., R. 10 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; few pebbles; slightly acid; abrupt smooth boundary.

BA—8 to 15 inches; dark grayish brown (10YR 4/2) silt loam; few medium distinct dark yellowish brown (10YR 4/4) mottles; weak coarse subangular blocky structure; friable; gray (10YR 5/1) cleavage faces; few pebbles; strongly acid; clear wavy boundary.

Bw—15 to 24 inches; brown (10YR 5/3) silt loam; few medium distinct strong brown (7.5YR 5/6) and many medium faint grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; few pebbles; strongly acid; clear irregular boundary.

BCg—24 to 36 inches; grayish brown (10YR 5/2) stratified silt loam and loam; many coarse prominent strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; friable; about 5 percent gravel; strongly acid; gradual smooth boundary.

C1—36 to 42 inches; strong brown (7.5YR 5/6) stratified loam and sandy loam; many medium prominent grayish brown (10YR 5/2) mottles; massive; very friable; few thin strata of loamy sand; about 10 percent gravel; medium acid; gradual smooth boundary.

C2—42 to 60 inches; yellowish brown (10YR 5/6) stratified loam, sandy loam; and gravelly loam; massive; friable; few thin strata of silt loam; about 25 percent gravel; medium acid.

The thickness of the solum ranges from 24 to 40 inches. Reaction is medium acid or slightly acid in the A horizon, medium acid or strongly acid in the B and BC horizons, and strongly acid to slightly acid in the C horizon. The content of coarse fragments is 2 to 15 percent within a depth of 30 inches and 5 to 25 percent below that depth.

Some pedons have an A horizon. The Ap or A horizon is commonly silt loam but is loam in some pedons. The Bw, BA, and BC horizons have hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 6. They are dominantly silt loam or loam but have thin strata of fine sandy loam or sandy loam in some pedons. They have a clay content of 18 to 24 percent. The strata in the C horizon vary in color, texture, and size and amount of coarse fragments. They commonly are loam, silt loam, sandy loam, or the gravelly or channery analogs of these textures.

Pewamo Series

The Pewamo series consists of deep, very poorly drained soils that formed in moderately fine textured Wisconsin glacial till. These soils are on flats and in closed depressions on till plains. Permeability is moderately slow. Slope is 0 to 2 percent.

Pewamo soils are similar to Luray soils and commonly are adjacent to Bennington and Condit soils. The adjacent soils do not have a mollic epipedon. They are better drained than the Pewamo soils and are higher on the landscape. Luray soils are stratified and contain more silt and less clay in the subsoil than the Pewamo soils.

Typical pedon of Pewamo silty clay loam, about 2 miles southwest of Centerburg; in an area of Hilliar Township about 2,500 feet south along Huffman Road from the intersection of Huffman Road and U.S. Route 36, then about 120 feet east, T. 5 N., R. 15 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (2.5Y 5/2) dry; moderate fine granular structure; firm; neutral; abrupt smooth boundary.

AB—9 to 14 inches; black (10YR 2/1) silty clay, very dark grayish brown (10YR 3/2) dry; common coarse faint dark brown (10YR 4/3) mottles; strong coarse angular blocky structure parting to moderate fine angular blocky; firm; few fine pebbles; neutral; clear irregular boundary.

Btg1—14 to 24 inches; dark gray (5Y 4/1) silty clay; many medium prominent yellowish brown (10YR 5/4) mottles; moderate fine angular blocky structure; very firm; clay films obscured by many distinct black (5Y 2/1) organic stains on faces of peds; tongues of AB material to a depth of 22 inches; few fine pebbles; slightly acid; clear irregular boundary.

Btg2—24 to 31 inches; gray (10YR 5/1) silty clay loam; many coarse prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; very firm; many distinct very dark gray (10YR 3/1) organic stains and common faint gray (10YR 5/1) clay films on faces of peds; many dark concretions; few fine pebbles; neutral; gradual smooth boundary.

Btg3—31 to 35 inches; gray (5Y 5/1) silty clay loam; common coarse prominent yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure; very firm; grayish brown (2.5Y 5/2) faces of peds; common faint dark grayish brown (2.5Y 4/2) clay films and few dark organic stains on faces of peds; few pebbles; neutral; diffuse wavy boundary.

Btg4—35 to 44 inches; gray (10YR 5/1) silty clay loam; many medium prominent strong brown (7.5YR 5/6) mottles; moderate coarse subangular blocky structure; firm; common faint gray (10YR 5/1) clay films on faces of peds; few pebbles; neutral; gradual wavy boundary.

BC—44 to 56 inches; yellowish brown (10YR 5/4) clay loam; many coarse distinct gray (10YR 5/1) and strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; firm; few distinct gray (10YR 5/1) coatings on vertical faces of peds; few pebbles; mildly alkaline; gradual wavy boundary.

C—56 to 60 inches; yellowish brown (10YR 5/6) clay loam; many medium distinct grayish brown (10YR 5/2) mottles; massive; firm; few pebbles; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to carbonates range from 48 to 66 inches. In unlimed areas the upper part of the solum is medium acid to neutral. The lower part is neutral or mildly alkaline. A few angular pebbles and cobblestones are common in the B and C horizons, but they are less than 5 percent of the volume.

The thickness of the Ap horizon combined with that of the AB horizon is 10 to 16 inches. These horizons have hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The AB horizon is not mottled in all pedons. It is silty clay loam or silty clay. The part of the Btg horizon within a depth of 30 inches has hue of 10YR to 5Y, value of 4 or 5, and chroma of 2 or less. It has mottles with higher chroma. In some pedons subhorizons below a depth of 30 inches have dominant colors that are higher in chroma. The upper 20 inches of the B horizon is silty clay loam, clay loam, or silty clay and has a clay content of 35 to 45 percent. The lower part of the Btg horizon and the BC horizon are clay loam or silty clay loam and have a clay content of 28 to 38 percent. The C horizon is clay loam or silty clay loam glacial till.

Rigley Series

The Rigley series consists of deep, well drained soils that formed in residuum and colluvium derived from medium and coarse grained sandstone of the Massillon and Black Hand Formations. These soils are on the tops, sides, and benches of unglaciated hills. Permeability is moderately rapid. Slope ranges from 2 to 25 percent.

Rigley soils commonly are adjacent to Coshocton, Gilpin, and Schaffenaker soils. Coshocton and Gilpin soils have more clay in the solum than the Rigley soils. They are on benches below the Rigley soils. The sandy Schaffenaker soils are underlain by bedrock at a depth of 20 to 40 inches. They are on the steeper parts of the landscape.

Typical pedon of Rigley sandy loam, 6 to 12 percent slopes, about 2 miles southeast of Bladensburg; in an area of Jackson Township about 2,600 feet north along Aspen Road from the intersection of Aspen and Jug Run Roads, then about 40 feet west, T. 5 N., R. 10 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) sandy loam, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; about 5 percent sandstone fragments; strongly acid; abrupt smooth boundary.

BA—8 to 11 inches; dark yellowish brown (10YR 4/4) sandy loam; weak very fine subangular blocky structure; very friable; about 5 percent sandstone fragments; strongly acid; clear irregular boundary.

Bt1—11 to 15 inches; yellowish brown (10YR 5/6) sandy loam; weak fine subangular blocky structure; very friable; many faint yellowish brown (10YR 5/4) clay films on sand grains and clay bridges between sand grains; about 5 percent sandstone fragments; very strongly acid; clear wavy boundary.

