United States Department of Agriculture

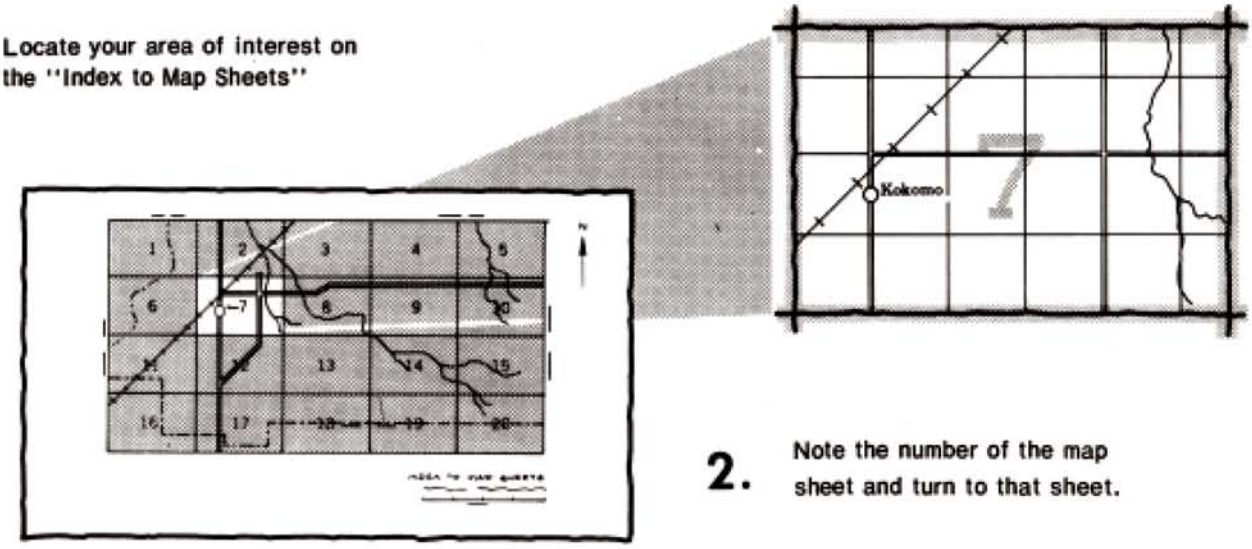
Soil Conservation Service

In Cooperation with The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Conservation Commission

Soil Survey of Warren and Forest Counties, Pennsylvania

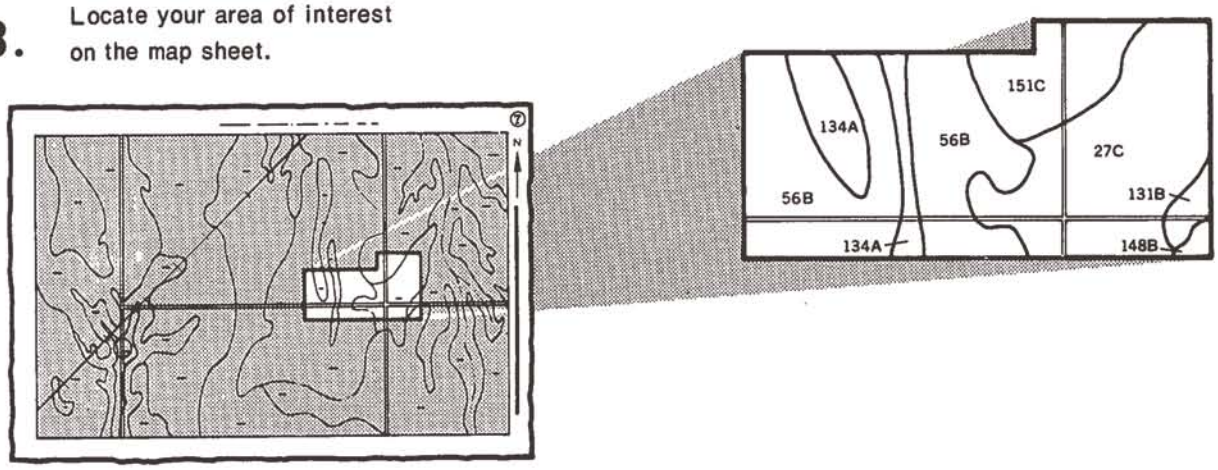
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets"

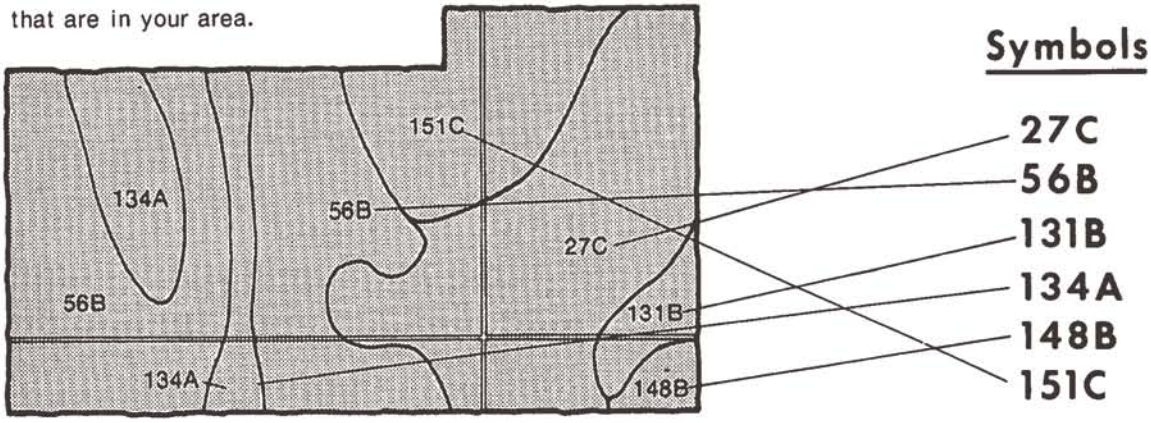


2. Note the number of the map sheet and turn to that sheet.

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

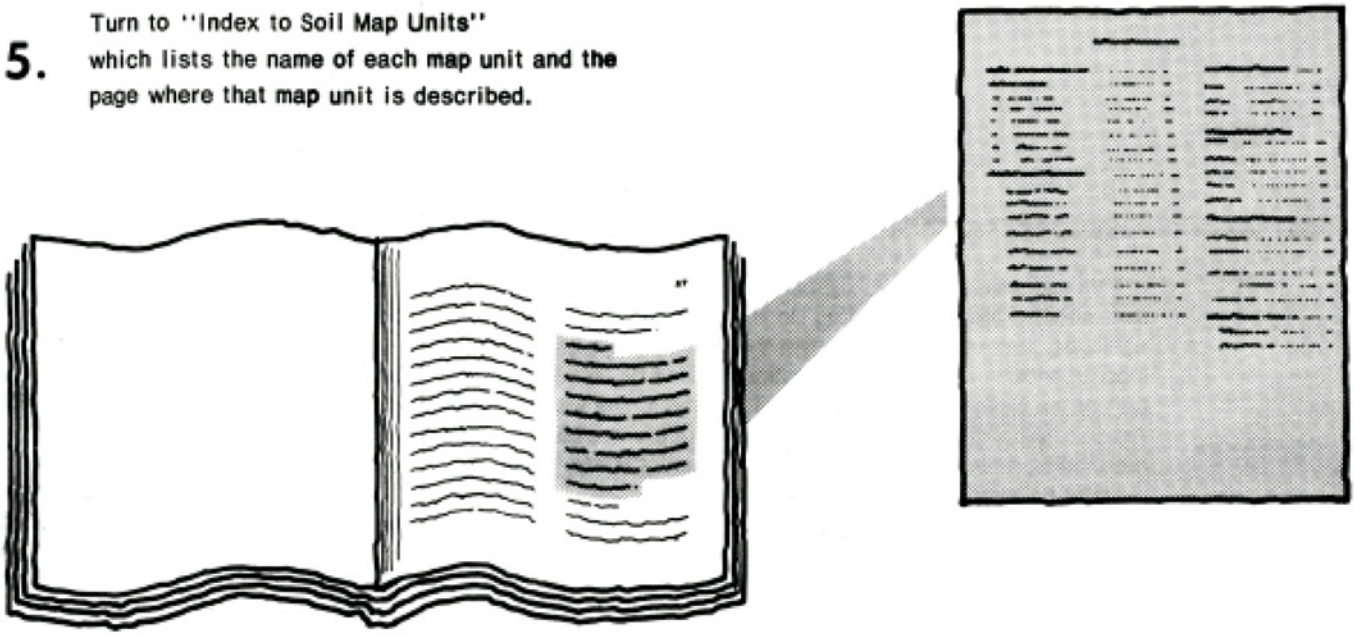


4. List the map unit symbols that are in your area.

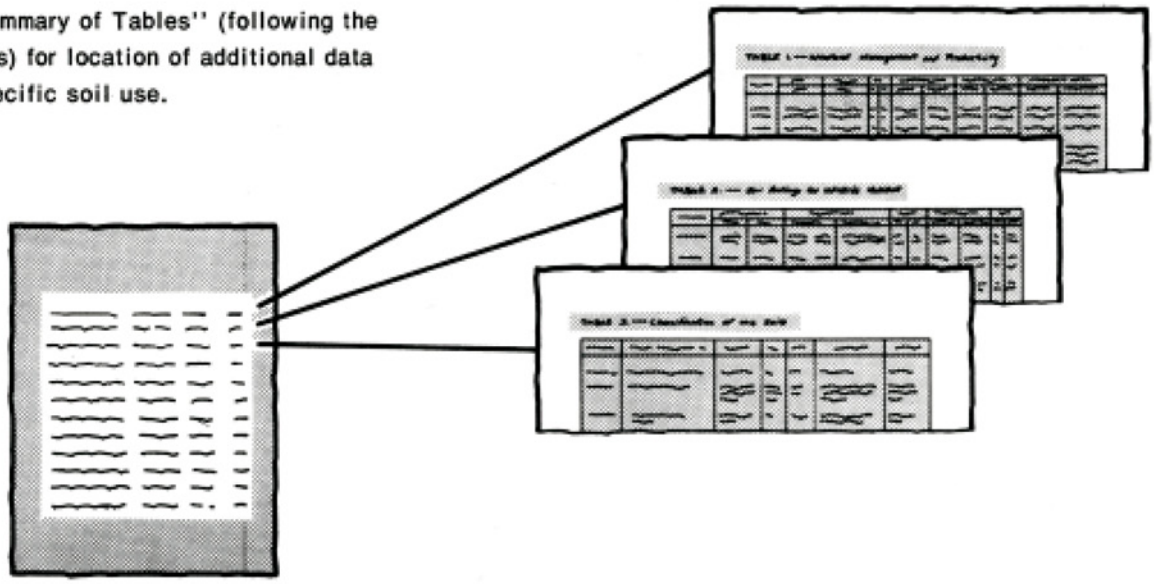


THIS SOIL SURVEY

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 performed in the period 1960 to 1978. Soil names and descriptions were approved in 1979. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1979. This survey was made cooperatively by the Soil Conservation Service and The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Conservation Commission. It is part of the technical assistance furnished to the Conservation Districts of Warren and Forest Counties. Financial assistance was provided by the Warren County Board of Commissioners.

Cover: Water impoundment in Hazelton-Gilpin-Ernest general soil map unit. Water covers the Ernest soils in the foreground. Hazelton and Gilpin soils are on the ridges in the background.

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soil series

Issued October 1985

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foreword

It is my pleasure to present the Soil Survey of Warren and Forest Counties. This report can help you and your community to plan and wisely use one of our most precious natural resources—the soil.

The soil survey is intended for many different users. This survey can help a farmer or woodland owner estimate the potential crop, forage, or timber production of his land, show the ability of the soil to support wildlife or to grow trees and shrubs, and help a homebuyer or developer determine soil-related hazards or limitations that affect homesites. It can also help land-use planners determine the suitability of areas for housing or onsite sewage disposal systems; the limitations of soils for roads, pipelines, buildings, landfills, and recreation areas; and many other uses.

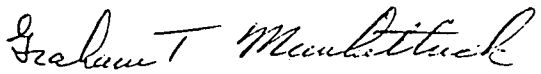
What value is soils information? Many people assume that soils are all alike. They are unaware that great differences in soils often occur in very short distances.

Some soils are continually or seasonally wet. Some are subject to flooding. Others are stony or moderately deep to bedrock. Some soils are slowly permeable and will not absorb liquid waste, while others become unstable when saturated with water, and slippage results. The possibility of this happening can be determined from information in this soil survey report.

This report consists of two parts. The first part describes suitabilities, hazards, and limitations of all soils in Warren and Forest Counties. The second part of the report is detailed maps showing the soils on every acre of land in the two-county area.

It is impossible to explain all of the ways that this soil survey report can be used. Additional information and assistance can be obtained at your local office of the Soil Conservation Service or the Cooperative Extension Service.

I believe that you will find this soil survey to be a valuable tool in resource planning and development. The widespread use of this publication will greatly assist in the conservation of our soil, water, woodland, and wildlife resources, resulting in a better environment and a better quality of life.



Graham T. Munkittrick
State Conservationist
Soil Conservation Service

soil survey of
Warren and Forest Counties, Pennsylvania

By James R. Cerutti, Soil Conservation Service

Field work by James R. Cerutti, Michael Yaworski, Norman J. Churchill, and Alex R. Topalanchik, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with The Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Conservation Commission

Warren and Forest Counties are located in the northwestern part of Pennsylvania (fig. 1). Warren County is bounded on the north by Chautauqua and Cattaraugus Counties in New York. In Pennsylvania it is bounded on the east by McKean County, on the west by Erie and Crawford Counties, and on the south by Forest County. Forest County is bounded by Venango County on the west, by Elk County on the east, and by Clarion and Jefferson Counties on the south. The two counties are 858,240 acres, or 1,341 square miles in area.

Census data of 1970 show a population of 52,608 for the two counties. Warren, which has a population of 12,998, is the county seat of Warren County. Tionesta, the county seat of Forest County, has a population of 711. Other principal towns are Sheffield, Youngsville, Sugar Grove, and Columbus in Warren County and Marienville in Forest County. The major sources of jobs are metal working, plastics, and electronics; oil and gas production; lumbering; retail trade; agriculture; transportation; and construction (*8*). The major employer is the manufacturing industry followed by wholesale and retail trade.

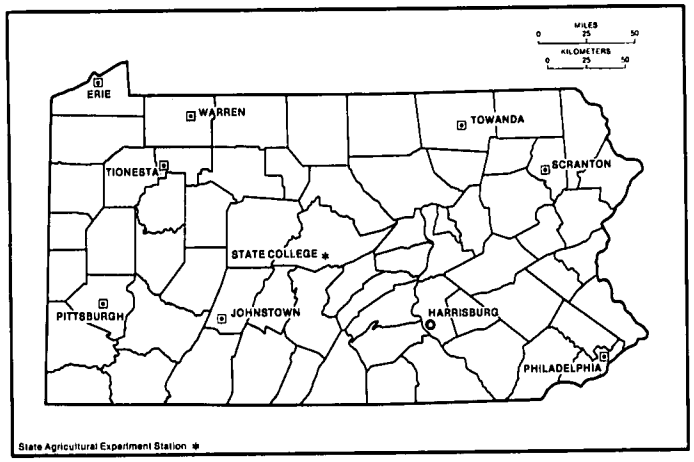


Figure 1.—Location of Warren and Forest Counties in Pennsylvania.

The area offers modern educational, medical, cultural, and religious facilities. Transportation is mostly by private vehicle, trucking, and railroad.

Approximately 87 percent of the land area is in forest, and 9 percent is used for crops and pasture. The remaining 4 percent is used for housing developments, industrial and commercial sites, and community services. The soils are of many different kinds. They formed in residual, glacial, colluvial, and alluvial materials derived mainly from shale and sandstone. A few of the soils are well suited to farm and urban uses, but most have limitations for these uses. Slope, wetness, and depth to bedrock are the main limitations. Sloping and steep soils are subject to severe erosion if they are unprotected.

general nature of the survey area

This section provides general information about Warren and Forest Counties. It discusses history, transportation, and climate.

history

The area of Warren and Forest Counties was not settled on a large scale until after the Revolutionary War.

The Holland Land Company, a group of New York financiers and land speculators, was the major force in the early settlement of this area and much of western New York. Most of the first settlers came from New York and eastern Pennsylvania by way of the upper reaches of the Allegheny River and the tributaries of the Susquehanna River. Warren County was formed from parts of Allegheny and Lycoming Counties in 1800. Forest County was formed from parts of Jefferson and Venango Counties in 1848. Warren County was named in honor of General Joseph Warren of Revolutionary War fame. Forest County was so named because of the original, dense forest.

A noteworthy person who lived in the area during its early years was Chief Cornplanter (*10*). After the Revolutionary War, the United States Congress, at George Washington's request, granted Cornplanter and his heirs, supposedly in perpetuity, sizable holdings of desirable river lands in recognition of his support of the early settlers. These granted lands were in what is today Warren and Venango Counties. Today, as a consequence of tribal sale and the building of the Allegheny Reservoir, only a small acreage of the granted land remains in Elk Township, Warren County. The last Indians left the granted lands several years before the completion of the reservoir project.

Lumbering was the first major industry in Warren and Forest Counties and has remained important to this day. At the time of original settlement, the area was virtually an unbroken forest.

The second oil well in the United States was drilled at Tidioute, Warren County, in 1860. Oil and gas production is still an important industry in both Warren and Forest Counties. Of the many refineries in the area in earlier years, only one remains in operation today. Early manufacturing activities, most of which were related to oil production and refining, have grown, over the years, into an extremely diversified industrial base.

transportation

Warren and Forest Counties have a fairly good highway system. Major roads are U.S. Highway 6 and 62. Numerous Pennsylvania routes and local roads provide good service within the counties.

Warren County has a general aviation airport for the use of privately owned aircraft and one private airstrip; Forest County has one private airstrip.

Warren County is served by one interstate busline. There is no regular local public bus service in either county. Three railroads provide freight service in the survey area.

climate

Winters are cold and snowy at high elevations in Warren and Forest Counties. Valleys are also frequently cold, but intermittent thaws preclude a long-lasting snow cover. Summers are fairly warm on mountain slopes and very warm, with occasional very hot days, in the valleys. Rainfall is evenly distributed during the year, but it is appreciably heavier on the windward, west-facing slopes than it is in the valleys. Normal annual precipitation is adequate for all crops; however, summer temperature and growing season length, particularly at higher elevations, can be inadequate.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Warren, Pennsylvania, for the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 28 degrees F, and the average daily minimum temperature is 19 degrees. The lowest temperature on record, which occurred at Warren on February 2, 1961, is -21 degrees. In summer the average temperature is 68 degrees, and the average daily maximum temperature is 81 degrees. The highest recorded temperature, which occurred on September 2, 1953, is 100 degrees.

Growing degree days, shown in Table 1, 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 (40 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 43 inches. Of this, 24 inches, or 56 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 16 inches. The heaviest 1-day rainfall during the period of record was 4.66 inches at Warren on October 16, 1954. Thunderstorms occur on about 36 days each year, and most occur in summer.

Average seasonal snowfall is 74 inches. The greatest snow depth at any one time during the period of record was 21 inches. On the average, 39 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 65 percent, humidity is higher at night, and the average at dawn is about 80 percent. The percentage of possible sunshine is 70 in summer and 40 in winter. The prevailing wind is from the southwest. Average windspeed is highest, 12 miles per hour, in winter.

Heavy rains, which occur at any time of the year, and severe thunderstorms in summer sometimes cause flash flooding, particularly in narrow valleys.

Climatic data for this section were especially prepared for the Soil Conservation Service by the National Climatic Center, Asheville, North Carolina.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers and woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

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

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

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

The boundaries of the map units on the General Soil Map of Warren and Forest Counties do not consistently match those of adjoining counties. These discrepancies exist because of the design of the legend, changes in the concepts of individual series, and different proportions of a series in each county. Adjacent areas in individual counties join similar kinds of soil.

soil descriptions

dominantly deep and moderately deep soils that formed in residual and colluvial materials

The soils that make up these map units are mostly deep and well drained through somewhat poorly drained. Some of the soils, however, are moderately deep and well drained. The soils are mostly on hillsides and sloping areas on plateaus. The map units in this group are mostly in woodland.

1. Hazleton-Cookport-Cavode

Deep, well drained through somewhat poorly drained, mainly sloping and moderately steep soils that formed in materials weathered dominantly from acid sandstone and shale

This map unit consists of broad plateaus that are dissected by major drainageways (fig. 2). These soils are mostly sloping and moderately steep, but the map unit includes nearly level and gently sloping soils and some steep and very steep escarpments.

This map unit makes up about 22 percent of the survey area. It is about 54 percent Hazleton soils, 17 percent Cookport soils, and 8 percent Cavode soils. The rest is minor soils.

The Hazleton soils are on hilltops and hillsides. They are deep and well drained.

The Cookport soils are on broad benches and hillsides. They are deep and moderately well drained, have a fragipan at a depth of 16 to 27 inches, and have a seasonal high water table at a depth of 18 to 36 inches.

The Cavode soils are on broad, upland ridgetops and benches. They are deep and somewhat poorly drained. A seasonal high water table is at a depth of 6 to 18 inches.

Minor soils are the well drained Gilpin soils and the moderately well drained Wharton and Ernest soils on uplands. Poorly drained Brinkerton soils are in depressions and along minor drainageways and poorly drained and very poorly drained Wayland soils are along the larger streams.

About three-fourths of this map unit is in woodland. Some areas are being used for farming, and a few small areas are being used for home site developments. Most cleared areas are suited to farming or reforestation.

The major limitations for urban uses are large stones on the surface, the seasonal high water table, slow permeability, and slope.

2. Cavode-Ernest-Gilpin

Deep and moderately deep, somewhat poorly drained through well drained, mainly sloping and moderately steep soils that formed in materials weathered dominantly from acid shale and sandstone

This map unit consists of areas of hilly soils that are strongly dissected by minor drainageways. These soils are mostly sloping and moderately steep; however, some are gently sloping.

This map unit makes up about 6 percent of the survey area. It is about 49 percent Cavode soils, 24 percent Ernest soils, and 12 percent Gilpin soils. The rest is minor soils.

The sloping Cavode soils are on broad, upland ridgetops and on benches. They are deep and somewhat poorly drained. A seasonal high water table is at a depth of 6 to 18 inches.

The sloping Ernest soils are on foot slopes and in drainageways. They are deep and moderately well

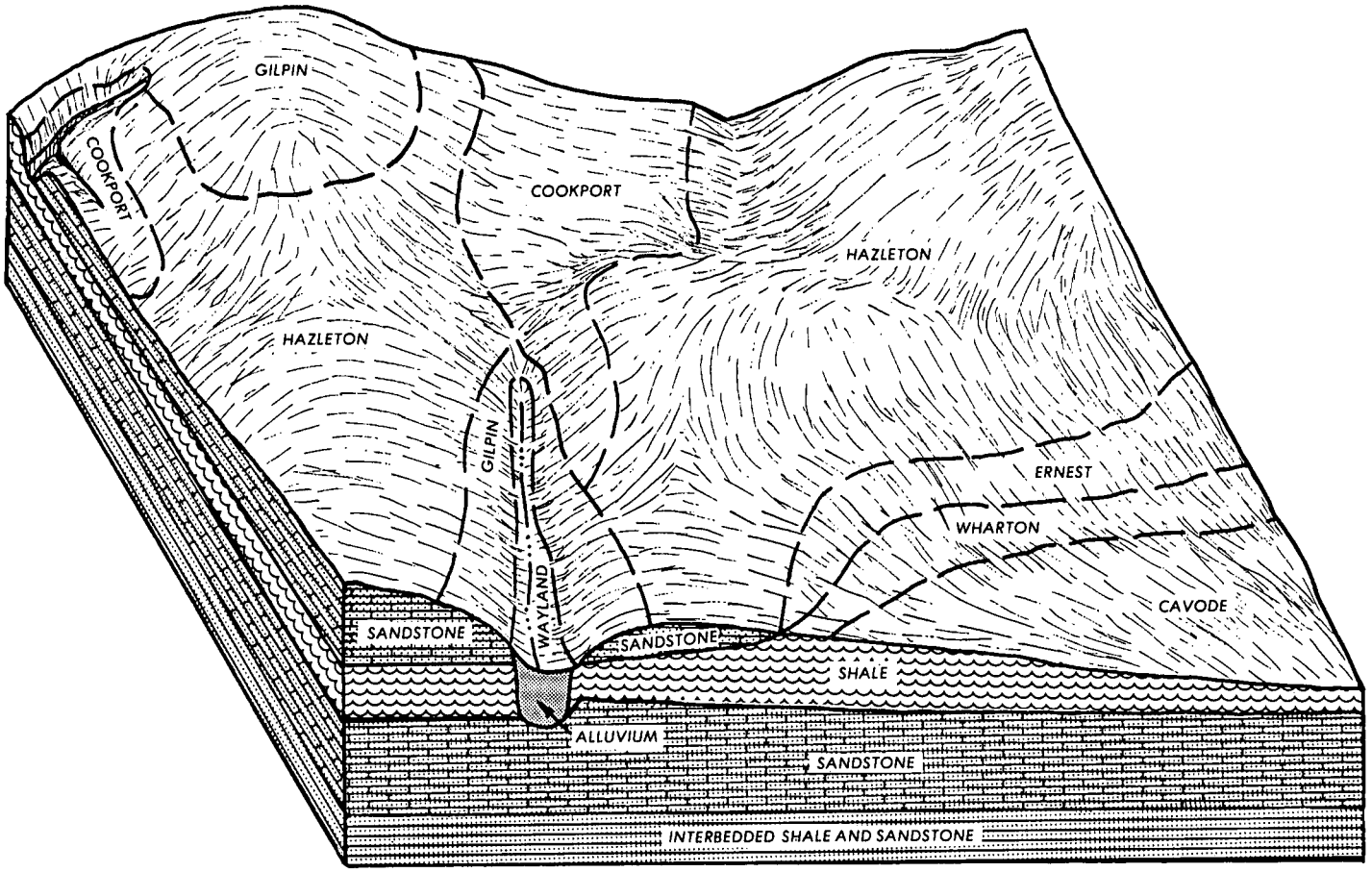


Figure 2.—Typical landscape and underlying material of the Hazleton-Cookport-Cavode map unit.

drained. They have a fragipan at a depth of 20 to 30 inches and a seasonal high water table at a depth of 18 to 36 inches.