Bt2—15 to 24 inches; strong brown (7.5YR 5/6) sandy loam; weak fine subangular blocky structure; very friable; many distinct yellowish brown (10YR 5/6) clay films on sand grains and clay bridges between sand grains; about 5 percent sandstone fragments; very strongly acid; clear wavy boundary.

Bt3—24 to 32 inches; strong brown (7.5YR 5/6) sandy loam; weak fine subangular blocky structure; friable; common faint brown (7.5YR 5/4) clay films on sand grains and clay bridges between sand grains; about 25 percent bands and irregularly shaped masses of loamy sand in which sand grains are not coated or bridged with clay; about 5 percent sandstone fragments; very strongly acid; clear smooth boundary.

Bt4—32 to 37 inches; yellowish brown (10YR 5/6) channery loamy sand; single grained; loose; about 15 percent zones of sandy loam in which sand grains are coated and bridged with clay; about 20 percent small sandstone channers; very strongly acid; clear irregular boundary.

BC—37 to 57 inches; yellowish brown (10YR 5/6) loamy sand; single grained; loose; about 10 percent masses that are slightly coherent and show some clay bridging; about 10 percent sandstone fragments; very strongly acid; gradual wavy boundary.

C—57 to 60 inches; brownish yellow (10YR 6/6) loamy sand; single grained; very hard in place, but loose when dug out; about 5 percent easily crushed rock fragments; very strongly acid.

The thickness of the solum ranges from 40 to 60 inches, and the depth to bedrock typically ranges from 60 to 80 inches. In unlimed areas reaction is strongly acid to extremely acid throughout the profile. The coarse fragments are mostly medium or coarse grained sandstone the size of pebbles or channers. Some rounded pebbles are in conglomeritic zones where the parent sandstone has been weathered. The content of coarse fragments is 5 to 20 percent in the B horizon and 5 to 30 percent in the C horizon.

The Ap horizon has hue of 10YR, value of 4, and chroma of 3 or 4. It is sandy loam or loam. Bleached sand grains make up as much as 30 percent of this horizon. Many pedons have an A horizon rather than an Ap horizon.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 8. The upper part commonly is sandy loam or loam in which the clay content is 10 to 18 percent. The lower part is sandy loam, loam, loamy sand, or the channery analogs of these textures.

The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 8. It is loam, sandy loam, sand, loamy sand, or the channery analogs of these textures. Some pedons have a 2C horizon of clay loam at a depth of 40 to 60 inches. Mottles are common directly above this horizon.

Rittman Series

The Rittman series consists of deep, moderately well drained soils that have a dense fragipan. These soils formed in clay loam or loam Wisconsin glacial till on till plains. They are on the tops and sides of hills and on side slopes in small valleys. Permeability is moderate above the fragipan and slow in the fragipan. Slope ranges from 2 to 12 percent.

Rittman soils are similar to Canfield and Titusville soils and commonly are adjacent to Wadsworth and Wooster soils. Canfield soils have less clay in the Bt horizon than the Rittman soils. Titusville soils formed in Illinoian glacial till. Their solum and fragipan are thicker than those of the Titusville soils. Wadsworth soils are somewhat poorly drained and are on the lower, more concave parts of the landscape. Wooster soils are well drained and are on hillsides below the Rittman soils.

Typical pedon of Rittman silt loam, 2 to 6 percent slopes, about 2 miles west-northwest of Fredericktown; in an area of Middlebury Township about 3,700 feet east along Ridge Road from the intersection of Ridge and Grange Roads, then about 50 feet south, T. 8 N., R. 14 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; weak fine granular structure; friable; about 10 percent pebbles; slightly acid; abrupt smooth boundary.

BA—8 to 12 inches; yellowish brown (10YR 5/4) silty clay loam; weak medium subangular blocky structure; firm; about 5 percent gravel; strongly acid; clear irregular boundary.

Bt1—12 to 18 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium and fine subangular blocky structure; firm; common faint yellowish brown (10YR 5/4) clay films on faces of peds; about 5 percent gravel; strongly acid; clear wavy boundary.

Bt2—18 to 23 inches; yellowish brown (10YR 5/4) silty clay loam; common medium faint yellowish brown (10YR 5/6), few coarse distinct gray (10YR 5/1), and common medium distinct strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; firm; many faint yellowish brown (10YR 5/4) and brown (10YR 5/3) clay films on faces of peds; about 5 percent gravel; strongly acid; gradual wavy boundary.

Bt3—23 to 27 inches; yellowish brown (10YR 5/4) silty clay loam; many medium and coarse distinct gray (10YR 5/1) and strong brown (7.5YR 5/8) mottles; moderate coarse prismatic structure parting to weak medium platy; firm; slightly brittle; common faint brown (10YR 5/3) clay films on plates; many faint brown (10YR 5/3) clay films on prisms; common fine distinct concretions (iron and manganese oxides); about 5 percent gravel; strongly acid; clear wavy boundary.

Btx1—27 to 34 inches; yellowish brown (10YR 5/4) clay loam; many medium and coarse distinct gray (10YR 5/1) and strong brown (7.5YR 5/8) mottles; moderate very coarse prismatic structure parting to moderate thin platy; very firm; very brittle; grayish brown (10YR 5/2) faces of peds; common faint grayish brown (10YR 5/2) clay films on faces of peds; many coarse distinct platelike concretions (iron and manganese oxides) on horizontal faces of peds; about 50 percent gravel; strongly acid; gradual wavy boundary.

Btx2—34 to 40 inches; yellowish brown (10YR 5/4) loam; many medium distinct grayish brown (10YR 5/2) and common medium distinct strong brown (7.5YR 5/6) mottles; weak very coarse prismatic structure parting to moderate thin platy; very firm; brittle; grayish brown (10YR 5/2) faces of peds; common faint grayish brown (10YR 5/2) clay films on faces of peds; many very coarse distinct platelike concretions (iron and manganese oxides) on horizontal faces of peds; about 10 percent gravel; medium acid; diffuse wavy boundary.

BC—40 to 52 inches; yellowish brown (10YR 5/4) loam; many medium distinct grayish brown (10YR 5/2), common fine distinct strong brown (7.5YR 5/6), and few coarse distinct reddish brown (5YR 4/4) mottles; weak very coarse prismatic structure parting to weak medium platy; firm; slightly brittle; few faint brown (10YR 5/3) clay films on faces of peds and few distinct clay flows on faces of prisms; about 5 percent gravel; slightly acid; clear wavy boundary.

C1—52 to 60 inches; yellowish brown (10YR 5/4) clay loam; common fine faint yellowish brown (10YR 5/6) mottles; massive; firm; about 10 percent gravel; slight effervescence; mildly alkaline; diffuse irregular boundary.