The sloping to moderately steep Gilpin soils are on hillsides. They are moderately deep and well drained. Bedrock is at a depth of 20 to 40 inches.

Minor soils are the well drained Hazleton soils and the moderately well drained Cookport and Wharton soils on uplands and the poorly drained Brinkerton soils on foot slopes.

About one-half of this map unit has been cleared, and one-half is in woodland. Most of the cleared land is now idle, but a few small areas are being used for farming and homesite development. The soils in the cleared areas are moderately suited to cultivated crops. These soils are suited to trees.

The major limitations for urban uses are slow permeability, a seasonal high water table, slope, and moderate depth to bedrock.

3. Ernest-Wharton-Gilpin

Deep and moderately deep, moderately well drained and well drained, mainly sloping to moderately steep soils that formed in materials weathered from acid shale, siltstone, and sandstone

This map unit consists of areas of hilly soils that are dissected by minor drainageways. These soils are mostly sloping to moderately steep; however, some are gently sloping, and others are steep.

This map unit makes up about 5 percent of the survey area. It is about 59 percent Ernest soils, 25 percent Wharton soils, and 11 percent Gilpin soils. The rest is minor soils.

The Ernest soils are on foot slopes and in drainageways. They are deep and moderately well drained. They have a fragipan at a depth of 20 to 30 inches and a seasonal high water table at a depth of 18 to 36 inches.

The sloping Wharton soils are on hilltops. They are deep and moderately well drained. A seasonal high water table is at a depth of 18 to 36 inches.

The sloping to steep Gilpin soils are on hillsides. They are moderately deep and well drained. Bedrock is at a depth of 20 to 40 inches.

Minor soils are the well drained Hazleton soils and the moderately well drained Cookport soils on uplands and the poorly drained Brinkerton soils on foot slopes.

Most of this map unit is in woodland. A few small areas have been cleared, but most are reverting to forest. Several hundred acres are used for general farming. The soils are moderately suited to cultivated crops and to trees.

The major limitations for urban uses are the slow permeability, the seasonal high water table, the slope, and the moderate depth to bedrock.

4. Gilpin-Cavode-Ernest

Moderately deep and deep, well drained through somewhat poorly drained, mainly sloping to very steep soils that formed in materials weathered from acid shale and sandstone

This map unit consists of areas of hilly soils that are strongly dissected by minor drainageways. These soils are mostly sloping to very steep, but some are nearly level and gently sloping.

This map unit makes up about 3 percent of the survey area. It is about 39 percent Gilpin soils, 26 percent Cavode soils, and 16 percent Ernest soils. The rest is minor soils.

The sloping to very steep Gilpin soils are on hillsides. They are moderately deep and well drained. Bedrock is at a depth of 20 to 40 inches.

The sloping Cavode soils are on hillsides. They are deep, are somewhat poorly drained, and have a seasonal high water table at a depth of 6 to 18 inches.

The sloping Ernest soils are on foot slopes. They are deep and moderately well drained. They have a fragipan at a depth of 20 to 30 inches and a seasonal high water table at a depth of 18 to 36 inches.

Minor soils are the well drained Hazleton soils, the moderately well drained Cookport soils, and the poorly drained Armagh soils on uplands. Also included are the poorly drained Brinkerton soils on foot slopes and the poorly drained and the very poorly drained Wayland soils in drainageways.

About one-fourth of this map unit was once farmed, but most is now idle or in brush. A few general farms still remain. About three-fourths is in woodland. Private tracts are being subdivided for summer home developments. The soils of this map unit have fair suitability for cultivated crops and are suited to trees. Slope and the hazard of erosion are the major limitations.

The moderate depth to bedrock, the slow permeability, the slope, and the seasonal high water table are the major limitations for urban uses.

5. Cookport-Hazleton-Ernest

Deep, moderately well drained and well drained, mainly gently sloping and sloping soils that formed in materials weathered from acid sandstone and shale

The map unit consists of broad plateaus, which are dissected by small drainageways. These soils are gently sloping and sloping; however, some are nearly level, and others are moderately steep.

This map unit makes up about 19 percent of the survey area. It is about 52 percent Cookport soils, 21 percent Hazleton soils, and 9 percent Ernest soils. The rest is minor soils.

The Cookport soils are on hillsides. They are deep and moderately well drained. They have a fragipan at a depth of 16 to 27 inches and a seasonal high water table at a depth of 18 to 36 inches.

The Hazleton soils are on hilltops. They are deep and well drained.

The Ernest soils are on foot slopes. They are deep and moderately well drained. They have a fragipan at a depth of 20 to 30 inches and a seasonal high water table at a depth of 18 to 36 inches.

Minor soils are the well drained Gilpin soils on hilltops, the poorly drained Brinkerton soils in depressions and on foot slopes, and the poorly drained and very poorly drained Wayland soils in drainageways.

About one-tenth of this map unit was once cleared, but almost none is now used for farming. This tenth of the map unit is reverting to brush and woodland. The remainder of the map unit is in woodland. Much of the privately owned land has been sold in one-half acre to several-acre plots for second homes. The soils that are relatively free of stone cover are moderately suited to cultivated crops. The major soils are well suited to trees.

The major limitations for urban uses are the seasonal high water table, the slow permeability, and the stones on the surface.

6. Hazleton-Gilpin-Ernest

Moderately deep and deep, well drained and moderately well drained, mainly sloping, steep, and very steep soils that formed in materials weathered from acid shale and sandstone

This map unit consists dominantly of valley sides along major rivers and creeks. These soils are mostly sloping, steep, and very steep. There are also minor areas of nearly level and gently sloping, narrow flood plains and terraces along the streams.

This map unit makes up 12 percent of the survey area. It is about 49 percent Hazleton soils, 37 percent Gilpin soils, and 7 percent Ernest soils. The rest is minor soils.

The Hazleton soils are on the upper part of the valley sides. They are deep and well drained.

The Gilpin soils are on the lower part of the valley sides. They are moderately deep and well drained.

The Ernest soils are on foot slopes. They are deep and moderately well drained. They have a fragipan at a depth of 20 to 30 inches and a seasonal high water table at a depth of 18 to 36 inches.

Minor soils are the poorly drained Brinkerton soils on foot slopes. The poorly drained and very poorly drained

Wayland soils, the poorly drained Atkins soils, and the moderately well drained Philo soils are on the flood plains. The moderately well drained Braceville soils, the poorly drained and somewhat poorly drained Rexford soils, and the well drained Chenango soils are on the terraces.

Nearly all the soils in this map unit are wooded. Trees grow well. There is some farming on the widely separated flood plain, terraces, and more gently sloping foot slopes. Most of this map unit, however, is too steep for farming. Several small villages are on the terraces. Hunting camps and summer homes are relatively common on the foot slopes.

The slope, the moderately slow permeability in the Ernest soils, and the stoniness are the major limitations for urban uses.

dominantly deep soils that formed in glacial till

The soils that make up these map units are mostly deep and somewhat poorly drained and moderately well drained. Some of the soils, however, are deep and poorly drained. The soils are dominantly on broad plateaus, but some are on hills. The map units in this group are mostly in woodland.

7. Venango-Mardin-Lordstown

Deep and moderately deep, somewhat poorly drained through well drained, mainly gently sloping soils that formed in Wisconsin glacial till

This map unit is only in Warren County. It is on broad upland plateaus and on hilltops and hillsides. Minor drainageways dissect the areas of this map unit, and major drainageways separate them. These soils are mostly gently sloping; however, some are sloping or nearly level, and others are steep.

This map unit makes up 13 percent of the survey area. It is about 51 percent Venango soils, 34 percent Mardin soils, and 6 percent Lordstown soils. The rest is minor soils.

The Venango soils are on the top of broad plateaus and on the upper and lower part of hillsides. They are deep and somewhat poorly drained. They have a fragipan starting at a depth of 14 to 28 inches and a seasonal high water table at a depth of 6 to 18 inches.

The Mardin soils are on broad plateaus and the middle part of side slopes. They are deep and moderately well drained. They have a fragipan at a depth of 14 to 26 inches and a seasonal high water table at a depth of 18 to 36 inches.

The Lordstown soils are on hilltops and hillsides. They are moderately deep and well drained.

Minor soils are the well drained Wooster soils on terminal moraines. The poorly drained and very poorly drained Chippewa soils are in depressions and are nearly level in heads of drainageways.

About one-third of the land in this association has been cleared and is used for dairy farming. The balance is in woodland. The soils are moderately suited to well suited to general farm crops. Soils of this association are well suited to trees.

The seasonal high water table, the slow permeability, and the moderate depth to bedrock are the major limitations for urban uses.

8. Hanover-Alvira-Shelmadine

Deep, well drained through poorly drained, mainly gently sloping and sloping soils that formed in pre-Wisconsin glacial till

This map unit is on broad plateaus and undulating to rolling, low hills. It has a few, major drainageways (fig. 3). These soils are mostly gently sloping and sloping; however, some are moderately steep or steep, and others are nearly level.

This map unit makes up 9 percent of the survey area. It is about 42 percent Hanover soils, 35 percent Alvira soils, and 4 percent Shelmadine soils. The rest is minor soils.

The Hanover soils are mostly on hilly sides. They are deep and moderately well drained and well drained. They have a fragipan at a depth of 16 to 30 inches and a seasonal high water table at a depth of 18 to 36 inches.

The Alvira soils are on plateaus and hillsides. They are deep and somewhat poorly drained. They have a fragipan at a depth of 16 to 28 inches and a seasonal high water table at a depth of 6 to 18 inches.

The Shelmadine soils are mostly on upland flats and in depressions, along drainageways, and on foot slopes. They are deep and poorly drained. They have a fragipan at a depth of 18 to 30 inches and a seasonal high water table at a depth of 0 to 6 inches.

Minor soils are the deep, well drained Hazleton soils and the moderately deep, well drained Lordstown soils on the steep slopes. The well drained Pope soils, the moderately well drained Philo soils, and the poorly drained and very poorly drained Wayland soils are along the drainageways.

About one-fourth of the land in this map unit was once cleared, but much of this is now idle and is reverting to forest. Very little farming is now being done. Some land has been divided into small tracts and is being used for hunting camps and development of second homes. The remainder of the map unit is in woods. The soils are moderately suited to general farm crops. Soils of this map unit are well suited to trees.

The seasonal high water table and the slow permeability are the major limitations for most urban uses of these soils.

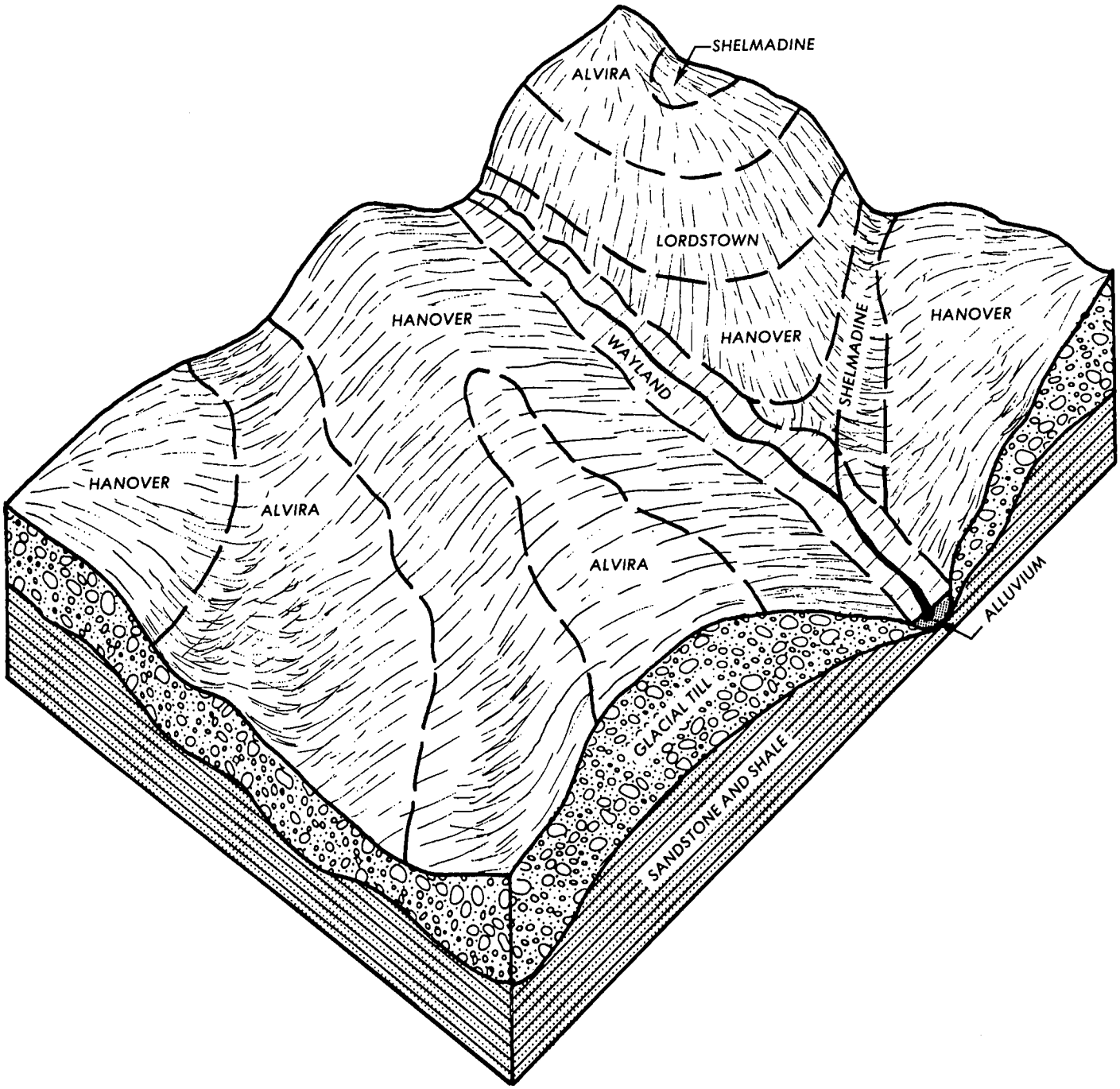


Figure 3.—Typical landscape and underlying material of the Hanover-Alvira-Shelmadine map unit.

9. Alvira-Lordstown-Shelmadine

Deep and moderately deep, poorly drained, somewhat poorly drained and well drained, mainly gently sloping to moderately steep soils that formed in pre-Wisconsin glacial till

This map unit is only in Warren County. It is on high hills that have relatively narrow, convex tops and long, uniform sides. It has a few drainageways. Most of these soils are gently sloping to moderately steep; however, some are nearly level and others are steep.

This map unit makes up 5 percent of the survey area.

It is about 35 percent Alvira soils, 23 percent Lordstown soils, and 18 percent Shelmadine soils. The rest is minor soils.

The Alvira soils are on hillsides. They are deep and somewhat poorly drained. They have a fragipan at a depth of 16 to 28 inches and a seasonal high water table at a depth of 6 to 18 inches.

The Lordstown soils are on hillsides. They are moderately deep and well drained.

The Shelmadine soils are mostly on hilltops and the lower part of foot slopes. They are deep and poorly drained. They have a fragipan at a depth of 18 to 30 inches and a high water table at a depth of 0 to 6 inches.

Minor soils are the poorly drained and very poorly drained Wayland soils along the drainageways. The well drained Hazleton soils and the moderately well drained Cookport soils are on several, higher knobs.

Most of this map unit is wooded. The few, small, widely separated farmed areas are mostly in pasture and hay. Summer homes and hunting camps are widely dispersed over the area. Soils in cleared areas are moderately suited to farming. The soils are well suited to trees.

The seasonal high water table, the slow permeability, and the moderate depth to bedrock are the major limitations for most urban uses.

soils that formed in glacial outwash and alluvial materials

The soils that make up this map unit are mostly deep and are very poorly drained, poorly drained, and well drained. Some of the soils, however, are deep and moderately well drained. The soils are on flood plains and terraces. The map unit in this group is mostly farmed. Some areas are used for cities and industry.

10. Wayland-Chenango-Braceville

Deep, very poorly drained through well drained, mainly nearly level and gently sloping soils that formed in water-deposited materials derived from acid sandstone and shale

This map unit is in valleys, mainly in the northern part of Warren County. It is on flood plains and terraces adjacent to major streams.

This map unit makes up 6 percent of the survey area. It is about 27 percent Wayland soils, 15 percent Chenango soils, and 10 percent Braceville soils. The rest is minor soils.

The Wayland soils are on the flood plains. They are deep and very poorly drained and poorly drained. They have a high water table at or near the surface.

The Chenango soils are on terraces that are above flood level. They are deep and well drained.

The Braceville soils are on terraces that are above flood level. They are deep and moderately well drained. They have a fragipan at a depth of 15 to 30 inches and a seasonal high water table at a depth of 18 to 36 inches.

Minor soils are the poorly drained and somewhat poorly drained Rexford soils on terraces; the well drained Pope soils, the moderately well drained Philo soils, and the poorly drained Atkins soils on flood plains; and Medihemists and Medisaprists in old lake beds.

Most of this map unit is farmed or used for urban and industrial purposes. Most cash crops of Warren County are produced on the soils of this map unit. Flooding of the lower lying soils is common, and these soils are generally idle or used for pasture. Wooded areas are small. The flooding, the seasonal high water table, and the slow permeability are the major limitations if these soils are farmed.

The flooding, the high water table of the Wayland soils, the seasonal high water table of the Braceville soils, and the slow permeability are the major limitation for urban uses.

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 underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, 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, Alvira very stony silt loam, 0 to 15 percent slopes, is one of several phases in the Alvira series.

Some map units are made up of two or more major soils. These map units are called undifferentiated groups.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in a mapped area are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Medihemists and Medisaprists, ponded, is an undifferentiated group in this survey area.

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 for each county. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

soil descriptions

AaA—Alvira silt loam, 0 to 3 percent slopes. This deep soil is nearly level and somewhat poorly drained. It is on broad uplands. Slopes are uniform and nearly flat and are 300 to 1,000 feet long. Individual areas are irregular in shape and are 5 to 30 acres.

Typically, the surface layer is very dark gray silt loam about 1 inch thick. The subsurface layer is brown silt loam to a depth of 7 inches. The subsoil extends to a depth of 60 inches. The upper 14 inches is mottled yellowish brown silt loam and light brownish gray silty clay loam. The lower 39 inches is a fragipan of mottled grayish brown and brown, very firm and brittle silty clay loam and channery loam.

Included with this soil in mapping are small areas of Shelmadine soils and the stony Alvira soils. Inclusions make up about 5 percent of the unit.

This Alvira soil has slow permeability in the fragipan layer, moderate available water capacity, and a seasonal high water table at a depth of 6 to 18 inches. Surface runoff is slow. Rooting depth is restricted by the fragipan and by the seasonal high water table. In unlimed areas reaction is extremely acid to strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is moderately suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is slight. The seasonal high water table causes the soil to warm slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage.

This soil is suited to pasture during drier periods. When the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, and most of the acreage is wooded. Potential productivity of the soil is moderately high. Rooting depth is restricted by the fragipan and by the seasonal high water table. Equipment use is restricted during wet seasons. Planting by machine is practical in the larger areas.

The slow permeability of the fragipan and the seasonal high water table are major limitations for most urban uses, especially for onsite sewage disposal.

This soil is in capability subclass IIIw and has a woodland ordination symbol of 3w.

AaB—Alvira silt loam, 3 to 8 percent slopes. This deep soil is gently sloping and somewhat poorly drained. It is on broad uplands. Slopes are uniform and smooth and are 200 to 500 feet long. Individual areas of this soil are irregular in shape and are 5 to 40 acres.

Typically, the surface layer is very dark gray silt loam about 1 inch thick. The subsurface layer is brown silt loam to a depth of 7 inches. The subsoil extends to a depth of 60 inches. The upper 14 inches is mottled yellowish brown silt loam and light brownish gray silty clay loam. The lower 39 inches is a fragipan of mottled grayish brown and brown, very firm and brittle silty clay loam and channery loam.

Included with this soil in mapping are small areas of Shelmadine soils, Hanover soils, and the stony Alvira soils. Inclusions make up about 5 percent of the unit.

This Alvira soil has slow permeability in the fragipan, moderate available water capacity, and a seasonal high water table at a depth of 6 to 18 inches. Surface runoff is moderate. Rooting depth is restricted by the fragipan and by the seasonal high water table. In unlimed areas reaction is extremely acid to strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is moderately suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is moderate. Contour stripcropping, minimum tillage, grassed waterways, use of cover crops, and the inclusion of grasses and legumes in the cropping system are practices that help reduce runoff and control erosion. Diverisons and subsurface drains are needed to help remove excess water and allow timely tillage.

This soil is suited to pasture during drier periods. When the soil is used for pastures, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, and most of the acreage is wooded. Poterıtial productivity of the soil is moderately high. Rooting depth is restricted by the fragipan and by the seasonal high water table. Equipment use is restricted during wet seasons. Planting by machine is practical in the larger areas.

The slow permeability of the fragipan and the seasonal high water table are major limitations for most urban uses, especially for onsite sewage disposal.

This soil is in capability subclass IIIw and has a woodland ordination symbol of 3w.

AaC—Alvira silt loam, 8 to 15 percent slopes. This deep soil is sloping and somewhat poorly drained. It is on side slopes of glaciated ridges and plateaus. Slopes are uniform and smooth and are 200 to 500 feet long. The areas of this soil are irregular in shape and normally range from 5 to 50 acres.

Typically, this soil has a surface layer of very dark gray silt loam about 1 inch thick. The subsurface layer is brown silt loam to a depth of 7 inches. The subsoil extends to a depth of 60 inches. The upper 14 inches is mottled yellowish brown silt loam and light brownish gray silty clay loam. The lower 39 inches is a fragipan of mottled grayish brown and brown, very firm and brittle silty clay loam and channery loam.

Included with this soil in mapping are small areas of Shelmadine and Hanover soils and scattered areas of the stony Alvira soil. Inclusions make up about 5 percent of the unit.

This Alvira soil has slow permeability in the fragipan, moderate available water capacity, and a seasonal high water table at a depth of 6 to 18 inches. Surface runoff is moderately rapid. Rooting depth is restricted by the seasonal high water table and by the fragipan. Reaction is extremely acid to strongly acid throughout in unlimed areas.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is moderately suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is severe. Excess water causes the soil to warm slowly in the spring. Contour stripcropping, minimum tillage, grassed waterways, and cover crops are some practices that can be used to control runoff and erosion. Excess surface water can be drained away more readily by keeping natural drainageways open. Diversions and subsurface drains are needed to help remove excess water and allow for timely tillage.

The soil is suited to permanent pasture. Prevention of overgrazing and prevention of grazing when the soil is wet are major concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are the chief

management needs to maintain major plant species. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to growing trees and nearly all of the acreage is wooded. Potential productivity of the soil is moderately high. Rooting depth is restricted by the seasonal high water table and by the fragipan. Equipment use is restricted in early spring and during other wet periods because of the seasonal high water table. Planting by machine is practical in the larger areas.

The slow permeability of the fragipan and the seasonal high water table are major limitations for most urban uses, especially for onsite sewage disposal.

This soil is in capability subclass IIIe and has a woodland ordination symbol of 3w.

AbC—Alvira very stony silt loam, 0 to 15 percent slopes. This deep soil is somewhat poorly drained and nearly level to sloping. It is on broad, glaciated plateaus and ridges. Slopes are uniform and smooth and are 100 to 500 feet in length. The areas are irregular in shape and normally range from 5 to 100 acres. Large stones cover about 3 to 15 percent of the surface area.

Typically, this soil has a surface layer of very dark gray silt loam about 1 inch thick. The subsurface layer is brown silt loam to a depth of 7 inches. The subsoil extends to a depth of 60 inches. The upper 14 inches is mottled yellowish brown silt loam and light brownish gray silty clay loam. The lower 39 inches is a fragipan of mottled, grayish brown and brown, very firm and brittle silty clay loam and channery loam.

Included with this soil in mapping are some areas of the nonstony Alvira and Hanover soils and the very stony Hanover soils. Included areas make up about 10 percent of the unit.

This Alvira soil has slow permeability in the fragipan and moderate available water capacity. It has a seasonal high water table within 6 to 18 inches of the surface in the spring and during other wet periods. Surface runoff is slow to moderately rapid. Rooting depth is rerstricted by the fragipan and by the seasonal high water table. Reaction is extremely acid to strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for recreation.

This soil is not being used for cultivated crops or for pasture because of the large stones on the surface. Removing the trees and surface stones to cultivate crops or pasture is usually not feasible because of the expense involved.

This soil is suited to trees, and most acreage is wooded. Potential productivity of the soil is moderately high. Rooting depth is restricted by the fragipan and by the seasonal high water table. Removal of undesirable species is a management practice that helps increase production. Use of equipment is restricted for a part of the year because of the high water table. Large stones on the surface can interfere with harvesting and planting seedlings.

This soil has major limitations for most urban uses because of the seasonal high water table, the slow permeability in the fragipan, and the very stony surface.

This soil is in capability subclass VIs and has a woodland ordination symbol of 3w.

AgB—Armagh silt loam, 0 to 8 percent slopes. This deep soil is nearly level and gently sloping and is poorly drained. It is in depressions and on benches of broad uplands not subjected to glacial action. Slopes are uniform and smooth and are 100 to 400 feet long. Areas are oval and are 5 to 50 acres.

Typically, the surface layer is very dark gray silt loam about 5 inches thick. The mottled subsoil extends to a depth of 48 inches. The upper 14 inches is light brownish gray silt loam and gray silty clay loam. The lower 29 inches is olive gray silty clay loam. The substratum is mottled olive gray shaly silty clay loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Cavode soils and the stony Armagh soils. Inclusions make up about 15 percent of the unit.

This Armagh soil has slow permeability, moderate to high available water capacity, and a high water table at a depth of 0 to 6 inches. Surface runoff is slow to medium. Rooting depth is restricted by the high water table. In unlimed areas reaction is very strongly acid or strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for recreation or are idle.

This soil is poorly suited to moderately suited to cultivated crops, and only a small acreage is cultivated. The erosion hazard is slight to moderate. The high water table causes the soil to warm slowly in the spring. Surface and subsurface drains are needed to help excess water and allow for timely tillage. Stripcropping, diversions, grassed waterways, and cover crops can be used to control erosion.

This soil is suited to pasture during drier periods. If the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation of pasture, deferred grazing, and restricted grazing during wet periods are suitable management practices. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, and most of the acreage is wooded (fig. 4). Potential productivity of the soil is moderately high. Rooting depth is restricted by the high water table. Equipment use is restricted during wet seasons.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the slow permeability and the high water table.

This soil is in capability subclass IVw and has a woodland ordination symbol of 3w.

Figure 4.—Typical woodland vegetation in an area of Armagh silt loam, 0 to 8 percent slopes.

AhB—Armagh very stony silt loam, 0 to 8 percent slopes. This deep soil is poorly drained and is nearly level and gently sloping. It is in depressions and on benches of broad uplands not subjected to glacial action. Slopes are uniform and smooth and are 100 to 400 feet in length. The areas are oval and normally range from 5 to 50 acres. Large stones cover about 3 to 15 percent of the surface area.

Typically, the surface layer is very dark gray silt loam about 5 inches thick. The mottled subsoil extends to a depth of 48 inches. The upper 14 inches is light brownish gray silt loam and gray silty clay loam. The lower 29 inches is olive gray silty clay loam. The substratum is mottled olive gray, shaly silty clay loam to a depth of 60 inches.

Included with this soil in mapping are some areas of the non stony Armagh and the Cavode soils and the very stony Cavode soils. Inclusions make up about 15 percent of the unit.

This Armagh soil has slow permeability and moderate to high available water capacity. Where unlimed, this soil is very strongly acid or strongly acid throughout. The soil has numerous large stones on the surface, and a high water table is within 0 to 6 inches of the surface during wet seasons. Surface runoff is slow to medium. Rooting depth is restricted by the high water table.

Most areas of this soil are used for woodland. A few areas are used for recreation.

This soil is not being used for cultivated crops or for pasture because of the large stones on the surface. Removing the trees and surface stones and reducing the water table to cultivate crops or pasture is usually not feasible because of the expense involved.

This soil is suited to trees, and most acreage is wooded. Potential productivity of the soil is moderately high. Rooting depth is restricted by the high water table. Removal of undesirable species is a management practice that helps increase production. Equipment use is restricted for a major part of the year because of the high water table. Large stones on the surface interfere with harvesting and planting seedlings.

This soil has serious limitations for most urban uses because of the high water table, the slow permeability, and the very stony surface.

This soil is in capability subclass VIIs and has a woodland ordination symbol of 3w.

At—Atkins silty clay loam. This deep soil is poorly drained and nearly level. It is on first bottoms of flood plains that are along larger streams. Slopes are nearly flat to slightly concave and range from 0 to 3 percent. The areas are long and narrow and normally range from 5 to 40 acres.

Typically, this soil has a surface layer of dark gray silty clay loam about 8 inches thick. The subsoil extends to a depth of 42 inches. It is mottled olive gray, dark gray, and gray silty clay loam. The substratum is mottled light brownish gray very gravelly loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Wayland, Philo, and Pope soils. Inclusions make up about 10 percent of the unit.

This Atkins soil is slowly permeable and has a high available water capacity. Where this soil is unlimed, reaction is very strongly acid or strongly acid throughout. The soil has a high water table at or near the surface for a major part of the year. Surface runoff is slow. Rooting depth is restricted by the high water table.

Most areas of this soil are used for woodland or pasture. A few areas are used for farming or recreation, or they are idle.

When properly drained, Atkins silty clay loam can be used for row crops. There is a slight hazard of erosion. Excess water causes the soil to warm slowly in the spring. Keeping natural drainageways open and installing open channels, where outlets are available, can be used to remove excess water. Crops can be damaged by floodwaters following intense rainfall.

This soil is moderately suited to pasture. Prevention of grazing when the soil is wet and prevention of overgrazing are major concerns of pasture management. If the pasture is grazed when the soil is wet, the surface layer of the soil becomes compacted. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used to maintain major plant species. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to moisture-tolerant trees. About one-half of the areas are wooded. Potential productivity of the soil for trees is very high. Rooting depth is restrictred by the high water table. Equipment use is restricted for a major part of the year because of the high water table and the flooding when streams oveflow. Planting by machine in the larger areas is practical.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the high water table, the slow permeability, and the flooding.

This soil is in capability subclass IIIw and has a woodland ordination symbol of 1w.

BcB—Braceville gravelly silt loam, 0 to 8 percent slopes. This deep soil is nearly level and gently sloping and is moderately well drained. It is on glacial outwash terraces. Slopes are smooth and are 100 to 400 feet long. Individual areas are rectangular and are 5 to 100 acres.

Typically, the surface and subsurface layers are dark brown and dark yellowish brown gravelly silt loam about 10 inches thick. The subsoil extends to a depth of 35 inches. The upper 9 inches is brown gravelly silt loam. The next 16 inches is a fragipan of mottled dark yellowish brown and brown gravelly loam. The substratum is grayish brown, stratified sand and gravel to a depth of 60 inches.

Included with this soil in mapping are small areas of Chenango and Rexford soils. Inclusions make up about 10 percent of the unit.

This Braceville soil has moderately slow and slow permeability in the fragipan and moderate available water capacity. Surface runoff is slow to medium. Rooting depth is restricted by the fragipan and by the seasonal high water table, which is at a depth of 18 to 36 inches. In unlimed areas the reaction is very strongly acid to medium acid above the fragipan and strongly acid to slightly acid in the fragipan and in the substratum.

Most areas of this soil are used for farming. A few areas are used for woodland or recreation, or they are idle.

This soil is well suited to cultivated crops, and most of the acreage is cultivated. The erosion hazard is slight to moderate. The seasonal high water table causes the soil to warm slowly in the spring. Surface and subsurface drains are needed to remove excess water and allow for timely tillage. Contour stripcropping, diversion terraces, grassed waterways, and cover crops help reduce runoff and control erosion.

This soil is well suited to pasture. When this soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are the chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is well suited to trees, but a very small acreage is wooded. Potential productivity of the soil for trees is high. Rooting depth is restricted by the fragipan and by the seasonal high water table. Planting by machine is practical in the larger areas.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of moderately slow and slow permeability in the fragipan and the seasonal high water table.

This soil is in capability subclass IIw and has a woodland ordination symbol of 2o.

BkB—Brinkerton silt loam, 0 to 8 percent slopes. This deep soil is nearly level and gently sloping and is poorly drained. It is on foot slopes that have not been subjected to glacial action. Slopes are concave and smooth and are 100 to 600 feet long. Individual areas are irregular in shape and are 5 to 40 acres.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil extends to a depth of 44 inches. The upper 21 inches is mottled light brownish gray and gray silty clay loam. The lower 16 inches is a fragipan of mottled gray, very firm and brittle channery silty clay loam. The substratum is gray channery silt loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Ernest soils and the very stony Brinkerton soil. Inclusions make up about 10 percent of the unit.

This Brinkerton soil has slow permeability in the fragipan and moderate available water capacity. Surface

runoff is slow to medium. Rooting depth is restricted by the fragipan and by the high water table that is within 6 inches from the surface. In unlimed areas reaction is very strongly acid to medium acid in the surface layer and subsoil and strongly acid or medium acid in the substratum.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

If adequately drained, this soil is moderately suited to cultivated crops. Only a small acreage is cultivated. The erosion hazard is slight to moderate. Because of the high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to remove excess water and allow for timely tillage. Contour stripcropping, diversion terraces, grassed waterways, and minimum tillage help control erosion.

This soil is suited to pasture during drier periods. When the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, and most of the acreage is wooded. Potential productivity of this soil for trees is high. Rooting depth is restricted by the fragipan and by the high water table (fig. 5). Equipment use is restricted during wet seasons. Planting by machine is practical in the larger areas.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the slow permeability and the high water table.

This soil is in capability subclass IVw and has a woodland ordination symbol of 2w.

BnB—Brinkerton very stony silt loam, 0 to 8 percent slopes. This deep soil is poorly drained and is nearly level and gently sloping. It is on foot slopes that have not been subjected to glacial action. Slopes are concave and smooth and are 200 to 600 feet long. The areas are irregular in shape and normally range from 5 to 60 acres. Large stones cover about 3 to 15 percent of the surface.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil extends to a depth of 44 inches. The upper 21 inches is mottled light brownish gray and gray silty clay loam. The lower 16 inches is a fragipan of mottled gray, very firm and brittle channery silty clay loam. The substratum is gray channery silt loam to a depth of 60 inches.

Included with this soil in mapping are some areas of the nonstony Brinkerton soil, the nonstony Ernest soils, and the very stony Ernest soil. Inclusions make up about 10 percent of the unit.

This Brinkerton soil has slow permeability in the fragipan, moderate available water capacity, and a high water table that is within 6 inches of the surface for part of the year. In unlimed areas reaction is very strongly acid to medium acid in the surface layer and subsoil and strongly acid or medium acid in the substratum. Surface runoff is slow to medium. Rooting depth is restricted by the fragipan and by the high water table.

This soil is mostly in woodland. A few areas are used for pasture or recreation, or they are idle.

This soil is not being used for cultivated crops or for improved pasture because of the large stones on the surface. Removing the trees and surface stones and reducing the water table to cultivate crops or pasture is usually not feasible because of the expense involved.

This soil is suited to trees, and most acreage is wooded. Potential productivity of the soil for trees is high. Rooting depth is restricted by the fragipan and by the high water table. Removal of undesirable species is a management practice that helps increase production. Equipment use is restricted for part of the year because of the high water table. Large stones on the surface interfere with harvesting and planting seedlings.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the high water table, the slow permeability, and the very stony surface.

This soil is in capability subclass VIIs and has a woodland ordination symbol of 2w.

Ca—Canadice silt loam. This deep soil is nearly level and poorly drained. It is in old lake beds. Slopes are uniform and smooth and are 300 to 1,000 feet long. Individual areas are irregular in shape and are 20 to 400 acres. Slope ranges from 0 to 3 percent.

Typically, the surface layer is very dark grayish brown silt loam about 3 inches thick. The subsoil extends to a depth of 40 inches. The upper 4 inches is mottled gray silt loam. The lower 33 inches is mottled gray and grayish brown silty clay loam. The substratum is gray and dark gray clay to a depth of 62 inches.

Included with this soil in mapping are small areas of Venango, Chippewa, and Rexford soils and Medihemists and Medisaprists, ponded. Inclusions make up about 10 percent of the unit.

This Canadice soil has very slow permeability and high available water capacity. Surface runoff is slow. Rooting depth is restricted by the high water table, which is 0 to 6 inches from the surface. In unlimed areas reaction is medium acid or slightly acid in the surface layer and upper part of the subsoil, slightly acid or neutral in the lower part of the subsoil, and neutral to moderately alkaline in the substratum.

Most areas of this soil are used for pasture. A few areas are used for woodland or recreation, or they are idle.

This soil is poorly suited to cultivated crops, and only a small acreage is cultivated. The erosion hazard is slight.

Figure 5.—Windthrow is a serious problem on Brinkerton silt loam, 0 to 8 percent slopes, because of the shallow rooting depth, which is caused by the fragipan and high water table.

Because of the high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow timely tillage.

This soil is suited to pasture during drier periods. When the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet,

and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, but very little acreage is wooded. Potential productivity of the soil for trees is low. Rooting depth is restricted by the high water table. Equipment use is restricted during wet seasons. Planting by machine is practical in the larger areas.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of very slow permeability and the high water table.

This soil is in capability subclass IVw and has a woodland ordination symbol of 5w.

CdB—Cavode silt loam, 0 to 8 percent slopes. This deep soil is nearly level and gently sloping and is somewhat poorly drained. It is on broad, upland ridgetops and benches not subjected to glacial action. Slopes are concave and smooth and are 200 to 600 feet long. Individual areas are irregular in shape and are 5 to 80 acres.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsoil extends to a depth of 40 inches. The upper 7 inches is brown and mottled brown silty clay loam. The lower 28 inches is mottled gray silty clay and grayish brown very shaly silty clay. The substratum is mottled grayish brown very shaly silty clay loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Armagh and Wharton soils. Inclusions make up about 10 percent of the unit.

This Cavode soil has slow permeability and high available water capacity. Surface runoff is slow to medium. Rooting depth is restricted by the seasonal high water table, which is within 6 to 18 inches of the surface in wet seasons. In unlimed areas reaction is very strongly acid or strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is moderately suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is slight to moderate. Because of the seasonal high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage. Contour stripcropping, grassed waterways, diversions, and minimum tillage help control erosion.

This soil is suited to pasture during drier periods. When the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is well suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is high. Rooting depth is restricted by the seasonal high water table. Equipment use is restricted during wet seasons. Planting by machine is practical in the larger areas.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the slow permeability, the clayey texture, and the seasonal high water table.

This soil is in capability subclass IIIw and has a woodland ordination symbol of 2w.

CdC—Cavode silt loam, 8 to 15 percent slopes. This deep soil is sloping and somewhat poorly drained. It is on the upper part of hillsides not subjected to glacial action. Slopes are concave and smooth and are 200 to 400 feet long. Individual areas are irregular in shape and are 5 to 40 acres.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsoil extends to a depth of 40 inches. The upper 7 inches is brown and mottled brown silty clay loam. The lower 28 inches is mottled gray silty clay and grayish brown very shaly silty clay. The substratum is mottled grayish brown very shaly silty clay loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Armagh and Wharton soils. Inclusions make up about 10 percent of the unit.

This Cavode soil has slow permeability and high available water capacity. Surface runoff is moderately rapid. Rooting depth is restricted by the seasonal high water table, which is within 6 to 18 inches of the surface in wet seasons. In unlimed areas reaction is very strongly acid or strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is moderately suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is severe. Because of the seasonal high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage. Contour stripcropping, grassed waterways, diversions, and minimum tillage help control erosion.

This soil is suited to pasture during drier periods. When the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is well suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is high. Rooting depth is restricted by the seasonal high water table. Equipment use is restricted during wet

seasons. Planting by machine is practical in the larger areas.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the slow permeability, the clayey texture, and the seasonal high water table.

This soil is in capability subclass IIIe and has a woodland ordination symbol of 2w.

CdD—Cavode silt loam, 15 to 25 percent slopes. This deep soil is moderately steep and somewhat poorly drained. It is on the upper part of hillsides not subjected to glacial action. Slopes are concave and smooth and are 200 to 500 feet long. Areas are irregular in shape and are 5 to 30 acres.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsoil extends to a depth of 40 inches. The upper 7 inches is brown and mottled brown silty clay loam. The lower 28 inches is mottled gray silty clay and grayish brown very shaly silty clay. The substratum is mottled grayish brown very shaly silty clay loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Wharton and Gilpin soils. Inclusions make up about 10 percent of the unit.

This Cavode soil has slow permeability and high available water capacity. Surface runoff is rapid or very rapid. Rooting depth is restricted by the seasonal high water table, which is within 6 to 18 inches of the surface in wet seasons. In unlimed areas reaction is very strongly acid or strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is moderately suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is very severe. Because of the seasonal high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage. Contour stripcropping, grassed waterways, diversions, and long-term grasses and legumes in the cropping system help control erosion.

This soil is suited to pasture during drier periods. If the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is well suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is high. Rooting depth is restricted by the seasonal high water table. Equipment use is restricted by the seasonal high water table and slope. Planting by machine can be a problem because of the moderately steep slopes.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the slow permeability, the clayey textures, the seasonal high water table, and the moderately steep slopes.

This soil is in capability subclass IVe and has a woodland ordination symbol of 2r.

CeC—Cavode very stony silt loam, 0 to 25 percent slopes. This deep soil is nearly level to moderately steep and somewhat poorly drained. It is on ridgetops and the upper part of hillsides not subjected to glacial action. Slopes are smooth and are 200 to 600 feet in length. Individual areas are long and narrow and normally range from 5 to 100 acres. Large stones cover about 3 to 15 percent of surface area.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsoil extends to a depth of 40 inches. The upper 7 inches is brown and mottled brown silty clay loam. The lower 28 inches is mottled gray silty clay and grayish brown very shaly silty clay. The substratum is mottled grayish brown very shaly silty clay loam to a depth of 60 inches.

Included with this soil in mapping are some areas of Wharton and Gilpin soils and the nonstony Cavode soils. Inclusions make up about 10 percent of the unit.

This Cavode soil has slow permeability, high available water capacity, and a seasonal high water table, which is within 6 to 18 inches of the surface for a part of the year. In unlimed areas reaction is very strongly acid or strongly acid throughout. Surface runoff is slow to rapid. Rooting depth is restricted by the seasonal high water table.

This soil is mostly in woodland. A few areas are used for pasture or recreation, or they are idle.

This soil is not being used for cultivated crops or for improved pasture because of the large stones on the surface. Removing the trees and surface stones and reducing the water table to cultivate crops or pasture is not usually feasible because of the expense involved.

This soil is suited to trees, and most acreage is wooded. Potential productivity of the soil for trees is high. Rooting depth is restricted by the seasonal high water table. Removal of undesirable species is a management practice that helps increase production. Equipment use is restricted for part of the year because of the seasonal high water table. Large stones on the surface interfere with harvesting and seeding.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the seasonal high water table, the clayey texture, the slow permeability, and the very stony surface.

This soil is in capability subclass VIs and has a woodland ordination symbol of 2w.

ChA—Chenango gravelly silt loam, 0 to 3 percent slopes. This deep soil is nearly level and well drained. It is on glacial outwash terraces. Slopes are uniform and smooth and are 300 to 600 feet long. Individual areas are irregular in shape and are 5 to 60 acres.

Typically, the surface layer is dark brown gravelly silt loam about 7 inches thick. The subsoil is dark yellowish brown and yellowish brown gravelly loam to a depth of 30 inches. The substratum is dark brown very gravelly coarse sand to a depth of 60 inches.

Included with this soil in mapping are small areas of Braceville and Rexford soils. Inclusions make up about 10 percent of the unit.

This Chenango soil has moderate permeability or moderately rapid permeability in the subsoil and low available water capacity. Surface runoff is slow. Rooting depth extends to 60 inches or more. In unlimed areas the reaction is very strongly acid or strongly acid in the surface layer and subsoil.

Most areas of this soil are used for farming (fig. 6). A few areas are used for woodland or recreation, or they are idle.

This soil is suited to cultivated crops, and most acreage is cultivated. The erosion hazard is slight. During drier years production is reduced because of the low available water capacity.

This soil is suited to pasture. When the soil is used for pasture, prevention of overgrazing and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during long dry periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, but little acreage is wooded. Potential productivity of the soil for trees is high. Management problems are few. Planting by machine is practical in the larger areas.

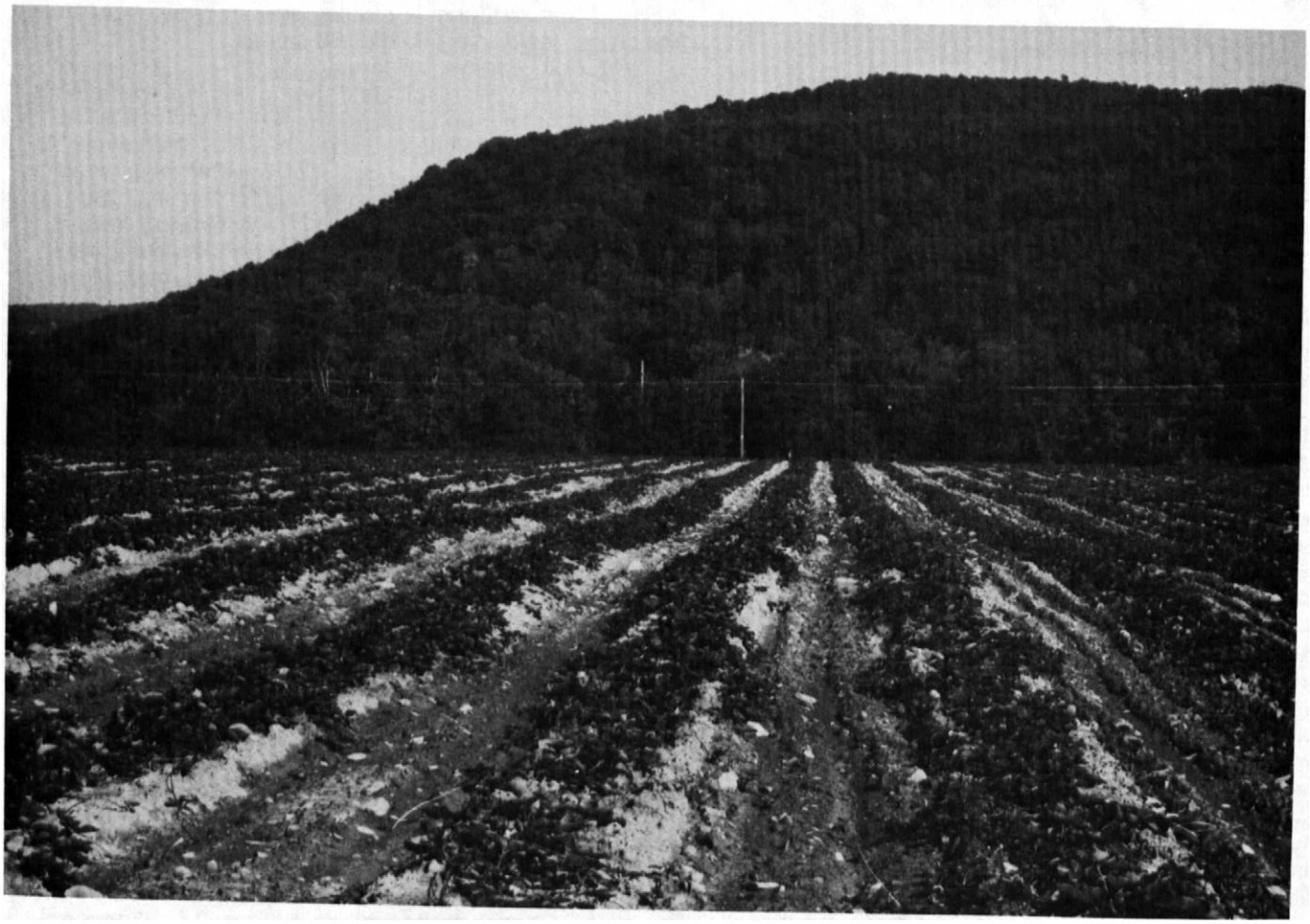


Figure 6.—Crops on Chenango gravelly silt loam, 0 to 3 percent slopes, foreground. Gilpin soils are on the sloping wooded areas, background.