C2—60 to 70 inches; dark yellowish brown (10YR 4/4) loam; massive; firm; about 10 percent gravel; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to carbonates range from 40 to 60 inches. The depth to the top of the fragipan ranges from 18 to 36 inches. In unlimed areas the upper part of the solum is strongly acid or very strongly acid. Reaction becomes less acid with increasing depth. It is slightly acid or neutral at the base of the solum. The content of small angular pebbles is 2 to 10 percent above the fragipan and 2 to 15 percent in and below the fragipan.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It has value of 5 only in eroded areas. Some pedons have A and E horizons. Some do not have a BA horizon, especially in eroded areas. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam or silty clay loam in which the clay content is 28 to 35 percent. The Btx horizon is 10 to 30 inches thick. It has hue of 10YR, value 4 or 5, and chroma 3 to 6. It is clay loam, silty clay loam, or loam and has a clay content of 25 to 32 percent. The BC horizon has colors and textures similar to those of the Btx horizon.

Schaffenaker Series

The Schaffenaker series consists of moderately deep, well drained soils on hillsides and high, narrow ridges. These soils formed in material weathered from medium and coarse grained sandstone of the Black Hand and Massillon Formations. Permeability is rapid or very rapid. Slope ranges from 12 to 60 percent.

Schaffenaker soils commonly are adjacent to Coshocton, Gilpin, and Rigley soils. The adjacent soils have more clay throughout than the Schaffenaker soils.

Also, they commonly are lower on the landscape. In some areas, however, they are on benches and ridgetops above the Schaffenaker soils.

Typical pedon of Schaffenaker loamy sand, 12 to 25 percent slopes, about 2 miles north-northwest of Greer; in an area of Jefferson Township about 500 feet north along Stumbaugh Road from the intersection of Stumbaugh and Big Hill Roads, then about 20 feet east, T. 9 N., R. 10 W.

A—0 to 1 inch; very dark brown (10YR 2/2) loamy sand, dark grayish brown (10YR 4/2) dry; single grained; very friable; numerous bleached sand grains; very strongly acid; clear irregular boundary.

E—1 to 3 inches; brown (10YR 4/3) loamy sand; single grained; very friable; extremely acid; clear irregular boundary.

Bw1—3 to 6 inches; brownish yellow (10YR 6/6) loamy sand; single grained; loose; about 2 percent sandstone fragments; very strongly acid; diffuse wavy boundary.

Bw2—6 to 24 inches; reddish yellow (7.5YR 6/6) loamy sand; single grained; loose; about 5 percent sandstone fragments; very strongly acid; gradual wavy boundary.

C1—24 to 31 inches; brownish yellow (10YR 6/6) channery sand; single grained; loose; about 20 percent sandstone fragments the size of fine channers, most of which are easily crushed; very strongly acid; clear irregular boundary.

C2—31 to 35 inches; brownish yellow (10YR 6/8) channery sand; single grained; loose; about 30 percent angular sandstone fragments; extremely acid; abrupt wavy boundary.

R—35 to 37 inches; brownish yellow (10YR 6/8) coarse grained sandstone; many stains; beds 6 to 36 inches thick.

The thickness of the solum ranges from 15 to 30 inches and the depth to bedrock from 20 to 40 inches. Reaction ranges from strongly acid to extremely acid throughout the profile. The fine earth material in all horizons is loamy sand or sand. Medium and coarse sand sizes dominate. The content of partly weathered sandstone channers 1 to 6 inches in diameter is 0 to 20 percent in the A, E, and Bw horizons and 5 to 50 percent in the C horizon.

The A horizon is 1 to 4 inches thick. It has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Bleached sand grains make up 10 to 40 percent of this horizon. Some pedons have an Ap horizon. The E horizon has hue of 10YR and value and chroma of 3 or 4. The Bw1 horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. In some pedons the E and Bw1 horizons are intermingled. The Bw2 and C horizons have hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. They commonly have stains with high chroma on or around partly weathered sandstone fragments. These horizons are sand, loamy sand, or the channery analogs of these textures.

The underlying sandstone is of either the Black Hand or Massilon Formation. The Black Hand Formation has conglomeritic zones, which become gravelly pockets in the profile when the sandstone weathers. The underlying bedrock has hue of 10YR or 2.5YR, value of 5 or 6, and chroma of 4 to 8.

Sebring Series

The Sebring series consists of deep, poorly drained soils that formed in glacial meltwater deposits having a high content of silt. These soils are in former lakebeds, on the wetter parts of slack water terraces along streams, and in upland draws. Permeability is moderately slow. Slope is 0 to 2 percent.

Sebring soils are similar to Condit and Fitchville soils and commonly are adjacent to Fitchville, Glenford, and Luray soils. Condit soils formed in glacial till and are not stratified. Fitchville and Glenford soils are better drained than the Sebring soils and are higher on the landscape. Luray soils have a mollic epipedon. They are very poorly drained and are on the lowest part of the landscape.

Typical pedon of Sebring silt loam, about 2.5 miles northeast of Millwood; in an area of Union Township about 700 feet north along Flat Run Road from the intersection of Flat Run and Boeshart Roads, then about 200 feet east, T. 7 N., R. 10 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium granular structure; friable; neutral; abrupt smooth boundary.

BEg—7 to 12 inches; dark grayish brown (10YR 4/2) silt loam; many medium distinct dark yellowish brown (10YR 4/4) and few medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; common distinct light brownish gray (2.5Y 6/2) degradational silt coatings on faces of peds; medium acid; clear irregular boundary.

Btg1—12 to 20 inches; dark gray (10YR 4/1) silty clay loam; many medium distinct dark yellowish brown (10YR 4/4) and common medium prominent yellowish red (5YR 5/8) mottles; moderate fine subangular blocky structure; firm; dark gray (10YR 4/1) faces of peds; common faint dark gray (10YR 4/1) clay films on faces of peds; medium acid; clear wavy boundary.

Btg2—20 to 30 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium distinct dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure; firm; grayish brown (10YR 5/2) faces of peds; many faint grayish brown (10YR 5/2) clay films on faces of peds; common dark concretions; slightly acid; gradual smooth boundary.

Btg3—30 to 38 inches; gray (10YR 5/1) silty clay loam; many coarse distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common faint dark gray (10YR 4/1) clay films on faces of peds; few concretions; slightly acid; clear smooth boundary.

BCg—38 to 50 inches; grayish brown (10YR 5/2) silty clay loam; common coarse faint gray (10YR 6/1) and common medium distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; weak very coarse subangular blocky structure; firm; weakly laminar because of stratification; few distinct dark gray (10YR 4/1) clay films on faces of peds; thin strata of silt loam; neutral; clear smooth boundary.

Cg—50 to 60 inches; grayish brown (10YR 5/2) silty clay loam; common coarse distinct yellowish brown (10YR 5/6) mottles; massive; firm; laminated; thin strata of friable silt loam and very fine sandy loam; mildly alkaline.

The solum ranges from 30 to 55 inches in thickness. In unlimed areas it is medium acid or strongly acid in the upper part. The lower part of the solum is neutral to strongly acid. The C horizon is slightly acid to moderately alkaline. It has free carbonates in some pedons. The upper 40 inches has virtually no coarse fragments.

The Ap horizon has hue of 10YR, value of 4, and chroma of 1 or 2. Some pedons have A and Eg horizons. The part of the Btg horizon within a depth of 30 inches has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. Below a depth of 30 inches, this horizon has subhorizons that have a dominant chroma of 3 or 4 in some pedons. The Btg horizon is dominantly silt loam or silty clay loam in which the clay content is 24 to 35 percent. In highly stratified pedons, thin subhorizons range from very fine sandy loam to silty clay. The BC and C horizons are dominantly silt loam and silty clay loam, but they have thin layers of other textures, especially loam and fine sand.