This soil has few limitations for most nonfarm uses. The rapid permeability in the substratum is a limitation for onsite sewage disposal.

This soil is in capability subclass IIs and has a woodland ordination symbol of 2o.

ChB—Chenango gravelly silt loam, 3 to 8 percent slopes. This deep soil is gently sloping and well drained. It is on glacial outwash terraces. Slopes are uniform and smooth and are 300 to 800 feet long. Individual areas are irregular in shape and are 5 to 70 acres.

Typically, the surface layer is dark brown gravelly silt loam about 7 inches thick. The subsoil is dark yellowish brown and yellowish brown gravelly loam to a depth of 30 inches. The substratum is dark brown very gravelly coarse sand to a depth of 60 inches.

Included with this soil in mapping are small areas of Braceville and Rexford soils. Inclusions make up about 10 percent of the unit.

This Chenango soil has moderate permeability or moderately rapid permeability in the subsoil and low available water capacity. Surface runoff is medium. The rooting depth extends to 60 inches or more. In unlimed areas the reaction is very strongly acid or strongly acid in the surface layer and subsoil.

Most areas of this soil are used for farming. A few areas are used for woodland or recreation, or they are idle.

This soil is suited to cultivated crops, and most acreage is cultivated. The erosion hazard is moderate. This soil warms early in the spring but droughtiness can be a problem in midsummer. Contour stripcropping, cover crops, and short-term rotations are needed to control erosion.

This soil is suited to pasture. When the soil is used for pasture, prevention of overgrazing and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during long, dry periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, but little acreage is wooded. Potential productivity of this soil for trees is high. Management problems are few. Planting by machine is practical in the larger areas.

This soil has few limitations for most urban uses. The rapid permeability in the substratum is a limitation for onsite sewage disposal.

This soil is in capability subclass IIs and has a woodland ordination symbol of 2o.

ChC—Chenango gravelly silt loam, 8 to 15 percent slopes. This deep soil is sloping and well drained. It is on glacial outwash terraces. Slopes are uniform and smooth and are 300 to 700 feet long. Individual areas are irregular in shape and are 5 to 60 acres.

Typically, the surface layer is dark brown gravelly silt loam about 7 inches thick. The subsoil is dark yellowish brown and yellowish brown gravelly loam to a depth of 30 inches. The substratum is dark brown very gravelly coarse sand to a depth of 60 inches.

Included with this soil in mapping are small areas of Braceville and Rexford soils. Inclusions make up about 10 percent of the unit.

This Chenango soil has moderate permeability or moderately rapid permeability in the subsoil and low available water capacity. Surface runoff is moderately rapid. Rooting depth extends to 60 inches or more. In unlimed areas the reaction is very strongly acid or strongly acid in the surface layer and subsoil.

Most areas of this soil are used for farming. A few areas are used for woodland or recreation, or they are idle.

This soil is suited to cultivated crops, and most acreage is cultivated. The erosion hazard is severe. This soil warms early in the spring. In drier years production is reduced because of the low available water capacity. Contour stripcropping, diversion terraces, and crop rotations that include small grains, grasses, and legumes are needed to control erosion.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during dry periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, but little acreage is wooded. Potential productivity of the soil for trees is high. Management problems are few, but care is needed during harvesting to avoid erosion of roads. Planting by machine is practical in the larger areas.

This soil has limitations for most urban uses because of slope. The rapid permeabilty in the substratum and the slope are limitations for onsite sewage disposal.

This soil is in capability subclass IIIe and has a woodland ordination symbol of 2o.

ChD—Chenango gravelly silt loam, 15 to 25 percent slopes. This deep soil is moderately steep and well drained. It is on glacial outwash terraces. Slopes are unifrom and smooth and are 100 to 400 feet long. Individual areas are irregular in shape and are 5 to 40 acres.

Typically, the surface layer is dark brown gravelly silt loam about 7 inches thick. The subsoil is dark yellowish brown and yellowish brown gravelly loam to a depth of 30 inches. The substratum is dark brown very gravelly coarse sand to a depth of 60 inches.

Included with this soil in mapping are small areas of Venango and Alvira soils. Inclusions make up about 10 percent of the unit.

This Chenango soil has moderate permeability or moderately rapid permeability in the subsoil and low available water capacity. Surface runoff is rapid. Rooting

depth extends to a depth of 60 inches or more. In unlimed areas the reaction is very strongly acid or strongly acid in the surface layer and subsoil.

Most areas of this soil are used for hay or pasture. A few areas are used for woodland or recreation, or they are idle.

This soil is moderately suited to cultivated crops. The erosion hazard is very severe. This soil warms early in the spring but can be droughty in midsummer. Contour stripcropping, diversion terraces, and long rotations of small grains, grasses, and legumes are needed to control erosion.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during long dry periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, but little acreage is wooded. Potential productivity of the soil for trees is high. Rooting depth extends to a depth of 60 inches or more. Management problems are erosion and equipment limitations. Care is needed to avoid erosion during harvesting. Planting by machine is possible on the less sloping soils.

This soil has limitations for most urban uses, especially for onsite sewage disposal, because of its moderately steep slope and rapid permeability in the substratum.

This soil is in capability subclass IVe and has a woodland ordination symbol of 2r.

CpB—Chippewa silt loam, 0 to 8 percent slopes. This deep soil is nearly level and gently sloping and is poorly drained and very poorly drained. It is on glaciated, broad uplands. Slopes are concave and smooth and are 300 to 1,000 feet long. Individual areas are irregular in shape and are 5 to 100 acres.

Typically, the surface layer is very dark gray silt loam about 6 inches thick. The subsurface layer is mottled dark gray and olive gray channery silt loam to a depth of 16 inches. The subsoil extends to a depth of 40 inches. It is a fragipan of grayish brown, mottled, very firm and brittle channery silt loam. The substratum is grayish brown channery silt loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Venango and Mardin soils. Inclusions make up about 10 percent of the unit.

This Chippewa soil has slow permeability or very slow permeability in the fragipan and substratum. It has low available water capacity and a high water table, which is 0 to 6 inches from the surface. Surface runoff is slow to moderate. Rooting depth is restricted by the fragipan and by the high water table. In unlimed areas reaction is very strongly acid or strongly acid above the fragipan.

Most areas of this soil are used for pasture. A few areas are used for farming or recreation, or they are idle.

This soil is poorly suited to moderately suited to cultivated crops. Most of the soil is used for pasture or long-term stands of forage plants for hay. Because of the high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage.

This soil is suited to pasture during drier periods. If the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is poorly suited to trees. About one-fourth of the acreage is wooded. Potential productivity of the soil for trees is low. Rooting depth is restricted by the fragipan and by the high water table. Equipment use is restricted during wet seasons. Planting by machine is practical in the larger areas during drier periods.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the slow permeability or very slow permeability and the high water table.

This soil is in capability subclass IVw and has a woodland ordination symbol of 5w.

CtA—Cookport silt loam, 0 to 3 percent slopes. This deep soil is nearly level and moderately well drained. It is on hilltops and broad, upland flats not subjected to glacial action. Slopes are concave and smooth and are 300 to 800 feet long. Individual areas are irregular in shape and are 10 to 200 acres.

Typically, the surface layer is dark brown silt loam about 3 inches thick. The subsurface layer is dark yellowish brown silt loam to a depth of 10 inches. The subsoil extends to a depth of 40 inches. The upper 6 inches is yellowish brown loam. The next 8 inches is mottled yellowish brown loam. The lower 16 inches is a fragipan of mottled yellowish brown, firm and brittle channery loam. The substratum is mottled yellowish brown very channery loam. Gray, sandstone bedrock is at a depth of 60 inches.

Included with this soil in mapping are small areas of Hazleton soils and the very stony Cookport soils. Inclusions make up about 10 percent of the unit.

This Cookport soil has slow permeability in the fragipan and moderate available water capacity. Surface runoff is slow. Rooting depth is restricted by the fragipan and by the seasonal high water table, which is at a depth of 8 to 36 inches. In unlimed areas reaction is very strongly acid or strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is moderately well suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is slight. Because of the seasonal high water

table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage.

This soil is suited to pasture during drier periods (fig. 7). When the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is well suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is high. Rooting depth is restricted by the fragipan and by the seasonal high water table. Equipment use is restricted during wet seasons. Planting by machine is practical in the larger areas.

The slow permeability of the fragipan and the seasonal high water table are major limitations for most urban uses, especially for onsite sewage disposal.

This soil is in capability subclass IIw and has a woodland ordination symbol of 2w.

CtB—Cookport silt loam, 3 to 8 percent sloeps. This deep soil is gently sloping and moderately well drained. It is on hilltops and broad uplands not subjected to glacial action. Slopes are concave and smooth and are 300 to 800 feet long. Individual areas are irregular in shape and are 10 to 200 acres.

Typically, the surface layer is dark brown silt loam about 3 inches thick. The subsurface layer is dark yellowish brown silt loam to a depth of 10 inches. The subsoil extends to a depth of 40 inches. The upper 6 inches is yellowish brown loam. The next 8 inches is mottled yellowish brown loam. The lower 16 inches is a fragipan of mottled yellowish brown, firm and brittle channery loam. The substratum is mottled yellowish brown very channery loam. Gray sandstone bedrock is at a depth of 60 inches.

Figure 7.—Cookport silt loam, 0 to 3 percent, is suited to pasture.

Included with this soil in mapping are small areas of Hazleton soils and the very stony Cookport soils. Inclusions make up about 10 percent of the unit.

This Cookport soil has slow permeability in the fragipan and moderate available water capacity. Surface runoff is medium. Rooting depth is restricted by the fragipan and by the seasonal high water table, which is at a depth of 18 to 36 inches. In unlimed areas reaction is very strongly acid or strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is moderately well suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is moderate. Because of the seasonal high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage. Contour stripcropping, diversions, grassed waterways, and minimum tillage are some practices that can be used to control erosion.

This soil is suited to pasture during drier periods. If the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is well suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is high. Rooting depth is restricted by the fragipan and by the seasonal high water table. Equipment use is restricted during wet seasons. Planting by machine is practical in the larger areas.

The slow permeability of the fragipan and the seasonal high water table are major limitations for most urban uses, especially for onsite sewage disposal.

This soil is in capability subclass IIe and has a woodland ordination symbol of 2w.

CtC—Cookport silt loam, 8 to 15 percent slopes. This deep soil is sloping and moderately well drained. It is on the upper part of hillsides not subjected to glacial action. Slopes are concave and smooth and are 300 to 800 feet long. Areas are irregular in shape and are 10 to 100 acres.

Typically, the surface layer is dark brown silt loam about 3 inches thick. The subsurface layer is dark yellowish brown silt loam to a depth of 10 inches. The subsoil extends to a depth of 40 inches. The upper 6 inches is yellowish brown loam. The next 8 inches is mottled yellowish brown loam. The lower 16 inches is a

fragipan of mottled yellowish brown, firm and brittle channery loam. The substratum is mottled yellowish brown very channery loam to a depth of 60 inches. Gray sandstone bedrock is at a depth of 60 inches.

Included with this soil in mapping are small areas of Hazleton soils and the very stony Cookport soils. Inclusions make up about 10 percent of the unit.

This Cookport soil has slow permeability in the fragipan and moderate available water capacity. Surface runoff is moderately rapid. Rooting depth is restricted by the fragipan and by the seasonal high water table, which is at a depth of 18 to 36 inches. In unlimed areas reaction is very strongly acid or strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is moderately well suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is severe. Because of the seasonal high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage. Contour stripcropping, diversion terraces, grassed waterways, and including grasses and legumes in the cropping system are practices that aid in slowing runoff and controlling erosion.

This soil is suited to pasture during drier periods. When the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is well suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is high. Rooting depth is restricted by the fragipan and by the seasonal high water table. Equipment use is restricted during wet seasons. Planting by machine is practical in the larger areas.

The slow permeability of the fragipan and the seasonal high water table are major limitations for most urban uses, especially for onsite sewage disposal.

This soil is in capability subclass IIIe and has a woodland ordination symbol of 2w.

CvC—Cookport very stony silt loam, 0 to 15 percent slopes. This deep soil is nearly level to sloping and is moderately well drained. It is on broad plateaus and the upper part of hillsides not subjected to glacial action. Slopes are concave and smooth and are 200 to 1,000 feet long. Individual areas are irregularly shaped or oblong and are 5 to 250 acres. Large stones cover about 3 to 15 percent of the surface area.

Typically, the surface layer is dark brown silt loam about 3 inches thick. The subsurface layer is dark yellowish brown silt loam to a depth of 10 inches. The subsoil extends to a depth of 40 inches. The upper 6 inches is yellowish brown loam. The next 8 inches is mottled yellowish brown loam. The lower 16 inches is a fragipan of mottled yellowish brown, firm and brittle channery loam. The substratum is mottled yellowish brown very channery loam to a depth of 60 inches. Gray sandstone bedrock is at a depth of 60 inches.

Included with this soil in mapping are some areas of the nonstony Cookport soils, the Hazleton soils, and the very stony Hazleton soils. Inclusions make up about 10 percent of the unit.

This Cookport soil has slow permeability in the fragipan, moderate available water capacity, and a seasonal high water table within 18 to 36 inches of the surface for part of the year. Reaction is very strongly acid or strongly acid throughout. Surface runoff is slow to moderately rapid. Rooting depth is restricted by the fragipan and by the seasonal high water table.

This soil is mostly in woodland. A few areas are used for pasture or recreation, or they are idle.

This soil is not being used for cultivated crops or for improved pasture because of the large stones on the surface. Removing the trees and surface stones is not usually feasible because of the expense involved.

This soil is suited to trees, and most acreage is wooded. Potential productivity of the soil for trees is high. Rooting depth is restricted by the fragipan and by the seasonal high water table. Removal of undesirable species is a management practice that helps increase production. Equipment use is restricted for a part of the year because of the seasonal high water table. The large stones on the surface interfere with harvesting and planting seedlings by machine.

This soil has major limitations for most nonfarm uses, especially for onsite sewage disposal, because of the seasonal high water table, slow permeability in the fragipan, and the very stony surface.

This soil is in capability subclass VIs and has a woodland ordination symbol of 2w.

EsB—Ernest silt loam, 3 to 8 percent slopes. This deep soil is gently sloping and moderately well drained. It is on foot slopes not subjected to glacial action. Slopes are concave and smooth and are 200 to 600 feet long. Areas are oblong and are 5 to 60 acres.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is brown silt loam to a depth of 8 inches. The subsoil extends to a depth of 42 inches. The upper 8 inches is yellowish brown silt loam. The next 13 inches is mottled brownish yellow and brown channery silt loam and channery silty clay loam. The lower 13 inches is a fragipan of mottled brown, firm and brittle channery silty clay loam. The substratum is brown channery silty clay loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Brinkerton soils and the very stony Ernest soil. Inclusions make up about 10 percent of the unit.

This Ernest soil has moderately slow permeability in the fragipan and substratum and moderate available

water capacity. Surface runoff is slow. Rooting depth is restricted by the fragipan and by the seasonal high water table, which is at a depth of 18 to 36 inches. In unlimed areas reaction is very strongly acid or strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is moderately well suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is moderate. Because of the seasonal high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage.

This soil is suited to pasture during drier periods. If the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is well suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is high. Rooting depth is restricted by the fragipan and by the seasonal high water table. Equipment use is restricted during wet seasons. Planting by machine is practical in the larger areas.

The moderately slow permeability of the soil and the seasonal high water table are major limitations for most urban uses, especially for onsite sewage disposal.

This soil is in capability subclass IIe and has a woodland ordination symbol of 2w.

EsC—Ernest silt loam, 8 to 15 percent slopes. This deep soil is sloping and moderately well drained. It is on foot slopes and in drainageways not subjected to glacial action. Slopes are concave and smooth and are 200 to 600 feet long. Individual areas are oblong and are 5 to 60 acres.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is brown silt loam to a depth of 8 inches. The subsoil extends to a depth of 42 inches. The upper 8 inches is yellowish brown silt loam. The next 13 inches is mottled brownish yellow and brown channery silt loam and channery silty clay loam. The lower 13 inches is a fragipan of mottled brown, firm and brittle channery silty clay loam. The substratum is brown channery silty clay loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Brinkerton soils and the very stony Ernest soil. Inclusions make up about 10 percent of the unit.

This Ernest soil has moderately slow permeability in the fragipan and substratum and moderate available water capacity. Surface runoff is moderately rapid. Rooting depth is restricted by the fragipan and by the seasonal high water table, which is at a depth of 18 to 36 inches. In unlimed areas reaction is very strongly acid or strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is moderately well suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is severe. Because of the seasonal high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage.

This soil is suited to pasture during drier periods. If the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is well suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is high. Rooting depth is restricted by the fragipan and by the seasonal high water table. Equipment use is restricted during wet seasons. Planting by machine is practical in the larger areas.

The moderately slow permeability of the soil and the seasonal high water table are major limitations for most urban uses, especially for onsite sewage disposal.

This soil is in capability subclass IIIe and has a woodland ordination symbol of 2w.

EvD—Ernest very stony silt loam, 0 to 25 percent slopes. This deep soil is moderately well drained and nearly level to moderately steep. It is on foot slopes and along the sides of drainageways that have not been subjected to glacial action. Slopes are concave and smooth and are 200 to 600 feet long. Individual areas are oblong and are 5 to 60 acres. Large stones cover about 3 to 15 percent of the surface.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is brown silt loam to a depth of 8 inches. The subsoil extends to a depth of 42 inches. The upper 8 inches is yellowish brown silt loam. The next 13 inches is mottled brownish yellow and brown channery silt loam and channery silty clay loam. The lower 13 inches is a fragipan of mottled brown, firm and brittle channery silty clay loam. The substratum is brown channery silty clay loam to a depth of 60 inches.

Included with this soil in mapping are some areas of the Brinkerton soils and the nonstony Ernest soils. Inclusions make up about 10 percent of the unit.

The Ernest soil has numerous, large stones on the surface. It has moderately slow permeability in the fragipan and substratum and moderate available water capacity. In unlimed areas reaction is very strongly acid or strongly acid throughout. A seasonal high water table is within 18 to 36 inches of the surface for part of the

year. Surface runoff is slow to rapid. Rooting depth is restricted by the fragipan and by the seasonal high water table.

This soil is mostly in woodland. It is too stony for crops or pasture.

This soil is not being used for cultivated crops or for pasture because of large stones on the surface. Removing the trees and stones and reducing the water table to cultivate crops or pasture is usually not feasible because of the expense involved.

This soil is suited to trees, and most acreage is wooded. Potential productivity of the soil for trees is high. Rooting depth is restricted by the fragipan and by the seasonal high water table. Removal of undesirable species is a management practice that helps increase production. Equipment use is restricted for part of the year because of the seasonal high water table. The large stones on the surface interfere with harvesting and planting seedlings.

This soil has a limitation for most urban uses because of the seasonal high water table; the slope, in some places; the moderately slow permeability; and the very stony surface.

This soil is in capability subclass VIs and has a woodland ordination symbol of 2w.

GnB—Gilpin channery silt loam, 3 to 8 percent slopes. This moderately deep soil is gently sloping and well drained. It is on broad uplands not subjected to glacial action. Slopes are convex and smooth and are 300 to 1,000 feet long. Individual areas are irregular in shape and are 5 to 70 acres.

Typically, the surface layer is black silt loam about 2 inches thick. The subsurface layer is grayish brown channery silt loam to a depth of 7 inches. The subsoil is yellowish brown channery silt loam and yellowish brown shaly silt loam to a depth of 27 inches. The 3-inch substratum is brown very shaly silt loam. Light olive brown siltstone and sandstone bedrock is at a depth of 30 inches.

Included with this soil in mapping are small areas of Wharton soils and the very stony Gilpin soil. Inclusions make up about 5 percent of the unit.

This Gilpin soil has moderate permeability and moderate available water capacity. Surface runoff is medium. Rooting depth is restricted by the moderate depth to bedrock. In unlimed areas reaction is extremely acid to strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is moderately suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is moderate. Yields on this soil are limited by moderate depth to bedrock and moderate available water capacity, especially in the drier years. Contour stripcropping and the use of cover crops help reduce runoff and control erosion.

This soil is suited to pasture. When this soil is used for pasture, prevention of overgrazing and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, and deferred grazing are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is high. Management problems are few. Rooting depth is restricted by the moderate depth to bedrock. Planting by machine is practical in the larger areas.

This soil is limited for many urban uses because of its moderate depth to bedrock. The moderate depth to bedrock is a major limitation for onsite sewage disposal.

This soil is in capability subclass IIe and has a woodland ordination symbol of 2o.

GnC—Gilpin channery silt loam, 8 to 15 percent slopes. This moderately deep soil is sloping and well drained. It is on broad uplands that have not been subjected to glacial action. Slopes are convex and smooth and are 300 to 1,000 feet long. Individual areas are irregular in shape and are 5 to 100 acres.

Typically, the surface layer is black silt loam about 2 inches thick. The subsurface layer is grayish brown channery silt loam to a depth of 7 inches. The subsoil is yellowish brown channery silt loam and yellowish brown shaly silt loam to a depth of 27 inches. The 3-inch substratum is brown very shaly silt loam. Light olive brown siltstone and sandstone bedrock is at a depth of 30 inches.

Included with this soil in mapping are small areas of Wharton soils and the very stony Gilpin soil. Inclusions make up about 10 percent of the unit.

This Gilpin soil has moderate permeability and moderate available water capacity. Surface runoff is moderately rapid. Rooting depth is restricted by the moderate depth to bedrock. In unlimed areas reaction is extremely acid to strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is moderately suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is severe. Yields on this soil are limited by the moderate depth to bedrock and the moderate available water capacity, especially in the drier years. Contour stripcropping, diversions, grassed waterways, and the use of cover crops help reduce runoff and control erosion.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, and deferred grazing are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is high. Rooting depth is restricted by the moderate depth

to bedrock. Management problems are few, but care is needed during harvesting to control erosion of roads. Planting by machine is practical in the larger areas.

This soil has limitations for most urban uses because of its moderate depth to bedrock, especially for onsite sewage disposal.

This soil is in capability subclass IIIe and has a woodland ordination symbol of 2o.

GnD—Gilpin channery silt loam, 15 to 25 percent slopes. This moderately deep soil is moderately steep and well drained. It is on the upper part of hillsides not subjected to glacial action. Slopes are convex and smooth and are 300 to 1,000 feet long. Individual areas are irregular in shape and are 5 to 100 acres.

Typically, the surface layer is black silt loam about 2 inches thick. The subsurface layer is grayish brown channery silt loam to a depth of 7 inches. The subsoil is yellowish brown channery silt loam and yellowish brown shaly silt loam to a depth of 27 inches. The 3-inch substratum is brown very shaly silt loam. Light olive brown siltstone and sandstone bedrock is at a depth of 30 inches.

Included with this soil in mapping are small areas of Wharton soils and the very stony Gilpin soil. Inclusions make up about 10 percent of the unit.

This Gilpin soil has moderate permeability and moderate available water capacity. Surface runoff is rapid. Rooting depth is restricted by the moderate depth to bedrock. In unlimed areas reaction is extremely acid to strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is moderately suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is very severe. Yields are limited on this soil by the moderate depth to bedrock and the moderate available water capacity, especially in the drier years. Contour stripcropping, diversions, grassed waterways, and the use of cover crops help reduce runoff and control erosion.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, and deferred grazing are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is high. Rooting depth is restricted by the moderate depth to bedrock. Equipment limitations and erosion are management problems because of slope. Planting by machine is possible on the less sloping soils.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of its moderately steep slopes and moderate depth to bedrock.

This soil is in capability subclass IVe and has a woodland ordination symbol of 2r.

GpF—Gilpin soils, 25 to 60 percent slopes. These steep and very steep soils are on hillsides of the uplands not subjected to glacial action. Gilpin soils comprise approximately 80 percent of the map unit. Individual areas are long and relatively narrow and are 10 to 200 acres.

Some areas have stones which are 10 to 36 inches in diameter and which cover 3 to 15 percent of the surface. Other areas are not stony or are made up of both stony and nonstony soils. These soils have a surface layer of channery silt loam and channery loam. The present and expected uses of these steep and very steep soils are so similar that separation of stony and nonstony soils is not important to the objectives of the survey.