Shoals Series

The Shoals series consists of deep, somewhat poorly drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slope is 0 to 2 percent.

Shoals soils are similar to Orrville soils and commonly are adjacent to Holly, Lobdell, and Sloan soils. Holly soils are poorly drained and very poorly drained, and Sloan soils are very poorly drained. Both are on the lower parts of the flood plains. Sloan soils have a mollic epipedon. Lobdell soils are moderately well drained and are on the higher parts of the flood plains. Orrville soils are more acid throughout than the Shoals soils.

Typical pedon of Shoals silt loam, occasionally flooded, just east of Batemantown; in an area of Middlebury Township about 250 east along Yankee Street Road from the intersection of Yankee Street and Darlington Roads, then about 400 feet south, T. 8 N., R. 14 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; few pebbles; neutral; abrupt smooth boundary.

Cg1—10 to 16 inches; grayish brown (10YR 5/2) silt loam; many medium distinct yellowish brown (10YR 5/4) mottles; very weak fine subangular blocky structure; friable; few pebbles; neutral; clear smooth boundary.

Cg2—16 to 21 inches; grayish brown (2.5Y 5/2) silt loam; many coarse distinct yellowish brown (10YR 5/6) and few coarse faint brown (10YR 5/3) mottles; very weak fine subangular blocky structure; friable; thin strata of very fine sandy loam; about 5 percent gravel; common concretions; neutral; clear smooth boundary.

C1—21 to 29 inches; yellowish brown (10YR 5/4) loam; common coarse faint yellowish brown (10YR 5/6) and common medium distinct grayish brown (10YR 5/2) and dark yellowish brown (10YR 4/4) mottles; very weak fine subangular blocky structure; very friable; thin strata of silt loam and sandy loam; about 5 percent gravel; few concretions; mildly alkaline; clear smooth boundary.

C2—29 to 42 inches; brown (10YR 5/3) stratified loam, silt loam, and sandy loam; many coarse faint grayish brown (10YR 5/2) and few coarse distinct strong brown (7.5YR 5/6) mottles; massive; very friable; few large concretions; mildly alkaline; clear wavy boundary.

C3—42 to 60 inches; yellowish brown (10YR 5/4) stratified silt loam, loam, and sandy loam; common coarse distinct gray (10YR 5/1) and strong brown (7.5YR 5/8) mottles; massive; friable; thin strata of dark gray (5Y 4/1) silty clay loam; slight effervescence; mildly alkaline.

The depth to carbonates ranges from 36 to 72 inches. The upper part of the profile is slightly acid to mildly alkaline, and the lower part is neutral or mildly alkaline. The content of coarse fragments ranges from 0 to 15 percent throughout the profile.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2. Some pedons have an A horizon. The Ap and A horizons commonly are silt loam but are loam in some pedons. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 6. The part of this horizon within a depth of 40 inches is dominantly silt loam and loam, but it commonly has thin strata of other textures. It has a clay content of 18 to 25 percent.

Individual strata in the part of the C horizon below a depth of 40 inches vary widely in color, texture, and content of coarse fragments.

Sloan Series

The Sloan series consists of deep, very poorly drained soils that formed in alluvium on the lower and wetter parts of flood plains. Permeability is moderate or moderately slow. Slope is 0 to 2 percent.

Sloan soils are similar to Holly soils and commonly are adjacent to Linwood, Lobdell, and Shoals soils. Holly, Lobdell, and Shoals soils have an ochric epipedon. Lobdell and Shoals soils are better drained than the Sloan soils and are on the higher parts of the flood plains. Linwood soils have a histic epipedon. They are in distinct depressions.

Typical pedon of Sloan silt loam, occasionally flooded, about 1 mile west-northwest of Mt. Vernon; in an area of Clinton Township about 1,820 feet north along Lower Green Valley Road from the intersection of Lower Green Valley Road and State Route 229, then about 1,080 feet east, T. 6 N., R. 13 W.

Ap—0 to 9 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; few pebbles; neutral; abrupt smooth boundary.

A—9 to 14 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure; friable; few fine pebbles; neutral; clear irregular boundary.

Bg1—14 to 22 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; common fine prominent strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; friable; many distinct black (10YR 2/1) coatings on faces of peds; about 5 percent pebbles; neutral; clear irregular boundary.

Bg2—22 to 32 inches; grayish brown (10YR 5/2) loam; common fine prominent light olive brown (2.5Y 5/6) mottles; weak medium subangular blocky structure; very friable; few cracks filled with very dark gray (10YR 3/1) A horizon material; few thin strata of sandy loam; about 5 percent gravel; neutral; clear irregular boundary.

Cg—32 to 42 inches; grayish brown (10YR 5/2) stratified loam and sandy loam; few coarse prominent light olive brown (2.5Y 5/6) mottles; massive; very friable; few thin dark grayish brown (10YR 4/2) Ab horizons; about 10 percent gravel; slight effervescence; mildly alkaline; clear smooth boundary.

C—42 to 60 inches; stratified light olive brown (2.5Y 5/4) loam and gravelly loam and dark gray (10YR 4/1) sandy loam; massive; very friable; about 15 percent gravel; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 30 to 50 inches. Reaction ranges from slightly acid to mildly alkaline in the solum and is mildly alkaline or moderately alkaline in the C horizon. The content of coarse fragments is 0 to 5 percent in the solum and 0 to 20 percent in the C horizon. The content of gravel is as much as 40 percent in the thin strata in the C horizon. The mollic epipedon is 10 to 24 inches thick and extends into the Bg horizon in most pedons.

The Ap and A horizons have hue of 10YR or 2.5Y or are neutral in hue. They have value of 2 or 3 and chroma of 0 to 2. They are dominantly silt loam but are silty clay loam or loam in some pedons. The Bg horizon has hue of 10YR to 5Y or is neutral in hue. It has value of 4 or 5 and chroma of 0 to 2. It is dominantly loam or silt loam, but it has thin strata ranging from sandy loam to silty clay loam. It has a clay content of 18 to 25 percent. Tongues of the A horizon extend into the Bg horizon in many pedons. The C horizon is dominantly stratified loam, sandy loam, silt loam, or the gravelly analogs of these textures.

Tioga Series

The Tioga series consists of deep, well drained soils on the highest parts of flood plains. These soils formed in alluvium. Permeability is moderate or moderately rapid in the solum and rapid in the substratum. Slope is 0 to 2 percent.

Tioga soils are similar to Lobdell soils and commonly are adjacent to Landes, Lobdell, and Medway soils. The adjacent soils commonly are farther from the stream channels than the Tioga soils. Landes and Medway soils have a mollic epipedon. Medway soils have more clay in the B horizon than the Tioga soils. Lobdell and Medway soils are moderately well drained.

Typical pedon of Tioga fine sandy loam, occasionally flooded, about 1.5 miles southeast of Greer; in an area of Jefferson Township about 780 feet south along Brinkhaven Road from the intersection of Brinkhaven and Alum Rock Roads, then about 380 feet east, T. 8 N., R. 10 W.

Ap—0 to 9 inches; brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; many distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; about 10 percent gravel; neutral; abrupt smooth boundary.

BA—9 to 15 inches; yellowish brown (10YR 5/4) silt loam; weak coarse subangular blocky structure; very friable; common distinct dark grayish brown (10YR 4/2) coatings on faces of peds; about 5 percent gravel; neutral; clear wavy boundary.

Bw1—15 to 22 inches; yellowish brown (10YR 5/6) loam; weak coarse subangular blocky structure; very friable; common distinct dark grayish brown (10YR

4/2) organic coatings on faces of peds; few pebbles; slightly acid; gradual wavy boundary.

Bw2—22 to 38 inches; yellowish brown (10YR 5/6) loam; weak medium subangular blocky structure; very friable; few strata of sandy loam; about 10 percent gravel; slightly acid; gradual smooth boundary.

C—38 to 60 inches; yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4) stratified fine sandy loam, loam, and silt loam; massive; very friable; few pebbles; neutral.

The thickness of the solum ranges from 20 to 40 inches. The depth to carbonates is more than 48 inches. Reaction is medium acid to neutral in the solum and slightly acid to mildly alkaline in the C horizon. The content of coarse fragments is 0 to 10 percent to a depth of 40 inches. In individual strata or subhorizons, however, the content of gravel is 0 to 35 percent. The content of gravel or channers below a depth of 40 inches is 0 to 60 percent.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. In some pedons it appears darker because organic coatings are on the faces of peds before the soil material is crushed. Some pedons have an A horizon.

The Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is dominantly fine sandy loam, loam, or silt loam, but it has strata of sandy loam in many pedons. The content of clay in the 10- to 40-inch control section is 10 to 18 percent.

The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is dominantly silt loam, loam, fine sandy loam, sandy loam, loamy sand, or the gravelly, very gravelly, channery, or very channery analogs of these textures. Layers and pockets of loose sand and gravel are common below a depth of 40 inches.

Titusville Series

The Titusville series consists of deep, moderately well drained, slowly permeable soils that have a dense fragipan. These soils formed in medium textured or moderately fine textured Illinoian glacial till. They are on till plains. Slope ranges from 2 to 12 percent.

Titusville soils are similar to Canfield, Homewood, and Rittman soils and commonly are adjacent to Gresham, Homewood, and Loudonville soils. Canfield and Rittman soils formed in Wisconsin glacial till. They are not so deeply leached as the Titusville soils and commonly have a thinner fragipan. Gresham soils are somewhat poorly drained and are in distinct depressions and drainageways. Homewood and Loudonville soils are on the more convex parts of the landscape. Homewood soils do not have mottles of low chroma in the top 10 inches of the argillic horizon. Loudonville soils are moderately deep over shattered bedrock and do not have a fragipan.

Typical pedon of Titusville silt loam, 2 to 6 percent slopes, about 2 miles east of Mt. Vernon; in an area of Monroe Township 600 feet south along Upper Gilchrist Road from the intersection of Upper Gilchrist Road and U.S. Route 36, then 50 feet east, T. 7 N., R. 12 W.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam, very pale brown (10YR 7/4) dry; weak fine granular structure; friable; about 5 percent gravel; medium acid; abrupt smooth boundary.

BA—9 to 11 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; about 5 percent gravel; very strongly acid; clear wavy boundary.

Bt1—11 to 18 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; firm; common faint yellowish brown (10YR 5/4) silt coatings and few distinct brown (10YR 5/3) clay films on faces of peds; about 5 percent gravel; strongly acid; diffuse irregular boundary.

Bt2—18 to 21 inches; yellowish brown (10YR 5/6) loam; many medium faint yellowish brown (10YR 5/4) and common medium distinct gray (10YR 5/1) mottles; moderate medium subangular blocky structure; firm; brown (10YR 5/3) faces of peds; common faint brown (10YR 5/3) and few distinct gray (10YR 5/1) clay films on faces of peds and in pores; about 10 percent gravel; strongly acid; clear wavy boundary.

Btx1—21 to 27 inches; yellowish brown (10YR 5/6) clay loam; common coarse faint yellowish brown (10YR 5/4) and common medium distinct grayish brown (10YR 5/2) mottles; moderate very coarse prismatic structure parting to moderate medium and thick platy; firm; brittle; grayish brown (10YR 5/2) faces of peds; common faint brown (10YR 5/3) and few distinct dark gray (10YR 4/1) clay films on faces of peds; few distinct concretions (iron and manganese oxides); about 5 percent gravel; strongly acid; gradual wavy boundary.

Btx2—27 to 36 inches; yellowish brown (10YR 5/6) loam; common medium distinct grayish brown (10YR 5/2) mottles; moderate very coarse prismatic structure parting to moderate medium platy; very firm; brittle; many distinct grayish brown (10YR 5/2) and brown (10YR 5/3) clay films on faces of peds; few distinct concretions (iron and manganese oxides); about 5 percent gravel; strongly acid; gradual wavy boundary.

Btx3—36 to 46 inches; yellowish brown (10YR 5/4) loam; many coarse faint yellowish brown (10YR 5/6) and common fine distinct gray (10YR 5/1) mottles; moderate very coarse prismatic structure parting to weak medium subangular blocky; very firm; brittle; grayish brown (10YR 5/2) faces of peds; common faint brown (10YR 5/3) clay films on faces of peds;

many coarse distinct stains (iron and manganese oxides) on horizontal faces of peds; about 10 percent gravel; strongly acid; clear wavy boundary.

BC—46 to 60 inches; yellowish brown (10YR 5/6) loam; many coarse faint yellowish brown (10YR 5/4) and few medium distinct gray (10YR 5/1) mottles; weak coarse subangular blocky structure; firm; few concretions (iron and manganese oxides) in the upper part; about 10 percent gravel; medium acid.

The thickness of the solum ranges from 50 to 80 inches. The depth to the top of the fragipan ranges from 18 to 28 inches. In unlimed areas the upper part of the solum is strongly acid to extremely acid. The fragipan is strongly acid or very strongly acid, and the BC horizon is strongly acid to neutral. The content of coarse fragments, mostly angular or subrounded sandstone, is 2 to 20 percent in the upper part of the solum, excluding the Ap horizon, and is 5 to 30 percent in the lower part of the solum and in the C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Pedons in some uncultivated areas have A and E horizons. The BA and Bt horizons have hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. The Bt horizon is loam, silt loam, clay loam, silty clay loam, or the gravelly analogs of these textures. It has a clay content of 22 to 32 percent. The Btx horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6. It is loam, silt loam, clay loam, silty clay loam, or the gravelly analogs of these textures. It has a clay content of 20 to 30 percent. The BC horizon has colors similar to those of the Btx horizon. It is loam, clay loam, or the gravelly analogs of these textures.

Wadsworth Series

The Wadsworth series consists of deep, somewhat poorly drained soils that have a dense fragipan. These soils formed in medium textured or moderately fine textured Wisconsin glacial till. They are in depressions and other concave areas on till plains. Permeability is moderately slow or moderate above the fragipan and slow or very slow in the fragipan.

Wadsworth soils are similar to Gresham soils and are commonly adjacent to Canfield and Rittman soils. Gresham soils formed in Illinoian glacial till. They are more acid in the lower part than the Wadsworth soils. Canfield and Rittman soils are moderately well drained and are on the higher, more convex parts of the landscape.