Typically, the surface layer is black and grayish brown channery silt loam that is 7 inches thick. The subsoil is yellowish brown channery silt loam and yellowish brown shaly silt loam to a depth of 27 inches. The 3-inch thick substratum is brown very shaly silt loam. Light olive brown siltstone and sandstone bedrock is at a depth of 30 inches.

Included with these soils in mapping are areas of very stony Hazleton and Ernest soils. The Hazleton soils have slopes of 40 to 80 percent.

These Gilpin soils have moderate permeability and moderate available water capacity. Surface runoff is very rapid. In unlimed areas reaction is extremely acid to strongly acid throughout.

Most areas of the Gilpin soils are used for woodland.

These soils are not being used for cultivated crops or for pasture because of steep and very steep slopes and stones on the surface. They are well suited to woodland, and potential productivity of the soil for trees is high. The steep and very steep slopes and the very stony surface interferes with harvesting and planting by machine.

The steep and very steep slopes and the stones on the surface, where they are present, are major limitations for most urban uses, especially for onsite sewage disposal.

This soil is in capability subclass VIIe and has a woodland ordination symbol of 2r.

GsC—Gilpin very stony silt loam, 8 to 15 percent slopes. This moderately deep soil is well drained and sloping. It is on hillsides and ridgetops that have not been subjected to glacial action. Slopes are convex and smooth and are 200 to 1,000 feet long. The areas are irregular in shape and normally range from 5 to 80 acres. Large stones cover about 3 to 15 percent of the surface.

Typically, this soil has a surface layer of black silt loam about 1-inch thick. The subsurface layer is grayish brown channery silt loam to a depth of 7 inches. The subsoil is yellowish brown channery silt loam and yellowish brown shaly silt loam to a depth of 27 inches. The 3-inch substratum is brown very shaly silt loam. Light olive brown siltstone and sandstone bedrock is at a depth of 30 inches.

Included with this soil in mapping are some areas of the nonstony Gilpin and Hazleton soils and the very stony Hazleton soils. Inclusions make up about 10 percent of the unit.

This Gilpin soil has numerous, large stones on the surface. It has moderate permeability and moderate available water capacity. In unlimed areas reaction is extremely acid to strongly acid throughout. Surface runoff is moderately rapid. Rooting depth is restricted by the moderate depth to bedrock.

This soil is mostly in woodland. It is too stony for crops or pasture.

This soil is not being used for cultivated crops or for pasture because of the large stones on the surface. Removing the trees and surface stones to cultivate crops or pasture is usually not feasible because of the expense involved.

This soil is suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is high. Rooting depth is restricted by the moderate depth to bedrock. Removal of undesirable species is a management practice that helps increase production. Large stones on the surface interfere with harvesting and planting seedlings by machine.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the moderate depth to bedrock and the very stony surface.

This soil is in capability subclass VIs and has a woodland ordination symbol of 2o.

HnB—Hanover silt loam, 3 to 8 percent slopes. This deep soil is gently sloping and is moderately well drained and well drained. It is on hillsides and broad uplands covered by glacial till. Slopes are convex and smooth and are 300 to 1,000 feet long. Individual areas are irregular in shape and are 5 to 100 acres.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is dark yellowish brown silt loam to a depth of 10 inches. The subsoil extends to a depth of 60 inches. The upper part is yellowish brown silt loam. The lower part is a fragipan of mottled yellowish brown, very firm and brittle silt loam and gravelly loam.

Included with this soil in mapping are small areas of Alvira soils and the stony Hanover soil. Inclusions make up about 10 percent of the unit.

This Hanover soil has moderate permeability above the fragipan and moderately slow permeability in the fragipan. It has moderate available water capacity. Surface runoff is medium. Rooting depth is restricted by the fragipan and by the seasonal high water table, which is at a depth of 18 to 36 inches. In unlimed areas reaction is very strongly acid or strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is well suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is moderate. Stripcropping, diversions, and grassed waterways can be used to control erosion. Surface and subsurface drains might be needed to help remove excess water and allow timely tillage.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This Hanover soil is well suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is very high. Rooting depth is restricted by the fragipan and by the seasonal high water table. The use of equipment might be restricted briefly during wet seasons. Planting by machine is practical in the larger areas.

This soil has limitations for most urban uses, especially for onsite sewage disposal, because of the moderately slow permeability in the fragipan and the seasonal high water table.

This soil is in capability subclass IIe and has a woodland ordination symbol of 1o.

HnC—Hanover silt loam, 8 to 15 percent slopes. This deep soil is sloping and is moderately well drained and well drained. It is on hillsides and broad uplands covered by glacial till. Slopes are convex and smooth and are 300 to 800 feet long. Individual areas are irregular in shape and are 5 to 150 acres.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is dark yellowish brown silt loam to a depth of 10 inches. The subsoil extends to a depth of 60 inches. The upper part is yellowish brown silt loam. The lower part is a fragipan of mottled yellowish brown, very firm and brittle silt loam and gravelly loam.

Included with this soil in mapping are small areas of Alvira soils and the stony Hanover soil. Inclusions make up about 10 percent of the unit.

This Hanover soil has moderate permeability above the fragipan and moderately slow permeability in the fragipan. It has moderate available water capacity. Surface runoff is moderately rapid. Rooting depth is restricted by the fragipan and by the seasonal high water table, which is at a depth of 18 to 36 inches. In unlimed areas reaction is very strongly acid or strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is well suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is severe. Stripcropping, diversions, and grassed waterways can be used to control erosion. Surface and subsurface drains might be needed to help remove excess water and allow for timely tillage.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This Hanover soil is well suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is very high. Rooting depth is restricted by the fragipan and by the seasonal high water table. The use of equipment might be restricted briefly during wet seasons. Planting by machine is practical in the larger areas.

This soil has limitations for most urban uses, especially for onsite sewage disposal, because of the moderately slow permeablity in the fragipan and the seasonal high water table.

This soil is in capability subclass IIIe and has a woodland ordination symbol of 1o.

HnD—Hanover silt loam, 15 to 25 percent slopes. This deep soil is moderately steep and is moderately well drained and well drained. It is on hillsides covered by glacial till. Slopes are convex and smooth and are 200 to 500 feet long. Individual areas are irregular in shape and are 5 to 70 acres.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is dark yellowish brown silt loam to a depth of 10 inches. The subsoil extends to a depth of 60 inches. The upper part is yellowish brown silt loam. The lower part is a fragipan of mottled yellowish brown, very firm and brittle silt loam and gravelly loam.

Included with this soil in mapping are small areas of Alvira soils and the stony Hanover soil. Inclusions make up about 10 percent of the unit.

This Hanover soil has moderate permeability above the fragipan and moderately slow permeability in the fragipan. It has moderate available water capacity. Surface runoff is rapid. Rooting depth is restricted by the fragipan and by the seasonal high water table, which is at a depth of 18 to 36 inches. In unlimed areas reaction is very strongly acid or strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is moderately suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is very severe. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage. Stripcropping, diversions, grassed waterways, and minimum tillage are practices that can be used to control erosion.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This Hanover soil is well suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is very high. Rooting depth is restricted by the fragipan and by the seasonal high water table. Equipment use is restricted by slope. Diversions, or water bars, on the roads are needed during harvesting to limit erosion.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the slope, the moderately slow permeability in the fragipan, and the seasonal high water table.

This soil is in capability subclass IVe and has a woodland ordination symbol of 1r.

HoF—Hanover soils, steep. These steep soils are on hillsides of the glaciated uplands. Individual areas are long and relatively narrow and are 10 to 100 acres. The Hanover soils have slopes of 25 to 40 percent and comprise approximately 80 percent of the map unit. Some delineated areas have stones which are 10 to 36 inches in diameter and which cover 3 to 15 percent of the surface. Some areas are not stony or are made up of stony and nonstony soils. These soils have a surface layer of silt loam and channery silt loam. Because slopes are steep, present and expected use is so similar that separation of the stony and the nonstony soils is not important to the objectives of the survey.

Typically, the surface layer is very dark grayish brown and dark yellowish brown silt loam 10 inches thick. The subsoil extends to a depth of 60 inches. The upper part is yellowish brown silt loam. The lower part is a fragipan of mottled yellowish brown very firm and brittle silt loam and gravelly loam.

Included with these soils in mapping are small areas of Alvira and Lordstown soils. The Alvira and Lordstown soils have slopes of 25 to 40 percent.

The Hanover soils have a seasonal high water table at a depth of 18 to 36 inches, moderately slow permeability in the fragipan, and moderate available water capacity. Surface runoff is very rapid. In unlimed areas reaction is very strongly acid or strongly acid throughout.

Most of these soils are used for woodland.

The soils are not being used for cultivated crops or for pasture because of steep slopes and stones on the surface. They are well suited to woodland, and potential productivity of the soils for trees is very high. The steep slopes and the very stony surface in some areas interfere with harvesting and mechanical planting.

The steep slopes and stones on the surface, where they are present, are the major limitations for most urban uses, especially for onsite sewage disposal.

These soils are in capability sublcass VIe and have a woodland ordination symbol of 1r.

HsD—Hanover very stony silt loam, 0 to 25 percent slopes. This deep soil is moderately well drained and well drained and is nearly level to moderately steep. It is on glaciated, broad uplands and the upper part of hillsides. Slopes are convex and smooth and are 200 to 1,000 feet in length. The areas are irregular in shape and normally range from 5 to 150 acres. Large stones cover about 3 to 15 percent of the surface area.

Typically, this soil has a surface layer of very dark grayish brown silt loam about 4 inches thick. The subsurface layer is dark yellowish brown silt loam to a depth of 10 inches. The subsoil extends to a depth of 60 inches. The upper part is yellowish brown silt loam, and the lower part is a fragipan of mottled yellowish brown, very firm and brittle silt loam and gravelly loam.

Included with this soil in mapping are some areas of nonstony Alvira and Hanover soils and the very stony Alvira soil. Inclusions make up about 10 percent of the unit.

This Hanover soil has numerous, large stones on the surface. It has moderate permeability above the fragipan and moderately slow permeability in the fragipan. It has moderate available water capacity. Reaction is very strongly acid or strongly acid throughout. A seasonal high water table is within 18 to 36 inches of the surface for part of the year. Surface runoff is slow to rapid. Rooting depth is restricted by the fragipan and by the seasonal high water table.

Most areas of this soil are used for woodland. A few areas are used for pasture or recreation, or they are idle.

This soil is not being used for cultivated crops or for improved pasture because of the large stones on the surface. Removing the trees and surface stones to cultivate crops or pasture is usually not feasible because of the expense involved.

The soil is suited to trees, and most acreage is wooded. Potential productivity of the soil for trees is very high. Rooting depth is restricted by the fragipan and by the seasonal high water table. Removal of undesirable species is a management practice that helps increase production. Slope in some areas and large stones on the surface interfere with harvesting and planting seedlings by machine.

This soil has limitations for most urban uses, especially for onsite sewage disposal, because of the seasonal high water table, the moderately slow permeability in the fragipan, and the very stony surfaces.

This soil is in capability subclass VIs and has a woodland ordination symbol of 1r.

HtA—Hazleton channery sandy loam, 0 to 3 percent slopes. This deep soil is nearly level and well drained. It is on broad uplands and narrow ridgetops that have not been subjected to glacial action. Slopes are convex and smooth and are 200 to 1,000 feet long. Individual areas are irregular in shape and are 5 to 100 acres.

Typically, this soil has a surface layer of dark gray sandy loam about 2 inches thick. The subsoil extends to a depth of 32 inches. In sequence from the top, it is dark reddish brown channery sandy loam to a depth of 4 inches; yellowish red channery sandy loam to a depth of 6 inches; reddish yellow channery sandy loam to a depth of 15 inches; strong brown channery sandy loam to a depth of 22 inches; and reddish yellow very channery sandy loam to a depth of 32 inches. The substratum is reddish yellow very channery coarse sandy loam. Yellowish brown sandstone bedrock is at a depth of 56 inches.

Included with this soil in mapping are small areas of Gilpin and Cookport soils and the very stony Hazleton soils. Inclusions make up about 10 percent of the unit.

This Hazleton soil has moderately rapid and rapid permeability and moderate available water capacity. Surface runoff is slow. In unlimed areas reaction is extremely acid to strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is well suited to cultivated crops, but only a small acreage is cultivated (fig. 8). The erosion hazard is slight.

This soil is well suited to pasture. If the soil is used for pasture, prevention of overgrazing and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, and deferred grazing are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

Figure 8.—Crops on Hazleton channery sandy loam, 0 to 3 percent slopes. Included Cookport soils are in slight depression, center.

This soil is suited to trees, and most of the acreage is wooded (fig. 9). Potential productivity of the soil for trees is moderately high. Planting by machine is practical in the larger areas.

This soil has limitations for some urban uses, especially for onsite sewage disposal, because of moderately rapid and rapid permeability, channery fragments, and bedrock at a depth of 3-1/2 to 6 feet.

This soil is in capability class I and has a woodland ordination symbol of 3o.

Figure 9.—Good stand on Hazleton channery sandy loam, 0 to 3 percent slopes, which has moderately high potential productivity.

HtB—Hazleton channery sandy loam, 3 to 8 percent slopes. This deep soil is gently sloping and well drained. It is on broad uplands and narrow ridgetops that have not been subjected to glacial action. Slopes are convex and smooth and are 200 to 1,000 feet long. Individual areas are irregular in shape and are 5 to 100 acres.

Typically, this soil has a surface layer of dark gray sandy loam about 2 inches thick. The subsoil extends to a depth of 32 inches. In sequence from the top, it is dark reddish brown channery sandy loam to a depth of 4 inches; yellowish red channery sandy loam to a depth of 6 inches; reddish yellow channery sandy loam to a depth of 15 inches; strong brown channery sandy loam to a depth of 22 inches; and reddish yellow very channery sandy loam to a depth of 32 inches. The substratum is reddish yellow very channery coarse sandy loam (fig. 10). Yellowish brown sandstone bedrock is at a depth of 56 inches.

Included with this soil in mapping are small areas of Gilpin and Cookport soils and the very stony Hazleton soils. Inclusions make up about 10 percent of the unit.

This Hazleton soil has moderately rapid and rapid permeability and moderate available water capacity. Surface runoff is medium. In unlimed areas reaction is extremely acid to strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is well suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is moderate. Stripcropping (fig. 11) and cover crops can be used to protect the soil from erosion.

This soil is well suited to pasture. If the soil is used for pasture, prevention of overgrazing and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during dry periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is moderately high. Planting by machine is practical in the larger areas.

This soil has limitations for some urban uses, especially for onsite sewage disposal, because of moderately rapid and rapid permeability, channery fragments, and bedrock at a depth of 3-1/2 to 6 feet.

This soil is in capability subclass IIe and has a woodland ordination symbol of 3o.

HtC—Hazleton channery sandy loam, 8 to 15 percent slopes. This deep soil is sloping and well drained. It is on the upper part of hillsides that have not been subjected to glacial action. Slopes are convex and smooth and are 200 to 800 feet in length. Areas are long and are 10 to 100 acres.

Typically, this soil has a surface layer of dark gray

Figure 10.—Typical very channery coarse sandy loam substratum in the Hazleton channery sandy loam map units.

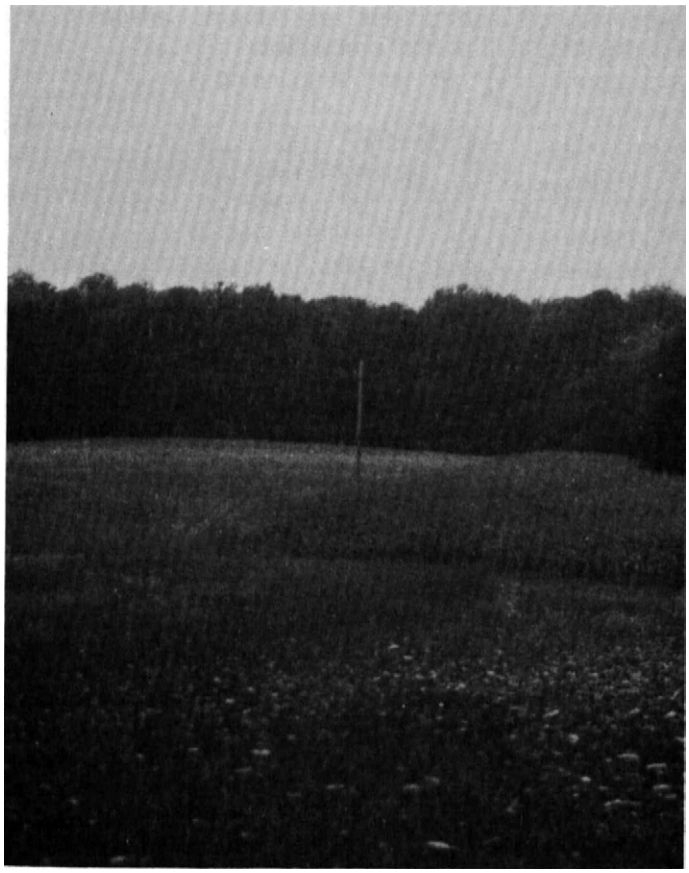


Figure 11.—Stripcropping and cover crops on Hazleton channery sandy loam, 3 to 8 percent slopes, protect the soil from erosion.

sandy loam about 2 inches thick. The subsoil extends to a depth of 32 inches. In sequence from the top, it is dark reddish brown channery sandy loam to a depth of 4 inches; yellowish red channery sandy loam to a depth of 6 inches; reddish yellow channery sandy loam to a depth of 15 inches; strong brown channery loam to a depth of 22 inches; and reddish yellow very channery sandy loam to a depth of 32 inches. The substratum is reddish yellow very channery coarse sandy loam. Yellowish brown sandstone bedrock is at a depth of 56 inches.

Included with this soil in mapping are small areas of Gilpin and Cookport soils and the very stony Hazleton soils. Inclusions make up about 10 percent of the unit.

This Hazleton soil has moderately rapid and rapid permeability and moderate available water capacity. Surface runoff is moderately rapid. In unlimed areas reaction is extremely acid to strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is well suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is severe. Stripcropping, diversions, and minimum tillage are desirable practices to control erosion. Cover crops

and long-term stands of forage plants for hay help maintain organic matter content and good tilth.

This soil is well suited to pasture. If the soil is used for pasture, prevention of overgrazing and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during dry periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is moderately high. Planting by machine is practical in the larger areas.

This soil has limitations for most urban uses, especially for onsite sewage disposal, because of slope, moderately rapid and rapid permeability, channery fragments, and bedrock at a depth of 3-1/2 to 6 feet.

This soil is in capability subclass IIIe and has a woodland ordination symbol of 3o.

HtD—Hazleton channery sandy loam, 15 to 25 percent slopes. This deep soil is moderately steep and well drained. It is on the upper part of hillsides that have not been subjected to glacial action. Slopes are convex and smooth and are 200 to 800 feet in length. Individual areas are long and are 10 to 100 acres.

Typically, this soil has a surface layer of dark gray sandy loam about 2 inches thick. The subsoil extends to a depth of 32 inches. In sequence from the top, it is dark reddish brown channery sandy loam to a depth of 4 inches; yellowish red channery sandy loam to a depth of 6 inches; reddish yellow channery sandy loam to a depth of 15 inches; strong brown channery sandy loam to a depth of 22 inches; and reddish yellow very channery sandy loam to a depth of 32 inches. The substratum is reddish yellow very channery coarse sandy loam. Yellowish brown sandstone bedrock is at a depth of 56 inches.

Included with this soil in mapping are small areas of Gilpin and Cookport soils and the very stony Hazleton soils. Inclusions make up about 10 percent of the unit.

This Hazleton soil has moderately rapid and rapid permeability and moderate available water capacity. Surface runoff is rapid. In unlimed areas reaction is extremely acid to strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is moderately suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is very severe. Stripcropping, diversions, and minimum tillage are desirable practices to control erosion. Cover crops and long-term stands of forage plants for hay help maintain organic matter content and good tilth.

This soil is moderately well suited to pasture. If the soil is used for pasture, prevention of overgrazing and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during dry periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is well suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is moderately high. The use of equipment is somewhat restricted by slope. Planting by machine generally is not practical.

This soil has limitations for most urban uses because of slope, moderately rapid and rapid permeability, channery fragments, and bedrock at a depth of 3-1/2 to 6 feet. Slope is a serious limitation for onsite sewage disposal.

This soil is in capability subclass IVe and has a woodland ordination symbol of 3r.

HvB—Hazleton very stony sandy loam, 0 to 8 percent slopes. This deep soil is well drained and is nearly level and gently sloping. It is on broad uplands and narrow ridgetops that have not been subjected to glacial action. Slopes are convex and smooth and are 200 to 1,000 feet in length. The areas are irregular in shape and normally range from 10 to 200 acres. Large stones cover about 3 to 15 percent of the surface.

Typically, this soil has a surface layer of dark gray sandy loam about 2 inches thick. The subsoil extends to a depth of 32 inches. In sequence from the top, it is dark reddish brown sandy loam to a depth of 4 inches; yellowish red channery sandy loam to a depth of 6 inches; reddish yellow channery sandy loam to a depth of 15 inches; strong brown channery sandy loam to a depth of 22 inches; and reddish yellow very channery sandy loam to a depth of 32 inches. The substratum is reddish yellow very channery coarse sandy loam. Yellowish brown sandstone bedrock is at a depth of 56 inches.

Included with this soil in mapping are some areas of nonstony Hazleton and Cookport soils and the very stony Cookport soil. Inclusions make up about 10 percent of the unit.

This Hazleton soil has moderately rapid and rapid permeability and moderate available water capacity. Reaction is extremely acid to strongly acid throughout. The soil has numerous, large stones on the surface and many channery fragments in the profile. Surface runoff is slow to medium.

Most areas of this soil are used for woodland. A few areas are used for pasture or recreation, or they are idle.

This soil is not being used for cultivated crops or for improved pasture because of the large stones on the surface. Removing the trees and surface stones to cultivate crops or pasture is not usually feasible because of the expense involved.

This soil is suited to trees, and most acreage is wooded. Potential productivity of the soil for trees is moderately high. Removal of undesirable species is a management practice that helps increase production.

Equipment use might be somewhat restricted in the more stony areas. Large stones on the surface interfere with mechanical planting.

This soil has limitations for most urban uses, especially for onsite sewage disposal, because it is 3-1/2 to 6 feet deep to bedrock, has moderately rapid and rapid permeability, and a very stony surface.

This soil is in capability subclass VIs and has a woodland ordination symbol of 3o.

HvD—Hazleton very stony sandy loam, 8 to 25 percent slopes. This deep soil is well drained and is sloping and moderately steep. It is on the upper part of hillsides not subjected to glacial action. Slopes are convex and smooth and are 200 to 800 feet in length. Individual areas are long and normally range from 10 to 200 acres. Large stones cover about 3 to 15 percent of the surface.

Typically, this soil has a surface layer of about 2 inches thick. The subsoil extends to a depth of 32 inches. In sequence from the top, it is dark reddish brown sandy loam to a depth of 4 inches; yellowish red channery sandy loam to a depth of 6 inches; reddish yellow channery sandy loam to a depth of 15 inches; strong brown channery sandy loam to a depth of 22 inches; and reddish yellow very channery sandy loam to a depth of 32 inches. The substratum is reddish yellow very channery coarse sandy loam. Yellowish brown sandstone bedrock is at a depth of 56 inches.

Included with this soil in mapping are some areas of nonstony Hazleton and Cookport soils and the very stony Cookport soil. Inclusions make up about 10 percent of the unit.

This Hazleton soil has moderately rapid and rapid permeability and moderate available water capacity. Reaction is extremely acid to strongly acid throughout. The soil has numerous large stones on the surface and many channery fragments in the profile. Surface runoff is moderately rapid to rapid.

Most areas of this soil are used for woodland. A few areas are used for pasture or recreation, or they are idle.

This soil is not being used for cultivated crops or for improved pasture because of the large stones on the surface. Removing the trees and surface stones to cultivate crops or pasture is usually not feasible because of the expense involved.

This soil is suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is moderately high. Removal of undesirable species is a management practice that helps increase production. Equipment use is somewhat restricted on the steeper and more stony soils. Large stones on the surface and slope interfere with mechanical planting.

This soil has limitations for most urban uses, especially for onsite sewage disposal, because of the 3-1/2 to 6 foot depth to bedrock, the moderately rapid and rapid permeability, the slope, and the very stony surface.

This soil is in capability subclass VIs and has a woodland ordination symbol of 3r.

HvF—Hazleton very stony sandy loam, 25 to 80 percent slopes. This deep soil is well drained and is steep and very steep. It is on the upper part of hillsides that have not been subjected to glacial action. Slopes are convex and smooth and are 200 to 800 feet in length. Individual areas are long and normally range from 10 to 200 acres. Large stones cover about 3 to 15 percent of the surface.

Typically, this soil has a surface layer of dark gray sandy loam about 2 inches thick. The subsoil extends to a depth of 32 inches. In sequence from the top, it is dark reddish brown sandy loam to a depth of 4 inches; yellowish red channery sandy loam to a depth of 6 inches; reddish yellow channery sandy loam to a depth of 15 inches; strong brown channery sandy loam to a depth of 22 inches; and reddish yellow very channery sandy loam to a depth of 32 inches. The substratum is reddish yellow very channery coarse sandy loam. Yellowish brown sandstone bedrock is at a depth of 56 inches.

Included with this soil in mapping are some areas of nonstony Hazleton and Gilpin soils and the very stony Gilpin soil. Inclusions make up about 10 percent of the unit.

This Hazleton soil has stones on the surface and many channery fragments in the profile. It has moderately rapid and rapid permeability and moderate available water capacity. Reaction is extremely acid to strongly acid throughout. Surface runoff is very rapid.

Most areas of this soil are used for woodland. A few areas are used for pasture or recreation, or they are idle.

This soil is not suited to cultivated crops or to improved pasture because of slope and the large stones on the surface.

This soil is suited to trees, and most acreage is wooded. Potential productivity of the soil for trees is moderately high. Removal of undesirable species is a management practice that helps increase production. The steep slopes are a serious restriction for equipment. Large surface stones and slope interfere with mechanical planting of seedlings.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the 3-1/2 to 6 foot depth to bedrock, the slope, and the very stony surface.

This soil is in capability subclass VIIs and has a woodland ordination symbol of 3r.

LdB—Lordstown channery silt loam, 3 to 8 percent slopes. This moderately deep soil is gently sloping and well drained. It is on glaciated, narrow hilltops. Slopes are convex and smooth and are 200 to 400 feet long. Individual areas are irregular in shape and are 5 to 30 acres.

Typically, the surface layer is dark grayish brown channery silt loam about 2 inches thick. The subsurface layer is dark brown channery silt loam to a depth of 7 inches. The subsoil extends to a depth of 38 inches. The

upper 5 inches is light yellowish brown channery silt loam. The lower 26 inches is yellowish brown channery silt loam. Gray sandstone and siltstone bedrock is at a depth of 38 inches.

Included with this soil in mapping are small areas of Mardin and Hanover soils and stony Lordstown soils. Inclusions make up about 10 percent of the unit.

This Lordstown soil has moderate to slow permeability and moderate available water capacity. Surface runoff is medium. Rooting depth is restricted by the moderate depth to bedrock. In unlimed areas reaction is very strongly acid or strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is moderately suited to cultivated crops, but only a small acreage is cultivated. There is a moderate hazard of erosion. Yields are limited by moderate depth to bedrock and the moderate available moisture capacity, especially in the drier years.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing and maintaining major plant species are the chief concerns of pasture management. Proper stocking rates, rotation grazing, and deferred grazing are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is moderately high. Management problems are few. Rooting depth is restricted by the moderate depth to bedrock. Planting by machine is practical in the larger areas.

This soil has limitations for many urban uses, especially for onsite sewage disposal, because bedrock is at a depth of 20 to 40 inches.

This soil is in capability subclass IIe and has a woodland ordination symbol of 3o.

LdC—Lordstown channery silt loam, 8 to 15 percent slopes. This moderately deep soil is sloping and well drained. It is on the upper part of glaciated hillsides. Slopes are convex and smooth and are 200 to 600 feet long. Individual areas are irregular in shape and are 5 to 50 acres.

Typically, the surface layer is dark grayish brown channery silt loam about 2 inches thick. The subsurface layer is dark brown channery silt loam to a depth of 7 inches. The subsoil extends to a depth of 38 inches. The upper 5 inches is light yellowish brown channery silt loam. The lower 26 inches is yellowish brown channery silt loam. Gray sandstone and siltstone bedrock is at a depth of 38 inches.

Included with this soil in mapping are small areas of Mardin and Hanover soils and stony Lordstown soils. Inclusions make up about 10 percent of the unit.

This Lordstown soil has moderate to slow permeability and moderate available water capacity. Surface runoff is moderately rapid. Rooting depth is restricted by the moderate depth to bedrock. In unlimed areas reaction is very strongly acid or strongly acid throughout.

Most areas of this soil are used for woodland. A few are used for farming or recreation, or they are idle.

This soil is moderately suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is severe. The yields are limited by the moderate depth to bedrock and the moderate available moisture capacity, especially in the drier years. Contour stripcropping, minimum tillage, cover crops, and long-term stands of forage plants for hay are desirable practices to control erosion.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing and maintaining major plant species are the chief concerns of pasture management. Proper stocking rates, rotation grazing, and deferred grazing are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is moderately high. Management problems are minor. Rooting depth is restricted by the moderate depth to bedrock. Planting by machine is practical in the larger areas.

This soil has limitations for most urban uses, especially for onsite sewage disposal, because of slope and bedrock at a depth of 20 to 40 inches.

This soil is in capability subclass IIIe and has a woodland ordination symbol of 3o.

LdD—Lordstown channery silt loam, 15 to 25 percent slopes. This moderately deep soil is moderately steep and well drained. It is on the upper part of glaciated hillsides. Slopes are convex and smooth and are 200 to 500 feet in length. Individual areas are long and relatively narrow and are 5 to 60 acres.

Typically, the surface layer is dark grayish brown channery silt loam about 2 inches thick. The subsurface layer is dark brown channery silt loam to a depth of 7 inches. The subsoil extends to a depth of 38 inches. The upper 5 inches is light yellowish brown channery silt loam. The lower 26 inches is yellowish brown channery silt loam. Gray sandstone and siltstone bedrock is at a depth of 38 inches.

Included with this soil in mapping are small areas of Mardin and Hanover soils and stony Lordstown soils. Inclusions make up about 10 percent of the unit.

This Lordstown soil has moderate to slow permeability and moderate available water capacity. Surface runoff is rapid. Rooting depth is restricted by the moderate depth to bedrock. In unlimed areas reaction is very strongly acid or strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is moderately suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is

very severe. Contour stripcropping, minimum tillage, cover crops, and long-term stands of forage plants for hay are desirable practices for minimizing the erosion hazard. Yields are limited by the moderate depth to bedrock and moderate available moisture capacity, especially in the drier years.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing and maintaining major plant species are the chief concerns of pasture management. Proper stocking rates, rotation grazing, and deferred grazing are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is moderately high. Rooting depth is restricted by the moderate depth to bedrock. Erosion and equipment limitations are management problems because of slope. Planting by machine usually is not practical because of slope.

This soil has serious limitations for most urban uses, especially for onsite sewage disposal, because of slope and bedrock at a depth of 20 to 40 inches.

This soil is in capability subclass IVe and has a woodland ordination symbol of 3r.

LtF—Lordstown soils, 25 to 70 percent slopes. These moderately deep soils are steep and very steep and are well drained. They are on hillsides of the glaciated uplands. Individual areas are long and relatively narrow and are 10 to 150 acres. Lordstown soils comprise approximately 80 percent of the map unit. Some areas have stones which are 10 to 36 inches in diameter and which cover 3 to 15 percent of the surface. Some areas are not stony or are made up of both stony and nonstony soils. These soils have a surface layer of channery silt loam, silt loam, and gravelly silt loam. Because of the steep and very steep slopes, present and expected use are so similar that separation of stony and nonstony soils is not important to the objectives of the survey.

Typically, the surface layer is dark grayish brown and dark brown channery silt loam 7 inches thick. The subsoil extends to a depth of 38 inches. The upper 5 inches is light yellowish brown channery silt loam. The lower 26 inches is yellowish brown channery silt loam. Gray sandstone and siltstone bedrock is at a depth of 38 inches.

Included with these soils in mapping are areas of Hanover and Mardin soils. The Hanover and Mardin soils have slopes of 25 to 40 percent.

These Lordstown soils have moderate to slow permeability and moderate available water capacity. Surface runoff is very rapid. Bedrock is at a depth of 20 to 40 inches. In unlimed areas reaction is very strongly acid or strongly acid throughout.

Most of these Lordstown soils are used for woodland. They are not being used for cultivated crops or for pasture because of steep and very steep slopes, and in some areas, stones on the surface.

These soils are moderately well suited to woodland, and potential productivity of the soils for trees is moderately high. The steep to very steep slopes restrict the selection of equipment to be used and planting by machine.

The steep and very steep slopes and stones on the surface, where they are present, are the major limitations for most urban uses, especially for onsite sewage disposal.

These soils are in capability subclass VIIe and have a woodland ordination symbol of 3r.

MaA—Mardin gravelly silt loam, 0 to 3 percent slopes. This deep soil is nearly level and moderately well drained. It is on glaciated, broad uplands. Slopes are convex and smooth to hummocky. They are 300 to 1,000 feet long. Individual areas are irregular in shape and are 5 to 150 acres.

Typically, the surface and subsurface layers are dark gray and dark brown gravelly silt loam about 8 inches thick. The subsoil extends to a depth of 64 inches. The upper 13 inches is yellowish brown and brown gravelly silt loam. The lower 43 inches is a fragipan of mottled dark brown gravelly silt loam and gravelly loam that is firm and very firm and brittle.

Included in mapping are small areas of Venango soils and the stony Mardin soil. Inclusions make up about 10 percent of the unit.

This Mardin soil has very slow and slow permeability in the fragipan and moderate available water capacity. Surface runoff is slow. Rooting depth is restricted by the fragipan and by the seasonal high water table, which is at a depth of 18 to 36 inches. In unlimed areas reaction is very strongly acid or strongly acid in the surface layer and subsoil.

Most areas of this soil are used for farming. A few areas are used for woodland or recreation, or they are idle.

This soil is suited to cultivated crops, and most areas are cultivated. The erosion hazard is slight. Because of the seasonal high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage. Cover crops and long-term stands of forage plants for hay help maintain organic matter content and good tilth.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, but little is wooded. Potential productivity of the soil for trees is moderately

high. Rooting depth is restricted by the fragipan and by the seasonal high water table. The use of equipment might be restricted briefly during wet seasons. Planting by machine is practical in the larger areas.

The slow and very slow permeability of the fragipan and the seasonal high water table are major limitations for most urban uses, especially for onsite sewage disposal.

This soil is in capability subclass IIw and has a woodland ordination symbol of 3o.

MaB—Mardin gravelly silt loam, 3 to 8 percent slopes. This deep soil is gently sloping and moderately well drained. It is on glaciated, broad uplands. Slopes are convex and smooth to hummocky. They are 300 to 1,000 feet long. Individual areas are irregular in shape and are 5 to 120 acres.

Typically, the surface and subsurface layers are dark gray and dark brown gravelly silt loam about 8 inches thick. The subsoil extends to a depth of 64 inches. The upper 13 inches is yellowish brown and brown gravelly silt loam. The lower 43 inches is a fragipan of mottled dark brown gravelly silt loam and gravelly loam that is firm and very firm and brittle.

Included in mapping are small areas of Venango soils and the stony Mardin soil. Inclusions make up about 10 percent of the unit.

This Mardin soil has very slow and slow permeability in the fragipan and moderate available water capacity. Surface runoff is moderate. Rooting depth is restricted by the fragipan and by the seasonal high water table, which is at a depth of 18 to 36 inches. In unlimed areas reaction is very strongly acid or strongly acid in the surface layer and subsoil.

Most areas of this soil are used for farming. A few areas are used for woodland or recreation, or they are idle.

This soil is suited to cultivated crops, and most areas are cultivated. The erosion hazard is moderate. Because of the seasonal high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage. Stripcropping, diversions, and minimum tillage are suitable practices to control erosion. Cover crops and long-term stands of forage plants for hay help maintain organic matter content and good tilth.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, but little is wooded. Potential productivity of the soil for trees is moderately high. Rooting depth is restricted by the fragipan and by the seasonal high water table. The use of equipment might be restricted briefly during wet seasons. Planting by machine is practical in the larger areas.

The slow and very slow permeability of the fragipan and the seasonal high water table are major limitations for most urban uses, especially for onsite sewage disposal.

This soil is in capability subclass IIw and has a woodland ordination symbol of 3o.

MaC—Mardin gravelly silt loam, 8 to 15 percent slopes. This deep soil is sloping and moderately well drained. It is on glaciated, broad uplands. Slopes are convex and smooth to hummocky. They are 200 to 800 feet long. Individual areas are elongated and are 5 to 80 acres.

Typically, the surface and subsurface layers are dark gray and dark brown gravelly silt loam about 8 inches thick. The subsoil extends to a depth of 64 inches. The upper 13 inches is yellowish brown and brown gravelly silt loam. The lower 43 inches is a fragipan of mottled dark brown gravelly silt loam and gravelly loam that is firm and very firm and brittle.

Included with this soil in mapping are small areas of Venango soils and the stony Mardin soils. Inclusions make up about 10 percent of the unit.

This Mardin soil has very slow and slow permeability in the fragipan and moderate available water capacity. Surface runoff is moderately rapid. Rooting depth is restricted by the fragipan and by the seasonal high water table, which is at a depth of 18 to 36 inches. In unlimed areas reaction is very strongly acid or strongly acid in the surface layer and subsoil.

Most areas of this soil are used for farming. A few areas are used for woodland or recreation, or they are idle.

This soil is suited to cultivated crops, and most is cultivated. The erosion hazard is severe. Because of the seasonal high water table, the soil warms slowly in spring. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage. Stripcropping, diversions, and minimum tillage are suitable practices to control erosion. Cover crops and long-term stands of forage plants for hay help maintain organic matter content and good tilth.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, but little is wooded. Potential productivity of the soil for trees is moderately high. Rooting depth is restricted by the fragipan and by the seasonal high water table. The use of equipment

might be restricted briefly during wet seasons. Planting by machine is practical in the larger areas.

The slow and very slow permeability of the fragipan and the seasonal high water table are major limitations for most urban uses, especially for onsite sewage disposal.

This soil is in capability subclass IIIe and has a woodland ordination symbol of 3o.

MaD—Mardin gravelly silt loam, 15 to 25 percent slopes. This deep soil is moderately steep and moderately well drained. It is on the upper part of glaciated hillsides. Slopes are convex and smooth to hummocky. They are 200 to 800 feet long. Individual areas are elongated and are 5 to 100 acres.

Typically, the surface and subsurface layers are dark gray and dark brown gravelly silt loam about 8 inches thick. The subsoil extends to a depth of 64 inches. The upper 13 inches is yellowish brown and brown gravelly silt loam. The lower 43 inches is a fragipan of mottled dark brown gravelly silt loam and gravelly loam that is firm and very firm and brittle.

Included in mapping are small areas of Venango and Lordstown soils and the stony Mardin soil. Inclusions make up about 10 percent of the unit.

This Mardin soil has very slow and slow permeability in the fragipan and moderate available water capacity. Surface runoff is rapid. Rooting depth is restricted by the fragipan and by the seasonal high water table, which is at a depth of 18 to 36 inches. In unlimed areas reaction is very strongly acid or strongly acid in the surface layer and subsoil.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is moderately suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is very severe. Because of the seasonal high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage. Stripcropping, diversions, and minimum tillage are practices that can be used to control erosion. Cover crops and long-term stands of forage plants for hay help maintain organic matter content and good tilth.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, and more than one-half of the acreage is wooded. Potential productivity of the soil for trees is moderately high. The rooting depth is restricted by the fragipan and by the seasonal high water table. The use of equipment is restricted by slope; however, planting by machine is generally practical in the larger areas.

The slow and very slow permeability of the fragipan, the slope, and the seasonal high water table are major limitations for most urban uses, especially for onsite sewage disposal.

This soil is in capability subclass IVe and has a woodland ordination symbol of 3r.

MdD—Mardin very stony silt loam, 0 to 25 percent slopes. This deep soil is moderately well drained and nearly level to moderately steep. It is on glaciated, broad uplands and the upper part of hillsides. Slopes are convex and smooth to hummocky. They are 200 to 1,000 feet in length. Individual areas are irregular in shape and normally range from 5 to 150 acres. Large stones cover about 3 to 15 percent of the surface.

Typically, the surface and subsurface layers are dark gray and dark brown gravelly silt loam about 8 inches thick. The subsoil extends to a depth of 64 inches. The upper 13 inches is yellowish brown and brown gravelly silt loam. The lower 43 inches is a fragipan of mottled dark brown gravelly silt loam and gravelly loam that is firm and very firm and brittle.

Included with this soil in mapping are some areas of nonstony Venango and Mardin soils and the very stony Venango soil. Inclusions make up about 10 percent of the unit.

This Mardin soil has numerous large stones on the surface. It has very slow and slow permeability in the fragipan and moderate available water capacity. In unlimed areas reaction is very strongly acid or strongly acid in the surface layer and subsoil. A seasonal high water table is within 18 to 36 inches of the surface for part of the year. Surface runoff is slow to rapid. Rooting depth is restricted by the fragipan and by the seasonal high water table.

Most areas of this soil are used for woodland. A few areas are used for pasture or recreation, or they are idle.

This soil is not being used for cultivated crops or for improved pasture because of the large stones on the surface. Removing the trees and surface stones to cultivate crops or pasture is usually not feasible because of the expense involved.

The soil is suited to trees, and most acreage is wooded. Potential productivity of the soil for trees is moderately high. Rooting depth is restricted by the fragipan and by the seasonal high water table. Removal of undesirable species is a management practice that helps increase production. Steep slopes and large stones on the surface interfere with harvesting and mechanical planting.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the seasonal high water table, the slow and very slow permeability in the fragipan, and the very stony surface.

This soil is in capability subclass VIs and has a woodland ordination symbol of 3r.

Mm—Medihemists and Medisaprists, ponded. These nearly level organic soils are deep and very poorly drained. The two areas of these soils are in Benson Swamp and Tamarack Swamp. They are irregularly shaped and are 338 and 493 acres, respectively. Each area is made up of about 50 percent Medihemists and about 35 percent Medisaprists soils.

The organic material in the Medihemists is dark reddish brown to black mucky peat 51 inches or more thick. It consists of partly decomposed, woody fragments, herbaceous material, and sphagnum peat.

The organic material in the Medisaprists is dark reddish brown to black muck 51 inches or more thick. It consists of highly decomposed woody fragments, herbaceous material, and sphagnum peat.

Included with these soils in mapping are areas of organic soils that are less than 51 inches deep to mineral soils. Also included are areas of organic soils that are more than two-thirds unrubbed fiber and areas of Canadice, Chippewa, and Rexford soils. The included soils in this unit are larger in size than included areas in most units in this survey area. They make up 15 percent of the unit.

These soils have a water table at or near the surface during most of the year. Bedrock is generally deeper than 6 feet. Reaction is extremely acid to strongly acid throughout.

Most areas of these soils are in cattails, sedges, and sphagnum moss or are in hemlock, white pine, and aspen. These soils are poorly suited to most uses, except wetland wildlife habitat. Small areas of Medihemists that can be drained are a potential source of commercial peat. One small area has been used for this purpose. The high water table and the organic nature of these soils are limitations for most other uses.

This map unit is not assigned to an interpretative grouping.

Ph—Philo silt loam. This deep soil is nearly level and moderately well drained. It is on flood plains. Slopes are uniform and nearly flat and are 200 to 500 feet long. Individual areas are long and narrow and are 5 to 50 acres. Slopes range from 0 to 3 percent.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsoil extends to a depth of 36 inches. The upper 15 inches is yellowish brown silt loam and sandy loam. The lower 14 inches is mottled yellowish brown sandy loam. The upper 9 inches of the substratum is mottled light brownish gray loamy sand. The lower part is dark grayish brown, stratified sand and gravel to a depth of 60 inches.

Included with this soil in mapping are small areas of Pope and Wayland soils. Inclusions make up about 5 percent of the unit.

This Philo soil has moderate or moderately slow permeability in the subsoil and high available water capacity. Surface runoff is slow. Rooting depth is restricted by the seasonal high water table, which is at a depth of 18 to 36 inches. In unlimed areas reaction is very strongly acid to medium acid throughout.

Most areas of this soil are used for farming. A few areas are used for woodland or recreation, or they are idle.

This soil is well suited to cultivated crops, and most of it is farmed. The erosion hazard is slight. Flooding is common in the spring. Because of the seasonal high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow timely tillage. Including cover crops and hay in a crop rotation system helps maintain organic matter content and good tilth.

This soil is suited to pasture. If it is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

Philo silt loam is well suited to trees, but little acreage is wooded. Potential productivity of the soil for trees is very high. Rooting depth is restricted by the seasonal high water table. Equipment use is restricted during wet seasons. Planting by machine is practical in the larger areas.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the flooding hazard, the moderate and moderately slow permeability, and the seasonal high water table.

This soil is in capability subclass IIw and has a woodland ordination symbol of 1w.

Pn—Pits, gravel. This map unit consists mostly of excavations that have either gravelly, cobbly, or bedrock bottoms (fig. 12). The areas range from 2 to 40 acres in size, and most are on intermediate terraces. Slopes are nearly level to sloping. The soil material that covers the gravel deposits or fractured sandstone has textures of gravelly silt loam, gravelly loam, sandy loam, or channery sandy loam.

A typical pedon is not given because this miscellaneous area does not have horizons.

Included soils comprise as much as 15 percent of the delineated areas. Pushed aside boulders and concretionary masses, topsoil, and subsurface materials can comprise as much as 5 percent of the worked areas.

With the exception of the pits in Braceville soils, permeability is rapid, both in the soil material and in the floor of the pit. Runoff varies according to the slope of the floor.

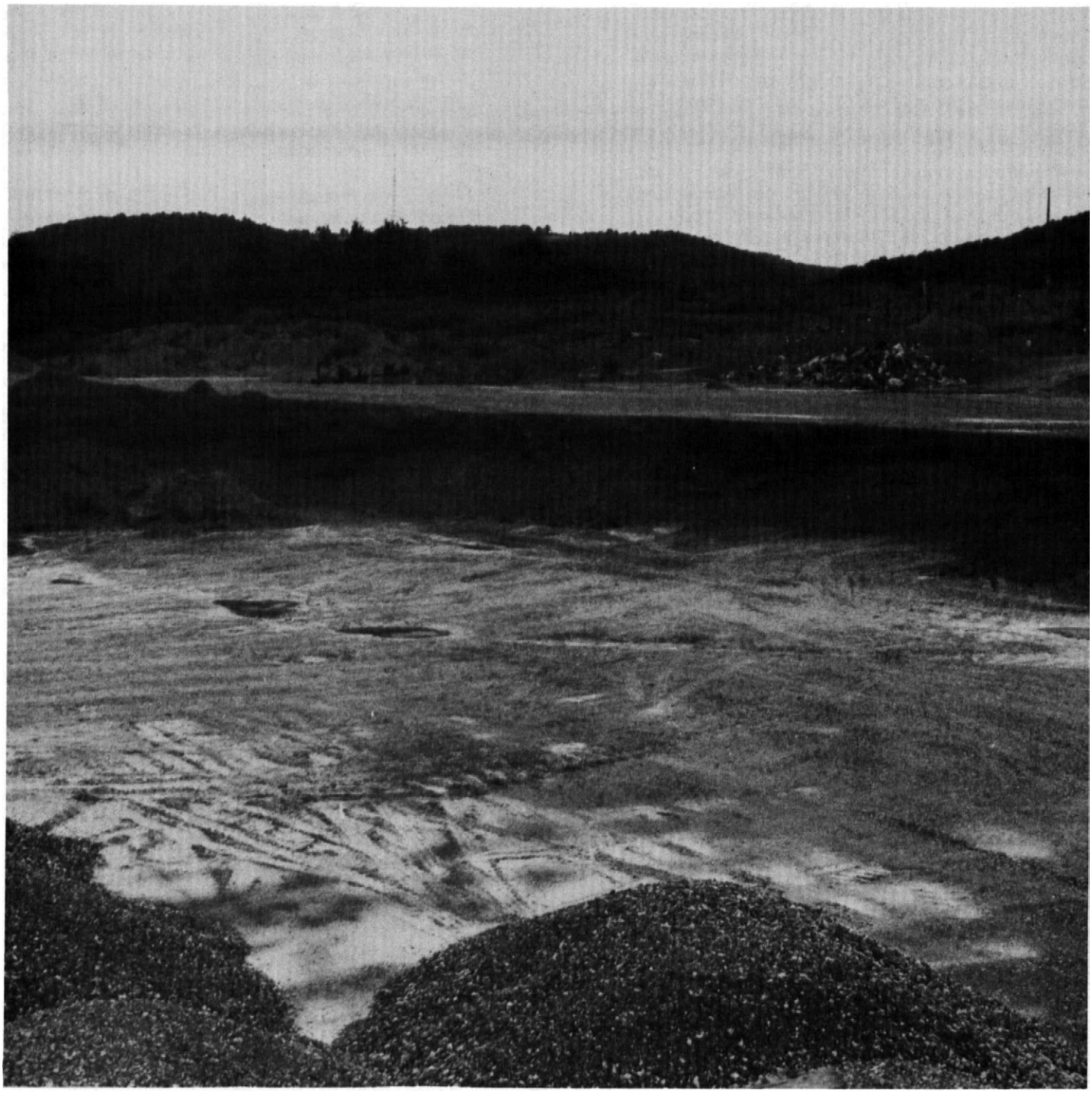


Figure 12.—Typical scene of Pits, gravel, that has gravelly bottom.