Typical pedon of Wadsworth silt loam, 1 to 4 percent slopes, about 0.3 mile southwest of Batemantown; in an area of Middlebury Township about 850 feet south-southwest along Grange Road from the intersection of Grange and Yankee Street Roads, then about 60 feet east, T. 8 N., R. 14 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (2.5Y 6/2) dry; weak fine granular structure; friable; few faint very dark grayish brown (10YR 3/2) organic coatings on faces of peds; few fine pebbles; slightly acid; abrupt smooth boundary.

BA—10 to 14 inches; brown (10YR 5/3) silt loam; common fine distinct gray (10YR 5/1) and many medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; friable; few fine pebbles; strongly acid; clear irregular boundary.

Bt—14 to 20 inches; yellowish brown (10YR 5/4) silty clay loam; many coarse distinct yellowish brown (10YR 5/8) and common medium distinct gray (10YR 5/1) mottles; moderate medium subangular blocky structure; firm; many distinct grayish brown (10YR 5/2) clay films on faces of peds; few distinct dark gray (10YR 4/1) clay flows on vertical faces of peds; strongly acid; clear wavy boundary.

Btx1—20 to 25 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct strong brown (7.5YR 5/6) and common medium distinct gray (10YR 5/1) mottles; weak very coarse subangular blocky structure parting to moderate medium platy; very firm; grayish brown (10YR 5/2) faces of peds; common faint grayish brown (10YR 5/2) clay films on faces of peds; highly leached zones around intersections of vertical cleavage; common fine distinct concretions (iron and manganese oxides); about 2 percent fine gravel; medium acid; clear wavy boundary.

Btx2—25 to 39 inches; yellowish brown (10YR 5/4) clay loam; common medium faint yellowish brown (10YR 5/6) and many fine distinct dark gray (10YR 4/1) mottles; weak very coarse prismatic structure; very firm; very brittle; gray (10YR 5/1) faces of peds; common faint dark gray (10YR 4/1) clay films on faces of peds; many distinct fine and medium concretions (iron and manganese oxides); about 5 percent gravel; slightly acid; clear irregular boundary.

BC—39 to 54 inches; yellowish brown (10YR 5/4) clay loam; many fine faint yellowish brown (10YR 5/6) and common fine distinct dark gray (10YR 4/1) mottles; moderate coarse subangular blocky structure; firm; few faint brown (10YR 5/3) clay films on faces of peds; few distinct dark gray (10YR 4/1) clay flows on vertical faces of peds; about 5 percent gravel; neutral; diffuse wavy boundary.

C—54 to 60 inches; yellowish brown (10YR 5/4) loam; few fine faint grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; massive; firm; about 5 percent gravel; neutral.

The thickness of the solum ranges from 34 to 60 inches. The depth to the top of the fragipan is 18 to 28 inches. The depth to carbonates ranges from 60 to 72 inches. In unlimed areas the upper part of the solum is strongly acid to extremely acid. The lower part of the solum and the C horizon to a depth of 60 inches are slightly acid or neutral. The content of coarse fragments is 0 to 5 percent in the A, BA, and Bt horizons and 2 to 15 percent in the Btx, BC, and C horizons.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. In some pedons it appears darker because organic coatings are on the faces of peds before the soil material is crushed. Some pedons have A and E horizons. Some have a B/E horizon rather than a BA horizon. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It has a clay content of 27 to 35 percent. The Btx horizon is 10 to 24 inches thick. It has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. It is dominantly clay loam or silty clay loam but has subhorizons of loam in some pedons. It has a clay content of 27 to 32 percent. The BC horizon has colors and textures similar to those of the fragipan, but it lacks the brittleness and prismatic structure of the fragipan. The C horizon is loam or clay loam glacial till in which the clay content is 20 to 30 percent.

Westmoreland Series

The Westmoreland series consists of deep, well drained, moderately permeable soils that formed in colluvium and residuum derived from interbedded sandstone, siltstone, and shale. These soils are on unglaciated hillsides. Slope ranges from 12 to 40 percent.

Westmoreland soils are similar to Loudonville soils and commonly are adjacent to Brownsville, Coshocton, Gilpin, and Rigley soils. Brownsville soils have a higher content of coarse fragments in the A and B horizons than the Westmoreland soils and do not have an argillic horizon. They are in positions on the landscape similar to those of Westmoreland soils. Coshocton soils are moderately well drained and have an argillic horizon. Gilpin and Loudonville soils are moderately deep over bedrock. Rigley soils have more sand throughout than the Westmoreland soils. Coshocton, Gilpin, and Rigley soils commonly are on hilltops above the Westmoreland soils.

Typical pedon of Westmoreland silt loam, 12 to 18 percent slopes, about 3.8 miles east of Millwood; in an area of Union Township about 2,600 feet southeast along Edgington Road from the intersection of Edgington and Chestnut Ridge Roads, then about 70 feet west, T. 7 N., R. 10 W.

A—0 to 3 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine granular structure; very friable; common distinct very dark gray (10YR 3/1) organic coatings on faces of peds; about 10 percent small angular sandstone fragments; medium acid; clear wavy boundary.

BE—3 to 8 inches; dark yellowish brown (10YR 4/4) loam; weak thin platy structure; very friable; few distinct brown (10YR 5/3) silt coatings on faces of peds; few small sandstone fragments; strongly acid; clear irregular boundary.

Bt1—8 to 14 inches; yellowish brown (10YR 5/6) loam; weak medium subangular blocky structure; friable; common distinct brown (10YR 5/3) clay films on faces of peds and in root channels; about 5 percent small angular sandstone fragments; strongly acid; gradual wavy boundary.

Bt2—14 to 18 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common distinct brown (10YR 5/3) clay films on faces of peds; about 5 percent small angular sandstone fragments; medium acid; clear smooth boundary.

Bt3—18 to 24 inches; yellowish brown (10YR 5/6) channery silt loam; moderate fine subangular blocky structure; friable; common distinct brown (10YR 5/3) clay films on faces of peds and on coarse fragments; about 20 percent small sandstone channers; few dark stains on channers; medium acid; clear wavy boundary.

BC—24 to 34 inches; yellowish brown (10YR 5/6) very channery silt loam; weak coarse subangular blocky structure; friable; about 50 percent small, randomly oriented sandstone channers; strongly acid; clear wavy boundary.

C—34 to 48 inches; yellowish brown (10YR 5/6) extremely channery silt loam; massive; friable; about 70 percent olive brown (2.5Y 4/4) sandstone channers 3 to 8 inches in diameter and 0.5 to 1.0 inch thick; channers displaced from original bedding planes; strongly acid; clear smooth boundary.

R—48 to 50 inches; olive brown (2.5Y 4/4) thinly bedded fine grained sandstone and siltstone; beds 1 to 3 inches thick.

The thickness of the solum ranges from 30 to 40 inches and the depth to bedrock from 40 to 80 inches. In unlimed areas the solum is very strongly acid to medium acid. The C horizon is strongly acid or medium acid. The coarse fragments are mostly sandstone or siltstone of channers. The content of coarse fragments is 2 to 30 percent in the BE and Bt horizons, 20 to 70 percent in the BC horizon, and 50 to 80 percent in the C horizon.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2. It is commonly silt loam but is loam or channery silt loam in some pedons. Some pedons have an E horizon. Pedons in cultivated areas have an Ap horizon.