Pits, gravel, is not suited to any use that requires a developed surface layer. Without replacement of topsoil, little vegetation of any value grows on this unit. Drought-resistant shrubs can be used to mask the visual blight. Onsite investigations are needed to determine suitability for specific uses.

This map unit is not assigned to an interpretive grouping.

Po—Pope loam. This deep soil is nearly level and well drained. It is on flood plains. Flooding is common. Slopes are uniform and nearly flat and are 200 to 500

feet long. Areas are long and narrow and are 5 to 60 acres. Slopes range from 0 to 3 percent.

Typically, the surface layer is dark grayish brown loam about 7 inches thick. The subsoil extends to a depth of 49 inches. It is brown and dark yellowish brown loam and silt loam that is mottled below a depth of 38 inches. The substratum is brown gravelly loamy coarse sand to a depth of 60 inches.

Included with this soil in mapping are small areas of Philo and Wayland soils. Inclusions make up about 5 percent of the unit.

This Pope soil has moderate or moderately rapid permeability and high available water capacity. Surface runoff is slow. In unlimed areas reaction is extremely acid to strongly acid throughout.

Most areas of this soil are used for farming. A few areas are used for woodland or recreation, or they are idle.

This soil is well suited to cultivated crops, and most of it is farmed. The soil has a slight hazard of erosion. Good tilth and a high amount of organic matter can be maintained by including cover crops and grasses and legumes in the cropping system.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, and deferred grazing are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

Pope loam is well suited to trees, but little acreage is wooded. Potential productivity of the soil for trees is high. Planting by machine is practical in the larger areas.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the flooding hazard.

This soil is in capability class I and has a woodland ordination symbol of 2o.

ReA—Rexford loam, 0 to 8 percent slopes. This deep soil is nearly level and gently sloping and is somewhat poorly drained and poorly drained. It is on glacial outwash terraces or terraces along streams. Slopes are uniform and smooth and are 200 to 600 feet long. Individual areas are irregular in shape and are 5 to 50 acres.

Typically, the surface layer is dark grayish brown loam about 9 inches thick. The subsoil extends to a depth of 36 inches. The upper 5 inches is mottled, yellowish brown silt loam. The next 10 inches is mottled, grayish brown sandy loam. The lower 12 inches is a fragipan of mottled grayish brown gravelly sandy loam that is very firm and brittle. The substratum is mottled olive brown sandy loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Braceville and Wayland soils. Inclusions make up about 5 percent of the unit.

This Rexford soil has slow permeability in the fragipan and moderate available water capacity. Surface runoff is slow to medium. Rooting depth is restricted by the fragipan and by the seasonal high water table. In unlimed areas reaction is very strongly acid to medium acid above the fragipan.

Most areas of this soil are used for farming. A few areas are used for woodland or recreation, or they are idle.

This soil is moderately suited to cultivated crops. About one-half of the acreage is in cultivated crops. The erosion hazard is slight to moderate. Because of the seasonal high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage (fig. 13). Including cover crops and hay in a crop rotation system helps maintain organic matter content and good tilth.

This soil is suited to pasture during drier periods. If the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, but very little is wooded. Potential productivity of the soil for trees is moderately high. Rooting depth is restricted by the fragipan and by the seasonal high water table. Equipment use is restricted during wet seasons. Planting by machine is practical in the larger areas.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the slow permeability in the fragipan and the seasonal high water table.

This soil is in capability subclass IIIw and has a woodland ordination symbol of 3w.

Sc—Scio silt loam. This deep soil is nearly level and moderately well drained. It is on low terraces and on old alluvial fans. Slopes are uniform and nearly flat and are 300 to 1,000 feet long. Areas are irregular in shape and are 5 to 50 acres. Slopes range from 0 to 3 percent.

Typically, the surface layer is very dark grayish brown silt loam about 11 inches thick. The subsoil extends to a depth of 44 inches. The upper 8 inches is dark yellowish brown silt loam. The lower 25 inches is mottled brown and dark brown silt loam. The substratum is mottled grayish brown gravelly loamy sand to a depth of 60 inches.

Included with this soil in mapping are small areas of Unadilla, Philo, and Pope soils. Inclusions make up about 5 percent of the unit.

This Scio soil has moderate permeability in the upper 40 inches and high available water capacity. Surface runoff is slow. Rooting depth is restricted by the seasonal high water table at a depth of 18 to 36 inches.

Figure 13.—Drainage is needed on Rexford loam, 0 to 8 percent slopes, for timely cultivation and harvesting.

In unlimed areas reaction is very strongly acid to medium acid in the upper 40 inches.

Most areas of this soil are used for farming. A few areas are used for woodland or recreation, or they are idle.

This soil is suited to cultivated crops, and most acreage is farmed. The erosion hazard is slight. Because of the seasonal high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage. Including cover crops and hay in a crop rotation system helps maintain organic matter content and good tilth.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is well suited to trees, but little acreage is wooded. Potential productivity of the soil for trees is high. Rooting depth is restricted by the seasonal high water table. Equipment use is slightly restricted during wet seasons. Planting by machine is practical in the larger areas.

This soil has limitations for some urban uses, especially for onsite sewage disposal, because of the seasonal high water table.

This soil is in capability subclass IIw and has a woodland ordination symbol of 2o.

ShC—Shelmadine silt loam, 3 to 15 percent slopes. This deep soil is gently sloping and sloping and is poorly drained. It is on flats, in depressions, in drainageways, and on foot slopes of uplands. Slopes are concave and smooth and are 200 to 500 feet long. Areas are fan-shaped or oblong-shaped and are 5 to 50 acres.

Typically, the surface layer is dark gray silt loam about 5 inches thick. The subsoil extends to a depth of 42 inches. The upper 21 inches is mottled light brownish gray silt loam, and mottled gray silty clay loam. The lower 16 inches is a fragipan of mottled dark yellowish brown silt loam that is very firm and brittle. The substratum is mottled dark brown channery loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Alvira soils and the stony Shelmadine soil. Inclusions make up about 10 percent of the unit.

This Shelmadine soil has slow permeability in the fragipan, moderate available water capacity, and a high water table within 6 inches of the surface. Surface runoff is medium to moderately rapid. Rooting depth is restricted by the fragipan and by the high water table. In unlimed areas reaction is extremely acid to strongly acid throughout.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is poorly suited to cultivated crops, and only a small acreage is cultivated. The erosion hazard is moderate to severe. Because of the high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow timely tillage. Contour stripcropping, diversions, and grasses and legumes in the cropping system are practices that reduce runoff and control erosion.

This soil is suited to pasture during drier periods. If the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is moderately high. Rooting depth is restricted by the fragipan and by the high water table. Equipment use is seriously restricted during wet seasons. Planting by machine is practical in the larger areas.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the slow permeability in the fragipan and the high water table.

This soil is in capability subclass IVw and has a woodland ordination symbol of 3w.

SvC—Shelmadine very stony silt loam, 0 to 15 percent slopes. This deep soil is poorly drained and nearly level to sloping. It is on flats, in depressions, in drainageways, and on foot slopes of glaciated uplands. Slopes are concave and smooth and are 200 to 500 feet in length. The areas are fan-shaped or oblong-shaped and normally range from 5 to 70 acres. Large stones cover about 3 to 15 percent of the surface.

Typically, the surface layer is dark gray silt loam about 5 inches thick. The subsoil extends to a depth of 42 inches. The upper 21 inches is mottled light brownish gray silt loam and mottled gray silty clay loam. The lower 16 inches is a fragipan of mottled dark yellowish brown silt loam that is very firm and brittle. The substratum is mottled dark brown channery loam to a depth of 60 inches.

Included with this soil in mapping are some areas of nonstony Alvira and Shelmadine soils and the very stony Alvira soil. Inclusions make up about 10 percent of the unit.

This Shelmadine soil has slow permeability in the fragipan, moderate available water capacity, and a high water table within 6 inches of the surface. Reaction is extremely acid to strongly acid throughout. Surface runoff is slow to moderately rapid. Rooting depth is restricted by the fragipan and by the high water table.

This soil is mostly in woodland. A few areas are used for pasture or recreation, or they are idle.

This soil is not being used for cultivated crops or for improved pasture because of the large stones on the surface. Removing the trees and surface stones and lowering the high water table to cultivate crops or pasture are not usually feasible because of the expense involved.

This soil is suited to trees, and most acreage is wooded. Potential productivity of the soil for trees is moderately high. Rooting depth is restricted by the fragipan and by the seasonal high water table. Removal of undesirable species is a management practice that helps increase production. Equipment use is restricted to part of the year because of the high water table. Large stones on the surface interfere with mechanical planting.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the high water table, the slow permeability in the fragipan, and the very stony surface.

This soil is in capability subclass VIIs and has a woodland ordination symbol of 3w.

Ud—Udorthents, smooth. This map unit consists of deep soil materials that are moderately well drained and well drained. The soil materials either have been placed on or have been disturbed on foot slopes and flood plains. They are the result of stripping and replacing of or mixing of the original soils and bedrock during

construction of homes and commercial buildings. These soils are generally around urbanized areas. Individual areas are irregularly shaped and range from 2 to 15 acres. Slopes are generally smooth and range from 0 to 15 percent.

The thickness of the fill material ranges from a few feet to 20 feet or more. The source of the fill is variable. It is largely from Brinkerton, Unadilla, Pope, Ernest, Chenango, and Gilpin soils. In some areas these soils have been stripped or excavated into the substratum. Coarse fragments range in size from small shale and gravel to stones and make up about 10 to 75 percent of the material.

Included with these soils in mapping are small areas of soils that are moderately steep and steep and wet, swampy soils that are on flood plains. Small areas of Gilpin, Ernest, Pope, Chenango, Unadilla, and Brinkerton soils are also included.

These soils have slow to very rapid permeability and high to very low available water capacity. Runoff is rapid to very slow. Runoff or ground water ponds in low areas or in depressions. Flooding occurs in some places. The hazard of erosion ranges from slight to severe. These soils are extremely acid to neutral throughout.

Most areas of these soils are in railroad yards and in housing, industrial, and commercial developments.

The soil materials comprising Udorthents are variable. A detailed onsite investigation is needed to determine the suitability and limitations of these soils for any proposed use.

This map unit is not assigned to an interpretative grouping.

UnA—Unadilla silt loam, 0 to 3 percent slopes. This deep soil is nearly level and well drained. It is on low terraces that are only a few feet above the usual flood level. Flooding is rare and very brief on this soil. Slopes are uniform and nearly flat and are 200 to 600 feet long. Individual areas are oblong and are 5 to 100 acres.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsoil is dark yellowish brown and yellowish brown silt loam to a depth of 42 inches. The substratum is dark brown gravelly sand to a depth of 60 inches.

Included with this soil in mapping are small areas of Scio, Philo, and Pope soils. Inclusions make up about 5 percent of the unit.

This Unadilla soil has moderate permeability in the surface layer and subsoil and high available water capacity. Surface runoff is slow. Rooting depth extends to a depth of 60 inches or more. In unlimed areas reaction is very strongly acid to medium acid in the surface layer and subsoil and strongly acid to mildly alkaline in the substratum.

Most areas of this soil are used for farming. A few areas are used for woodland or recreation, or they are idle.

This soil is well suited to cultivated crops. The erosion hazard is slight. Good tilth and high organic matter content of this soil can be maintained by including cover crops and grasses and legumes in a cropping system.

This soil is well suited to pasture. If it is used for pasture, prevention of overgrazing and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, and deferred grazing are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, but little acreage is wooded. Potential productivity of the soil for trees is high. Management problems are few. Planting by machine is practical in the larger areas.

This soil has limitations for some urban uses, especially for onsite sewage disposal and dwellings, because of the rare hazard of flooding.

This soil is in capability class I and has a woodland ordination symbol of 2o.

VeA—Venango silt loam, 0 to 3 percent slopes. This deep soil is nearly level and somewhat poorly drained. It is on glaciated, broad uplands. Slopes are uniform and smooth and are 300 to 1,000 feet long. Areas are irregular in shape and are 5 to 80 acres.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is brown silt loam to a depth of 11 inches. The subsoil extends to a depth of 46 inches. The upper 8 inches is mottled yellowish brown silt loam. The lower 27 inches is a fragipan of mottled brown silt loam and mottled dark yellowish brown channery loam that is firm and brittle. The substratum is mottled olive brown gravelly silt loam to a depth of 62 inches.

Included with this soil in mapping are small areas of Mardin and Chippewa soils and the stony Venango soil. Inclusions make up about 10 percent of the unit.

This Venango soil has slow permeability in the fragipan and moderate available water capacity. Surface runoff is slow. Rooting depth is restricted by the fragipan and by the seasonal high water table at a depth of 6 to 18 inches. In unlimed areas reaction is extremely acid to medium acid above the fragipan, strongly acid to slightly acid in the fragipan, and neutral to moderately alkaline below the fragipan.

Most areas of this soil are used for farming. A few areas are used for woodland or recreation, or they are idle.

This soil is moderately well suited to cultivated crops, and more than one-half of the acreage is farmed. The erosion hazard is slight. Because of the seasonal high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow timely tillage. Including cover crops and hay in a crop rotation system helps maintain organic matter content and good tilth.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species

are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is well suited to trees, and much is wooded. Potential productivity of this soil for trees is high. Rooting depth is restricted by the fragipan and by the seasonal high water table. Equipment use is restricted during wet seasons. Planting by machine is practical in the larger areas.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of slow permeability in the fragipan and the seasonal high water table.

This soil is in capability subclass IIIw and has a woodland ordination symbol of 2w.

VeB—Venango silt loam, 3 to 8 percent slopes. This deep soil is gently sloping and somewhat poorly drained. It is on glaciated, broad uplands. Slopes are uniform and smooth and are 300 to 800 feet long. Individual areas are irregular in shape and are 5 to 100 acres.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is brown silt loam to a depth of 11 inches. The subsoil extends to a depth of 46 inches. The upper 8 inches is mottled yellowish brown silt loam. The lower 27 inches is a fragipan of mottled brown silt loam and mottled dark yellowish brown channery loam that is firm and brittle. The substratum is mottled olive brown gravelly silt loam to a depth of 62 inches.

Included with this soil in mapping are small areas of Mardin and Chippewa soils and the stony Venango soil. Inclusions make up about 5 percent of the unit.

This Venango soil has slow permeability in the fragipan and moderate available water capacity. Surface runoff is medium. Rooting depth is restricted by the fragipan and by the seasonal high water table at a depth of 6 to 18 inches. In unlimed areas reaction is extremely acid to medium acid above the fragipan, strongly acid to slightly acid in the fragipan, and neutral to moderately alkaline below the fragipan.

Most areas of this soil are used for farming. A few areas are used for woodland or recreation, or they are idle.

This soil is moderately well suited to cultivated crops, and more than one-half of the acreage is farmed. The erosion hazard is moderate. Because of the seasonal high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage. Contour stripcropping, diversion terraces, grassed waterways, and minimum tillage help to control erosion.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is well suited to trees, and much is wooded. Potential productivity of the soil for trees is high. Rooting depth is restricted by the fragipan and by the seasonal high water table. Equipment use is restricted during wet seasons. Planting by machine is practical in the larger areas.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the slow permeability in the fragipan and the seasonal high water table.

This soil is in capability subclass IIIw and has a woodland ordination symbol of 2w.

VeC—Venango silt loam, 8 to 15 percent slopes. This deep soil is sloping and somewhat poorly drained. It is on the upper part of glaciated hillsides. Slopes are convex and smooth and are 200 to 600 feet long. Individual areas are elongated and are 10 to 100 acres.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is brown silt loam to a depth of 11 inches. The subsoil extends to a depth of 46 inches. The upper 8 inches is mottled yellowish brown silt loam. The lower 27 inches is a fragipan of mottled brown silt loam and mottled dark yellowish brown channery loam that is firm and brittle. The substratum is mottled olive brown gravelly silt loam to a depth of 62 inches.

Included with this soil in mapping are small areas of Mardin and Lordstown soils and the stony Venango soil. Inclusions make up about 10 percent of the unit.

This Venango soil has slow permeability in the fragipan and moderate available water capacity. Surface runoff is moderately rapid. Rooting depth is restricted by the fragipan and by the seasonal high water table at a depth of 6 to 18 inches. In unlimed areas reaction is extremely acid to medium acid above the fragipan, strongly acid to slightly acid in the fragipan, and neutral to moderately alkaline below the fragipan.

Most areas of this soil are used for farming. Some areas are used for woodland; others are used for recreation or are idle.

This soil is moderately well suited to cultivated crops, and more than one-half of the acreage is farmed. The erosion hazard is severe. Because of the seasonal high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage. Contour stripcropping, diversion terraces, grassed waterways, and minimum tillage help to control erosion.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing, prevention of grazing

when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is well suited to trees, and much is wooded. Potential productivity of the soil for trees is high. Rooting depth is restricted by the fragipan and by the seasonal high water table. Equipment use is restricted during wet seasons. Planting by machine is practical in the larger areas.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the slow permeability in the fragipan and the seasonal high water table.

This soil is in capability subclass IIIe and has a woodland ordination symbol of 2w.

VsC—Venango very stony silt loam, 8 to 15 percent slopes. This deep soil is sloping and somewhat poorly drained. It is on the upper part of glaciated hillsides. Slopes are convex and smooth and are 200 to 600 feet in length. The areas are elongated and normally range from 10 to 100 acres. Large stones cover about 3 to 15 percent of the surface.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is brown silt loam to a depth of 11 inches. The subsoil extends to a depth of 46 inches. The upper 8 inches is mottled yellowish brown silt loam. The lower 27 inches is a fragipan of mottled brown silt loam and mottled dark yellowish brown channery loam that is firm and brittle. The substratum is mottled olive brown gravelly silt loam to a depth of 62 inches.

Included with this soil in mapping are some areas of nonstony Venango and Mardin soils and the very stony Mardin soil. Inclusions make up about 10 percent of the unit.

This Venango soil has slow permeability in the fragipan, moderate available water capacity, and a seasonal high water table within 6 to 18 inches of the surface for part of the year. Reaction is extremely acid to medium acid above the fragipan, strongly acid to slightly acid in the fragipan, and neutral to moderately alkaline below the fragipan. Surface runoff is moderately rapid. Rooting depth is restricted by the fragipan and by the seasonal high water table.

This soil is mostly in woodland. A few areas are used for pasture or recreation, or they are idle.

This soil is not being used for cultivated crops or for improved pasture because of the large stones on the surface. Removing the trees and surface stones and lowering the water table to cultivate crops or pasture is usually not feasible because of the expense involved.

This soil is suited to trees, and most acreage is wooded. Potential productivity of the soil for trees is high. Rooting depth is restricted by the fragipan and by the seasonal high water table. Removal of undesirable species is a management practice that helps increase production. Equipment use is restricted for part of the year because of the high water table. Large stones on the surface interfere with mechanical planting.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the seasonal high water table, the slow permeability in the fragipan, and the very stony surface.

This soil is in capability subclass VIs and has a woodland ordination symbol of 2w.

Wa—Wayland silt loam. This deep soil is nearly level and is poorly drained and very poorly drained. It is on flood plains and is frequently flooded. Slopes are uniform and smooth and are 200 to 500 feet long. Individual areas are long and narrow and are 5 to 100 acres.

Typically, the surface and subsurface layers are very dark grayish brown silt loam about 13 inches thick. The subsoil extends to a depth of 28 inches. It is mottled, grayish brown silt loam. The substratum is mottled gray silty clay loam to a depth of 36 inches. It is mottled gray silt loam to a depth of 64 inches.

Included with this soil in mapping are small areas of Philo and Atkins soils. Inclusions make up about 5 percent of the unit.

This soil has slow permeability and high available water capacity. Surface runoff is slow. Rooting depth is restricted by the high water table at or near the surface. In unlimed areas reaction is strongly acid to mildly alkaline to a depth of 24 inches and medium acid to moderately alkaline below 24 inches.

Most areas of this soil are used for farming. A few areas are used for woodland or recreation, or they are idle.

This soil is moderately suited to cultivated crops, but most of the acreage is used for pasture. The erosion hazard is slight. Because of the seasonal high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage. Including cover crops and hay in a crop rotation system helps maintain organic matter content and good tilth.

This soil is suited to pasture during drier periods. If the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is suited to trees, and about one-third of the areas are wooded. Potential productivity of the soil for trees is moderate. Rooting depth is restricted by the high water table in winter and spring. Equipment use is seriously restricted during wet seasons. Planting by

machine is practical in the larger areas when the soil is not too wet.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the frequent flooding, the slow permeability, and the high water table.

This soil is in capability subclass IIIw and has a woodland ordination symbol of 4w.

WhB—Wharton silt loam, 3 to 8 percent slopes. This deep soil is gently sloping and moderately well drained. It is on broad uplands that have not been subjected to glacial action. Slopes are concave and smooth and are 300 to 600 feet long. Individual areas are irregular in shape and are 5 to 60 acres.

Typically, the surface layer is dark brown silt loam about 2 inches thick. The subsurface layer is yellowish brown silt loam to a depth of 7 inches. The subsoil extends to a depth of of 47 inches. The upper 11 inches is yellowish brown silty clay loam. The lower 29 inches is mottled strong brown, yellowish brown, and brownish yellow silty clay loam and shaly silty clay loam. The substratum is mottled dark grayish brown shaly silt loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Cavode and Gilpin soils. Inclusions make up about 10 percent of the unit.

This Wharton soil has slow permeability and moderate available water capacity. Surface runoff is medium. Rooting depth is restricted by the seasonal high water table, which is at a depth of 18 to 36 inches. In unlimed areas reaction is very strongly acid or strongly acid in the surface layer and subsoil and extremely acid or very strongly acid in the substratum.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is well suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is moderate. Because of the seasonal high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage. Stripcropping, diversions, and minimum tillage are desirable practices to limit erosion. A cropping system that includes cover crops and long-term stands of forage plants for hay helps maintain organic matter content and good tilth.

This soil is suited to pasture during drier periods. If the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is well suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is high. Rooting depth is restricted by the seasonal high water table. Equipment use can be restricted briefly during wet seasons. Planting by machine is practical in the larger areas.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the slow permeability and the seasonal high water table that is within 18 to 36 inches of the surface.

This soil is in capability subclass IIe and has a woodland ordination symbol of 2o.

WhC—Wharton silt loam, 8 to 15 percent slopes. This deep soil is sloping and moderately well drained. It is on the upper part of glaciated hillsides. Slopes are concave and smooth and are 200 to 500 feet long. Individual areas are long and narrow and are 5 to 80 acres.

Typically, the surface layer is dark brown silt loam about 2 inches thick. The subsurface layer is yellowish brown silt loam to a depth of 7 inches. The subsoil extends to a depth of 47 inches. The upper 11 inches is yellowish brown silty clay loam. The lower 29 inches is mottled strong brown, yellowish brown, and brownish yellow silty clay loam and shaly silty clay loam. The substratum is mottled dark grayish brown shaly silt loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Cavode and Gilpin soils. Inclusions make up about 10 percent of the unit.

This Wharton soil has slow permeability and moderate available water capacity. Surface runoff is moderately rapid. Rooting depth is restricted by the seasonal high water table, which is at a depth of 18 to 36 inches. In unlimed areas reaction is very strongly acid or strongly acid in the surface layer and subsoil and extremely acid or very strongly acid in the substratum.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is well suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is severe. Because of the seasonal high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage. Stripcropping, diversions, and minimum tillage are desirable practices to limit erosion. A cropping system that includes cover crops and long-term stands of forage for hay helps maintain organic matter content and good tilth.

This soil is suited to pasture during drier periods. If the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is well suited to trees, and most of the acreage is wooded. Potential productivity of the soil for

trees is high. Rooting depth is restricted by the seasonal high water table. Equipment use can be restricted briefly during wet seasons. Planting by machine is practical in the larger areas.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the slow permeability, the slope, and the seasonal high water table that is within 18 to 36 inches of the surface.

This soil is in capability subclass IIIe and has a woodland ordination symbol of 2r.

WhD—Wharton silt loam, 15 to 25 percent slopes. This deep soil is moderately steep and moderately well drained. It is on the upper part of hillsides that have not been subjected to glacial action. Slopes are concave and smooth and are 300 to 600 feet long. Individual areas are long and narrow and are 5 to 100 acres.

Typically, the surface layer is dark brown silt loam about 2 inches thick. The subsurface layer is yellowish brown silt loam to a depth of 7 inches. The subsoil extends to a depth of 47 inches. The upper 11 inches is yellowish brown silty clay loam. The lower 29 inches is mottled strong brown, yellowish brown, and brownish yellow silty clay loam and shaly silty clay loam. The substratum is mottled dark grayish brown shaly silt loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Cavode and Gilpin soils. Inclusions make up about 10 percent of the unit.