The BE and Bt horizons have hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. Mottles with low chroma are below a depth of 30 inches where beds of clayey shale restrict internal water movement. The BE and Bt horizons are dominantly silt loam, loam, or the channery analogs of these textures, but they have subhorizons of clay loam or silty clay loam in some pedons. The BC horizon has colors similar to those of the Bt horizon, but hue is 2.5Y in some zones where rock fragments of that hue have weathered into soil. The BC horizon is channery, very channery, or extremely channery silt loam or loam. It has thin subhorizons of channery or very channery silty clay loam in some pedons.

The C horizon is very channery or extremely channery silt loam or loam. The underlying rock is dominantly fine grained sandstone and siltstone, but it has thin beds of shale in some pedons. It commonly has hue of 2.5Y, value of 4 to 6, and chroma of 2 to 4 on unweathered faces.

Wooster Series

The Wooster series consists of deep, well drained soils that have a weakly expressed fragipan. These soils formed in medium textured and moderately coarse textured Wisconsin glacial till on till plains and moraines. They are on the tops and sides of hills and on side slopes in stream valleys. Permeability is moderately slow. Slope ranges from 2 to 40 percent.

Wooster soils are similar to Canfield and Homewood soils and commonly are adjacent to Canfield and Rittman soils. The adjacent soils are moderately well drained and are on hilltops, concave foot slopes, and the sides of small valleys. Homewood soils have a fragipan that is thicker and more strongly expressed than that of the Wooster soils. Also, they have a thicker solum.

Typical pedon of Wooster silt loam, 2 to 6 percent slopes, about 2.5 miles northeast of Fredericktown; in an area of Berlin Township about 6,800 feet southwest along Fredericktown-Amity Road from the intersection of Fredericktown-Amity and Old Mansfield Roads, then about 1,050 feet north, T. 8 N., R. 13 W.

Ap—0 to 10 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; about 10 percent coarse fragments; slightly acid; abrupt smooth boundary.

BA—10 to 12 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; few dark brown (10YR 4/3) root channel fillings; about 5 percent coarse fragments; slightly acid; clear irregular boundary.

Bt1—12 to 17 inches; yellowish brown (10YR 5/6) silt loam; moderate fine subangular blocky structure; firm; common faint yellowish brown (10YR 5/4) clay films on faces of peds; about 5 percent coarse fragments; strongly acid; diffuse wavy boundary.

Bt2—17 to 26 inches; yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; firm; common faint yellowish brown (10YR 5/4) clay films on faces of peds; about 10 percent coarse fragments; medium acid; clear wavy boundary.

Bt3—26 to 32 inches; yellowish brown (10YR 5/6) loam; weak coarse prismatic structure parting to moderate fine subangular blocky; firm; slightly brittle; common faint yellowish brown (10YR 5/4) clay films and common distinct light yellowish brown (10YR 6/4) silt coatings on faces of peds; about 5 percent coarse fragments; medium acid; clear irregular boundary.

Btx—32 to 44 inches; yellowish brown (10YR 5/6) loam; many coarse faint yellowish brown (10YR 5/4) and common coarse distinct gray (10YR 5/1) mottles; moderate very coarse prismatic structure parting to weak thick platy; very firm; brittle; common faint yellowish brown (10YR 5/4) clay films and silt coatings on faces of peds; about 10 percent coarse fragments; medium acid; diffuse irregular boundary.

BC—44 to 60 inches; yellowish brown (10YR 5/4) loam; few fine distinct gray (10YR 5/1) mottles; weak coarse subangular blocky structure; firm; few manganese stains; about 10 percent angular sandstone fragments with strong brown (7.5YR 5/8) stains; medium acid.

The thickness of the solum ranges from 40 to 80 inches. The depth to the top of the fragipan ranges from 24 to 36 inches. The depth to carbonates is more than 60 inches. In unlimed areas reaction is medium acid to very strongly acid above the fragipan. The fragipan is medium acid or strongly acid, and the BC horizon, medium acid to neutral. The content of angular sandstone fragments and igneous pebbles is 2 to 10 percent above the fragipan and 5 to 25 percent in and below the fragipan.

In uneroded areas the Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. In eroded areas it has value of 5. Some pedons have A and E horizons. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It has mottles with high chroma directly above the fragipan in some pedons. It is loam or silt loam. The Btx horizon is 10 to 20 inches thick. The Btx and BC horizons have colors similar to those of the Bt horizon. They are loam, silt loam, or the channery analogs of these textures and have a clay content of 18 to 25 percent. In some pedons a C horizon of loam, sandy loam, or the channery analogs of these textures is within a depth of 60 inches.

Formation of the Soils

This section relates the factors of soil formation to the soils in Knox County and explains the processes of soil formation.

Factors of Soil Formation

The soil is a three-dimensional natural body capable of supporting plant growth. The nature of the soil at any given site is the result of the interaction of many factors. For the sake of convenience, these factors can be grouped into five general categories: parent material, plants and animals, climate, relief, and time. The variations observed among soils are caused by variations in one or more of these factors.

Parent Material

Parent material is the raw material acted upon by the other soil-forming factors. It largely determines the very important property of soil texture, which in turn controls permeability and available water capacity. The soils in Knox County formed in different kinds of parent material. Many formed in material deposited by glaciers or by glacial meltwater. Other soils formed in material deposited by flowing streams in relatively recent times, in material weathered from rock in place, or in the remains of decaying plants.

Glacial till is material that was deposited directly by glacial ice. The glacial ice contained a variety of soil materials, which were left behind when the ice melted. Glacial till typically contains particles that range in size from fine clay to large stones. The smaller stones and pebbles have sharp angles, indicating that they have not been rounded by water action. The composition of the till depends on the nature of the area over which the ice passed before reaching the area of deposition. Some boulders were carried for long distances, but most of the till originated in what is now Ohio.

The till in the southwestern part of the county contains relatively large quantities of clay and lime. Bennington soils, which formed in this till, have a silty clay loam or clay loam subsoil and have natural lime below a depth of about 3 feet. Farther north and east, the till contains less shale and limestone and more sandstone. Wooster and Canfield soils, which formed in this till, have a loam or silt loam subsoil and have no natural lime within a depth of 5 feet. Soils that formed in glacial till are generally compact and are slowly permeable or moderately slowly permeable.

Meltwater deposits were laid down by water from the melting glaciers. They are of two general kinds—lacustrine deposits, which were laid down in still water, and outwash deposits, which were laid down by moving water. The size of particles that can be carried by water depends on the speed at which the water is moving. When water slows to a given speed, all particles larger than a given size that are suspended in the water drop out. Reduction in speed occurs where a stream flows into a still lake. The coarser sand and gravel particles are deposited near the mouth of the stream, and the fine clay particles are carried far into the lake, where they settle slowly from the still water.

Lacustrine deposits are moderately extensive in Knox County. Several stream valleys were blocked by the glaciers or by the deposits that they left behind. Lakes formed in these blocked valleys. Lacustrine sediments were deposited in these areas. Soils that have a high content of silt, such as Fitchville, Glenford, and Luray, formed in these sediments. They have a narrow range of particle sizes and are soft and unstable when wet.

Outwash deposits are also moderately extensive in Knox County. These deposits were laid down as meltwater from the glaciers poured down the valleys between the rock hills. Because of the speed of the water, the smaller silt and clay particles were washed away and the sand and gravel was left behind. Soils that formed in these outwash deposits are gravelly and porous. Chili and Fox soils are examples.

The speed of the water at many points did not remain constant during the period of deposition. Changes in water velocity resulted in the deposition of thin layers of material in which the dominant particle size is different from that in the layers above or below. This stratification is evident in many areas of Luray and Fitchville soils, which have alternating thin strata of silt loam and silty clay loam.

Even more drastic changes in deposition are evidenced by Ockley soils. The upper part of these soils formed in silty deposits laid down in still water, the next part formed in loamy outwash, and the lower part is sandy and gravelly material laid down by moving water.

When streams flood, they deposit alluvium on the flood plains. This material has been washed from soils farther upstream in the watershed. Since the frequency and duration of flooding and the speed of the floodwater vary within small areas, alluvial deposits commonly vary in texture. They are made up of a number of thin layers, each of which was deposited by a different flood. Soils that formed in alluvium, such as Lobdell, Holly, and Shoals, have weakly expressed horizons since the soil-forming process starts over again with each new deposition.

Material weathered from rock is an important parent material, especially in the eastern part of the county. Most of the rock in Knox County is sandstone. The coarse grained Massillon and Black Hand Sandstones weather to sand or loamy sand. Schaffenaker and Rigley soils formed in this material. Siltstone and the finer grained sandstone weathers to silt loam parent material, such as that in which Gilpin and Westmoreland soils formed. In general, soils that formed in material weathered from sandstone are well drained.

The upper part of Linwood soils formed in the residue of decomposed plant material. Plants died and fell into shallow lakes. The permanently wet conditions prevented oxidation and slowed decomposition, and the residue accumulated. The very dark color in Linwood soils is caused by the organic parent material.

Plants and Animals

The type of vegetation under which a soil forms has an influence on the color and organic matter content of the soil. Soils that formed under forest vegetation generally have less organic matter and consequently are lighter in color than those that formed under grass.

Most of the soils in Knox County formed under hardwood forest vegetation. Wooster, Amanda, and Gilpin soils formed under a forest consisting primarily of hardwood species, such as red oak, white oak, and black oak. Most of the poorly drained or very poorly drained soils, such as Sebring, Luray, and Condit, formed under swamp forest vegetation.

Soil contains many micro-organisms, such as bacteria and fungi, which aid in breaking down the plant residue in the soil. The type of organic residue left in the soil depends to some extent on the type of organism in the soil. Generally, fungi are most active in acid soils and bacteria are most active in alkaline soils.

Earthworms, burrowing insects, and small animals are constantly mixing the soil. Their burrows make the soil more porous. As a result, water moves through the soil more rapidly. Earthworms are active in the incorporation of organic matter into the soil. Leaf fall on a soil well populated with earthworms is generally incorporated by early the next spring. Parts of the leaf fall from 2 or 3 years back remain on the surface of some soils in which the earthworm population is low.

Some human activities, such as cultivating and clearing the land, have accelerated erosion. Cultivation also influences soil structure and tends to lower the organic matter content. Because large areas of the more poorly drained soils, such as Pewamo, have been drained artificially, their future formation will take place under drier conditions. The conversion of native forest to cropland can also be expected to influence future soil formation. Additions of nutrients, such as lime and fertilizer, tend to change, to some degree, the chemical regime of the soil.

Climate

The climate in an area the size of Knox County is essentially a constant factor of soil formation. None of the soil differences in the county can be directly attributed to differences in climate. Some differences in micro-climate influence the amount of effective precipitation. The amount of precipitation is reduced by runoff on steep slopes and is increased in depressional areas, which receive the runoff.

The entire county has a humid, temperate climate, which is conducive to the growth of hardwood forests. More information about the climate is available under the heading "General Nature of the County."

Relief

Relief, along with parent material, helps to determine the natural drainage of the soils in Knox County. Relief influences the amount of runoff and the depth to the seasonal high water table. In general, soils in the steeper areas are better drained than those in the more nearly level areas. Quite different kinds of soil can form from the same kind of parent material under the different water regimes in the various landscape positions. For example, Glenford and Luray soils both formed in silty lacustrine deposits. The moderately well drained Glenford soils are in areas where the depth to the seasonal high water table is generally more than 24 inches. Water passes through these soils readily. The very poorly drained Luray soils are in low, nearly level areas where the seasonal high water table is near or above the surface. These soils are permeable enough to allow water to pass through them, but the water tends to accumulate on the surface.

Relief varies considerably in Knox County. In the western part of the county, the most extensive landform is a nearly level and gently undulating till plain. Relief is stronger throughout the central part of the county, where the glacier had less of a leveling effect on the rock hills. Relief is even stronger in areas in the eastern part of the county that were not glaciated. The proportion of well drained soils is considerably higher in the steeper eastern part of the county. Conversely, the proportion of very poorly drained and somewhat poorly drained soils is much higher in the more nearly level western part.

Time

The length of time that the parent material has been exposed to the processes of soil formation has an effect on the nature of the soil. The youngest soils in the county, in terms of years, are those that formed in recent stream deposits. Examples are Lobdell and Shoals soils, which show less evidence of horizon development than the older soils.

The soil-forming processes act at different rates on different types of soil material. Schaffenaker soils are probably among the oldest in the county. They have very weakly defined horizons, however, because they are composed mainly of quartz, a very resistant mineral.

Processes of Soil Formation

The soils formed in the parent material as a result of complex processes. These processes are continuous. The four main kinds of soil-forming processes are additions, removals, transfers, and transformations.

The accumulation of organic matter is the best example of an addition in the soils of Knox County. It is responsible for the darker colors of the surface layer as compared to those of the subsoil. Organic residue from the plants that have grown on the soil has darkened the surface layer.

Most removals result from the leaching that occurs when water moves downward through the soil. The parent material of some of the soils in the county was limy. Lime has been leached from the upper 3 to 6 feet in most of these soils.

During the development of the soil profile, water transferred clay from the A and E horizons to the B horizon. The A and E horizons, especially the E horizon, are zones of eluviation, or loss. The B horizon is a zone of illuviation, or gain. In Centerburg, Wooster, Loudonville, and many other soils, the B horizon contains more clay than the original material and the A and E horizons less. In some B horizons thin clay films are in pores and on the faces of peds. This clay has been moved from the A horizon to the B horizon.

Most transformations in the soils of Knox County involve clay minerals. One visible transformation is the weathering of rock into soil material. Gilpin, Ripley, and other soils that formed in material weathered from rock commonly have masses that resemble rock fragments in place but that are easily crushed to soil material with the fingers.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. The depth of the soil over bedrock. Deep soils are more than 40 inches deep over bedrock; moderately deep soils, 20 to 40 inches; and shallow soils, 10 to 20 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

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, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Natural levee. A long, low ridge along channel banks where floodwater overflowing the channel has deposited the coarsest part of its load. The ridge slopes gently away from the stream. The deposits are wedge shaped.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Perimeter drain. A drain installed around the perimeter of a septic tank absorption field to lower the water table. Also called a curtain drain.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch

Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slack water deposit (geology). Material that was deposited in still water and was subsequently exposed when the water level was lowered or when the elevation of the land was raised.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer of a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in glacial lake or other body of still water in front of a glacier.

Water bar. A shallow trench and a mound of earth constructed at an angle across a road or trail to intercept and divert surface runoff and control erosion.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.