This Wharton soil has slow permeability and moderate available water capacity. Surface runoff is rapid. Rooting depth is restricted by the seasonal high water table, which is at a depth of 18 to 36 inches. In unlimed areas reaction is very strongly acid or strongly acid in the surface layer and subsoil and extremely acid or very strongly acid in the substratum.

Most areas of this soil are used for woodland. A few areas are used for farming or recreation, or they are idle.

This soil is moderately suited to cultivated crops, but only a small acreage is cultivated. The erosion hazard is very severe. Because of the seasonal high water table, the soil warms slowly in the spring. Surface and subsurface drains are needed to help remove excess water and allow for timely tillage. Stripcropping, diversions, and long-term stands of grasses and legumes in a cropping system are needed to control erosion.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing, prevention of grazing when the soil is wet, and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, deferred grazing, and restricted grazing during wet periods are some management practices than can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is well suited to trees, and most of the acreage is wooded. Potential productivity of the soil for trees is high. Rooting depth is restricted by the seasonal high water table. Equipment use is restricted by slope. Planting by machine is practical in larger areas of less sloping soils.

This soil has major limitations for most urban uses, especially for onsite sewage disposal, because of the slope, the slow permeability, and the seasonal high water table.

This soil is in capability subclass IVe and has a woodland ordination symbol of 2r.

WoB—Wooster gravelly silt loam, 3 to 8 percent slopes. This deep soil is gently sloping and well drained. It is on terminal moraines. Slopes are convex and smooth and are 200 to 600 feet long. Individual areas are irregularly shaped and are 5 to 70 acres.

Typically, the surface layer is very dark grayish brown silt loam about 2 inches thick. The subsurface layer is brown gravelly silt loam 8 inches thick. The subsoil is 32 inches thick. The upper 17 inches is yellowish brown gravelly silt loam and the lower 15 inches is a fragipan of yellowish brown, firm and brittle gravelly loam. The substratum is yellowish brown very gravelly sandy loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Mardin and Venango soils. Inclusions make up about 10 percent of the unit.

This Wooster soil has moderately slow permeability in the fragipan and moderate available water capacity. Surface runoff is medium. Rooting depth is restricted by the fragipan. In unlimed areas reaction is very strongly acid to medium acid in the surface layer and subsoil.

Most areas of this soil are used for farming. A few areas are used for woodland or recreation, or they are idle.

This soil is well suited to cultivated crops, and nearly all of it is cultivated. The erosion hazard is moderate. Contour stripcropping, diversions, grassed waterways, and minimum tillage help control erosion.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, and deferred grazing are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is well suited to trees, but only a small acreage is wooded. Potential productivity of the soil for trees is very high. Rooting depth is restricted by the fragipan. Planting by machine is practical in the larger areas.

The moderately slow permeability in the fragipan is a limitation for a few urban uses, especially for onsite sewage disposal.

This soil is in capability subclass IIe and has a woodland ordination symbol of 1o.

WoC—Wooster gravelly silt loam, 8 to 15 percent slopes. This deep soil is sloping and well drained. It is

on terminal moraines. Slopes are convex and smooth and are 200 to 600 feet long. Individual areas are irregularly shaped and are 5 to 90 acres.

Typically, the surface layer is very dark grayish brown silt loam about 2 inches thick. The subsurface layer is brown gravelly silt loam 8 inches thick. The subsoil is 32 inches thick. The upper 17 inches is yellowish brown gravelly silt loam and the lower 15 inches is a fragipan of yellowish brown, firm and brittle gravelly loam. The substratum is yellowish brown very gravelly sandy loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Mardin and Venango soils. Inclusions make up about 10 percent of the unit.

This Wooster soil has moderately slow permeability in the fragipan and moderate available water capacity. Surface runoff is moderately rapid. Rooting depth is restricted by the fragipan. In unlimed areas reaction is very strongly acid to medium acid in the surface layer and subsoil.

Most areas of this soil are used for farming. A few areas are used for woodland or recreation, or they are idle.

This soil is well suited to cultivated crops, and nearly all of it is cultivated. The erosion hazard is severe. Contour stripcropping, diversions, grassed waterways, and minimum tillage help control erosion.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, and deferred grazing are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is well suited to trees, but only a small acreage is wooded. Potential productivity of the soil for trees is very high. Management problems are few. Rooting depth is restricted by the fragipan. Planting by machine is practical in the larger areas.

The moderately slow permeability in the fragipan and the slope are limitations for many urban uses, especially for onsite sewage disposal.

This soil is in capability subclass IIIe and has a woodland ordination symbol of 1o.

WoD—Wooster gravelly silt loam, 15 to 25 percent slopes. This deep soil is moderately steep and well drained. It is on terminal moraines. Slopes are convex and smooth and are 200 to 400 feet long. Individual areas are irregularly shaped and are 5 to 50 acres.

Typically, the surface layer is very dark grayish brown silt loam about 2 inches thick. The subsurface layer is brown gravelly silt loam to a depth of 10 inches. The subsoil extends to a depth of 42 inches. The upper 17 inches is yellowish brown gravelly silt loam and the lower 15 inches is a fragipan of yellowish brown, firm and brittle gravelly loam. The substratum is yellowish brown very gravelly sandy loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Mardin and Lordstown soils. Inclusions make up about 10 percent of the unit.

This Wooster soil has moderately slow permeability in the fragipan and moderate available water capacity. Surface runoff is rapid. Rooting depth is restricted by the fragipan. In unlimed areas reaction is very strongly acid to medium acid in the surface layer and subsoil.

Most areas of this soil are used for pasture and woodland. A few areas are used for cultivated crops or recreation, or they are idle.

This soil is moderately suited to cultivated crops, and only a small acreage is cultivated. The erosion hazard is very severe. Contour stripcropping, grassed waterways, diversions, and grasses and legumes in a cropping system help control erosion.

This soil is suited to pasture. If the soil is used for pasture, prevention of overgrazing and maintaining major plant species are chief concerns of pasture management. Proper stocking rates, rotation grazing, and deferred grazing are some management practices that can be used. Attaining optimum production requires maintaining fertility by periodically applying nutrients.

This soil is well suited to trees, and about one-half of the acreage is wooded. Potential productivity of the soil for trees is very high. Rooting depth is restricted by the fragipan. Equipment use is limited by the moderately steep slopes. Planting by machine generally is not practical.

The moderately slow permeability of the fragipan and the moderately steep slopes are major limitations for most urban uses, especially for onsite sewage disposal.

This soil is in capability subclass IVe and has a woodland ordination symbol of 1r.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

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

crops and pasture

John C. Spitzer, conservation agronomist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. 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.

This section provides information about the overall agriculture potential and needed management practices in the survey area for those in agricultural businesses, equipment dealers, drainage contractors, fertilizer companies, processing companies, planners, conservationists, and others. Information about management is presented for each kind of soil in the section "Detailed soil map units." When making plans for management systems for an individual field or farm, check the detailed information given in the description of each soil.

In 1974 livestock and livestock products accounted for most of the agricultural income for Warren and Forest Counties.

In Warren County 64,392 acres was used for crops and pasture, according to the 1975 Conservation Needs Inventory. Of this total, 29,636 acres was used for permanent pasture; 6,200 acres was used for row crops, mainly corn; 22,000 acres was used for permanent and rotated stands of forage plants for hay; 2,350 acres was used for small grain; and 237 acres was used for orchards and vegetables.

In Forest County 6,805 acres was used for crops and pasture, according to the 1975 Conservation Needs Inventory. Of this total, 1,989 acres was used for permanent pasture; 320 acres was used for row crops, mainly corn; 1,000 acres was used for permanent and rotated stands of forage plants for hay; and 320 acres for small grain.

About 129,013 acres of prime farmland is currently being used as woodland and about 9,583 acres as pasture. In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all the cropland in these counties. This soil survey can greatly facilitate the application of such technology.

Soil erosion is the major management problem on most of the cropland and pasture in Warren and Forest Counties. Mardin, Hanover, and Wharton soils are potentially productive for crops and pasture; however, where slopes are 3 percent or more, the hazard of erosion is moderate to severe.

Loss of the surface layer from erosion is damaging for two reasons. First, productivity is reduced as the surface

layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a layer in or below the subsoil that limits the depth of the rooting zone. For example, Gilpin and Lordstown soils have moderate depth to bedrock that limits rooting depth. Erosion also reduces productivity on soils that tend to be droughty, such as Chenango soils. Second, soil erosion from farms can pollute streams and reservoirs by sediment deposition. Control of erosion minimizes the pollution of streams, which helps to maintain water quality for municipal use, for recreation, and for fish and wildlife.

In many fields of sloping, channery or gravelly soils, preparing a good seedbed and tilling are difficult because the original surface soil has been eroded away and a high amount of coarse fragments has been left on the surface. Such areas are common on Hazleton and Chenango soils. Erosion control practices provide a protective surface cover, reduce surface runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods keeps soil erosion losses to a minimum.

On livestock farms, which require pasture and hay, the legume and grass forage crops in the cropping system help reduce erosion on sloping soils and also provide nutrients and improve soil tilth.

Contour farming, stripcropping, and terracing are common erosion control practices in the survey area. They are best adapted to soils that have smooth, uniform slopes, such as most areas of the sloping Hazleton, Gilpin, Hanover, Wharton, Venango, and Alvira soils. Some areas of these soils, however, have irregular slopes, which make contour tillage or terracing impractical. Cropping systems that provide substantial vegetative cover help to control erosion on these soils. Minimizing tillage and maintaining crop residue on the surface help to increase infiltration and to reduce the hazard of erosion. These practices can be adapted to most soils in the survey area. No-tillage when planting corn is effective in reducing erosion on sloping soils. It is suited to most soils in the survey area, except the poorly drained and very poorly drained soils.

Diversions reduce the length of slope, resulting in the reduction of erosion. They are most practical on deep, well drained soils that have regular slopes. Wharton and Venango soils are suitable for diversions. Other soils are less suitable because of irregular slopes, excessive wetness in the diversion channels, or bedrock at a depth of less than 40 inches.

Information for the design of erosion control practices for each kind of soil is contained in the Technical Guide, available in local field offices of the Soil Consevation Service.

Soil drainage is the major management need on about 39,690 acres used for crops and pasture in the survey area. Some soils are naturally so wet that production of common crops or pasture plants is generally not successful without artificial drainage. Examples of such soils are the poorly drained or very poorly drained Atkins, Chippewa, and Armagh soils.

The design of both surface and subsurface drainage systems varies with the kind of soil. A combination of surface and subsurface drains is needed in most areas of the poorly drained soils used for more intensive cropping systems. Drains have to be more closely spaced in soils that have slow permeability. Finding adequate outlets for drainage systems is often difficult for soils in depressions or low lying areas, such as the Atkins or Wayland soils.

Soil fertility is naturally low in some soils in the survey area. Many soils on uplands are naturally strongly acid. These soils require applications of ground limestone to supply calcium and to raise the pH factor sufficiently to grow alfalfa and other crops. Available phosphorus and magnesium levels are also naturally low in most soils. Additions of lime and fertilizer to the soils should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of lime and fertilizer to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils that have good tilth are granular and porous.

In the survey area the Wooster and Hazleton soils have the best combination of soil properties and air circulation for growing fruit and vegetables. Pope and Philo soils are also good for growing vegetables, but damage can result from flooding. Areas planted to low residue producing vegetable crops should be rotated with a cover crop or a heavy residue producing crop to reduce erosion and maintain organic matter.

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 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

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

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures 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 5 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.

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 grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

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 slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

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

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of each map unit is given in the section "Detailed soil map units."

woodland management and productivity

Paxton G. Wolfe, woodland conservationist, Soil Conservation Service, helped prepare this section.

Warren and Forest Counties have approximately 742,300 acres of woodland, of which 737,400 acres is commercial. Warren County has 488,600 acres of woodland, and Forest County has 253,700 acres (*12*). Eighty-seven percent of the total land area in the two counties is woodland. Warren County is 84 percent woodland, and Forest County is 95 percent woodland. Of the total woodland, farmers own 10 percent, private concerns own 41 percent, industry owns 12 percent; and 37 percent is publicly owned. Less than one percent of the woodland is classified as noncommercial.

The Allegheny National Forest covers 118,000 acres, which is 20 percent of the total land area in Warren County, and 110,600 acres, which is 42 percent of the land area in Forest County.

Stands of second and third growth trees make up the woodland. Some of the finest black cherry in the United States grows in this area of Pennsylvania. The wood of black cherry is highly prized for furniture. The principal forest cover types (*9*) that make up the present woodland in the two counties and the extent of each are as follows:

Maple-beech-birch cover type makes up 46 percent of the woodland in the two counties. Sugar maple, beech, and yellow birch are the component species in this cover type. Associated species are varying admixtures of basswood, red maple, hemlock, red oak, white ash, white pine, black birch, black cherry, yellow-poplar, and cucumbertree.

Oak-hickory cover type makes up 18 percent of the total woodland in the counties. This cover type mainly consists of white oak, red oak, and hickories, although black oak and chestnut oak are sometimes dominant. The principal associated species are yellow-poplar, shagbark hickory, white ash, red maple, and beech.

Elm-ash-red maple cover type makes up 15 percent of the total woodland. In this cover type white ash, American elm, and red maple are dominant. Associated species are slippery elm, yellow birch, sycamore, and hemlock.

Aspen-birch cover type makes up 13 percent of the woodland. Quaking aspen, bigtooth aspen, and gray birch are dominant in this cover type. Principal associated species are pin cherry, red maple, yellow birch, white pine, ash, and sugar maple.

White pine cover type makes up 5 percent of the woodland in the counties. White pine is in pure stands or is the dominant species. Principal associates are Virginia pine; pitch pine; ash; sugar maple; red maple; hemlock; red oak; white oak; quaking aspen; bigtooth aspen; and paper, yellow, and black birch.

Chestnut oak cover type is on another 3 percent. Chestnut oak grows in pure stands or is the dominant species. Common associated species are red oak, white oak, black oak, scarlet oak, pitch pine, blackgum, and red maple.

Ninety-seven percent of the woodland in the two counties is on soils that have very high, high, and moderately high productivity. Two percent is on soils that have moderate productivity, and one percent is on soils that have low productivity.

Sawtimber makes up approximately 43 percent of the acreage of commercial woodland (in Warren County 46 percent, in Forest County 37 percent); poletimer makes up 43 percent of the commercial woodland (in Warren County 38 percent, in Forest County 53 percent); and seedlings and saplings make up 12 percent of the commercial woodland (in Warren County 15 percent, in Forest County 8 percent). The remaining two percent is classified as less than 10 percent stock trees (in Warren County 1 percent stock trees, in Forest County 2 percent stock trees).

A woodland owner can encourage the growth of desirable trees by using good woodland management practices in the areas where the soils are rated very high, high, and moderately high for potential productivity or where the site index is 66 or more. Site index is a measure of site quality based on the average height, in feet, of the dominant and codiminant commercial species at 50 years of age. A professional forester can provide assistance for a woodland improvement program.

Those soils which have a site index of less than 55 and which are rated low for potential productivity generally do not economically justify management to increase yields. Soils which have a site index of 55-65 and which are rated moderate are the most difficult to appraise for management of wood crops. A thorough inventory of the growing stock and its quality on the site is needed. The market potential for the species, and whether or not the soils rated moderate are mixed with larger areas of more productive soils, should be investigated to determine if woodland management is economically feasible.

Warren and Forest Counties have an ideal climate for maple syrup production. Sugar maples can be established on the deep, well drained and moderately well drained soils where sugar maples of large poletimber and sawtimber size are found. The United States Department of Agriculture, Forest Service, or a consulting forester can assist woodland owners to develop their stands for maple syrup production with the proper silvicultural treatment. The sap of individual sugar maples can be checked for the percent of sugar to determine which trees are to remain in the stand for tapping in February and March.

The woodland in Warren and Forest Counties has watershed protection, recreation, wildlife, and aesthetic values, as well as being a source of income from wood crops. The better sites should return a good profit to the owner if they are properly managed and if they are protected from fire, disease, insects, grazing by livestock, and damage by deer.

Table 7 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 (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. 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 *w* indicates excessive water in or on the soil and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: w and r.

In table 7, *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 a few trees may be blown down by normal 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 50 years (*7*). The site index applies to fully stocked, even-aged, unmanaged stands. Generally 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. In this survey, however, tree species that commonly grow in the soil are listed regardless of potential value or potential growth rate.

Trees to plant are those that are suited to the soils and to commercial wood production.

recreation

The soils of the survey area are rated in table 8 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 8, 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 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

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, horseback riding, and bicycling 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

Richard D. Hegslip, biologist, Soil Conservation Service, helped prepare this section.

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 9, 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. 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, orchardgrass, bromegrass, clover, crownvetch, 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 bluestem, goldenrod, beggarweed, wheatgrass, and grama.

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, the available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, beech, apple, hawthorn, dogwood, hickory, sassafras, sumac, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are American cranberrybush, winterberry, autumn-olive, and crabapple.

Coniferous plants furnish cover browse, seeds, and cones. 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, and hemlock.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, cattails, pickerelweed, 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, (fig. 14) 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, bogs, and 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 redtailed-hawk, meadowlark, field sparrow, cottontail rabbit, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and black bear.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, raccoon, muskrat, mink, and beaver.

engineering

John J. Mank, assistant state conservation engineer, Soil Conservation Service, helped prepare this section.

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

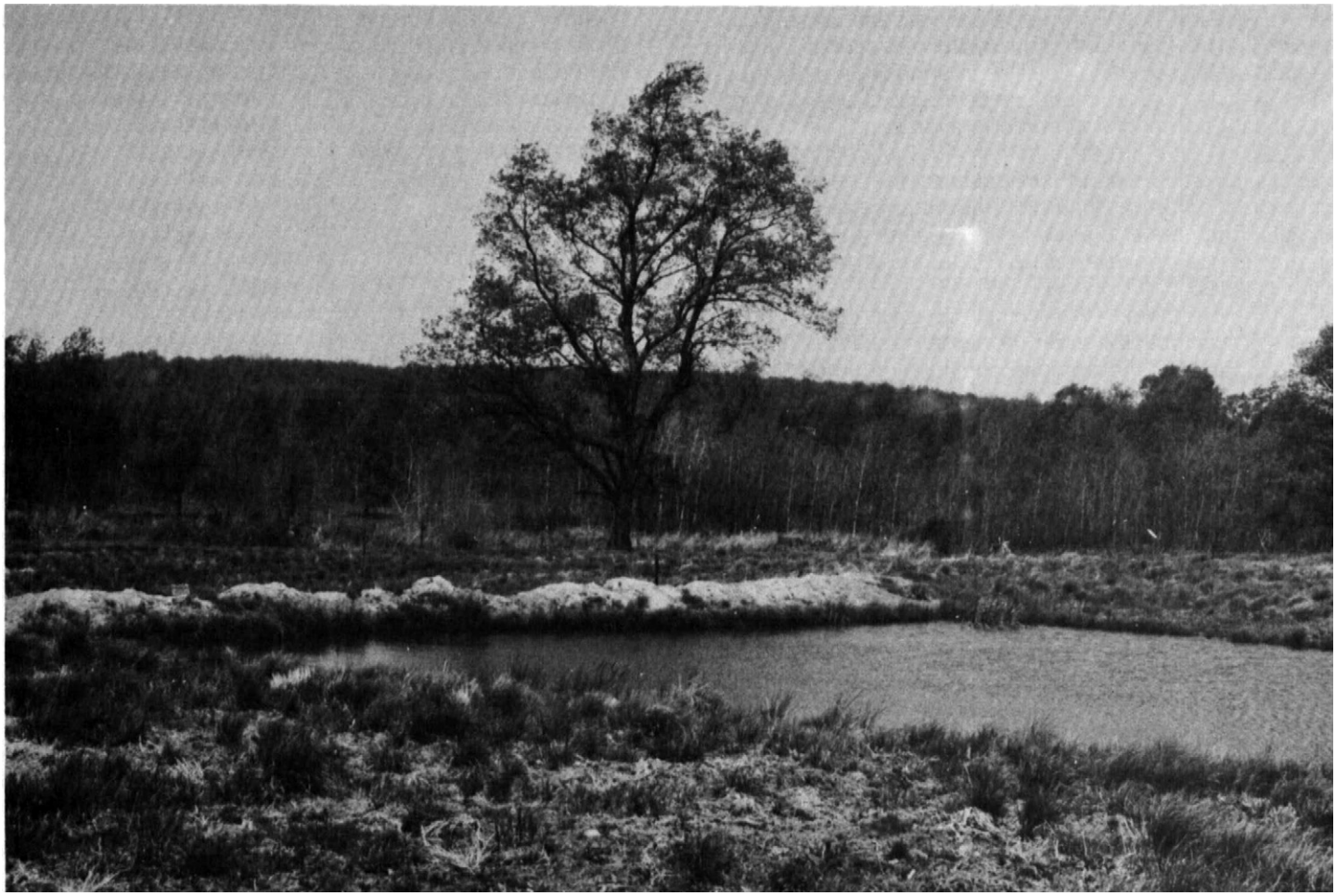


Figure 14.—Shallow water impoundment on Armagh silt loam, 0 to 8 percent slopes, is used for wildlife.

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 10 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, 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 salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 11 shows the degree and the 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 11 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 effectively filter the effluent. 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 11 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 11 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 12 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 12, 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 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a

depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion; low available water capacity; restricted rooting depth; toxic substances, such as salts or sodium; and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

John J. Mank, assistant state conservation engineer, Soil Conservation Service, helped prepare this section.

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help 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 14 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. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2,5*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

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, SP-SM.

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 and liquid limit are 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 15 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 earth-moving 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.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 15, the estimated content of organic matter of the plow layer 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 16 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.

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 and water in swamps and marshes are not considered flooding.

Table 16 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, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of 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 is local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, 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 16.

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. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. 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 specified as 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 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.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*13*). 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. In table 17, the soils of the survey area are classified according to the system. 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 Entisol.

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 Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

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 Fluvaquents (*Fluv*, meaning water deposited, plus *aquent*, the suborder of the Entisols 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 Fluvaquents.

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-loamy, mixed, acid, mesic Typic Fluvaquents.

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. Nearby soils of other series are listed. 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 (*11*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*13*). 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."

Alvira series

Soils of the Alvira series are fine-loamy, mixed, mesic Aeric Fragiaquults.

These somewhat poorly drained soils are on uplands. They formed in pre-Wisconsin till weathered from acid sandstone and shale. Slopes range from 0 to 15 percent.

The principal associated soils are the moderately well drained and well drained Hanover soils and the poorly drained Shelmadine soils.

Typical pedon of Alvira silt loam, 0 to 3 percent slopes, in a wooded area in Warren County; near Torpedo on Route T393; 1.9 miles west of Pa. Route 27 on Route T393, north roadbank:

O1—2 inches to 1/2 inch; litter of loose leaves and stems.
O2—1/2 inch to 0 inch; dark grayish brown (10YR 4/2) mat of roots and decaying stems and leaves.
A1—0 to 1 inch; very dark gray (10YR 3/1) silt loam; weak fine granular structure; very friable, nonsticky, nonplastic; 5 percent coarse fragments; very strongly acid; abrupt wavy boundary.
A2—1 to 7 inches; brown (10YR 4/3) silt loam; weak fine granular structure; friable, slightly sticky, slightly plastic; 5 percent coarse fragments; very strongly acid; clear wavy boundary.
B1—7 to 15 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct grayish brown (10YR 5/2) mottles; weak fine and medium subangular blocky structure; firm, slightly sticky, slightly plastic; 5 percent coarse fragments; very strongly acid; clear wavy boundary.
B2tg—15 to 21 inches; light brownish gray (10YR 6/2) silty clay loam; many medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm, sticky, plastic; common thin clay films on ped faces; 10 percent coarse fragments; very strongly acid; clear wavy boundary.
Bx1g—21 to 34 inches; grayish brown (10YR 5/2) silty clay loam; common fine and medium distinct strong brown (7.5YR 5/6) mottles; moderate very coarse prismatic structure parting to moderate fine and medium subangular blocky; brittle; very firm, sticky, plastic; common thin gray (N6/) clay and silt films on ped faces; 10 percent coarse fragments; very strongly acid; clear wavy boundary.
Bx2—34 to 60 inches; brown (10YR 5/3) channery loam, common fine and medium distinct strong brown (7.5YR 5/6) mottles; moderate very coarse prismatic structure parting to moderate medium subangular blocky; brittle; very firm, nonsticky, nonplastic; few thin gray (N6/) silt and clay coatings on prism faces; 20 percent coarse fragments, strongly acid.

The solum is 40 to 70 inches thick. Bedrock is more than 4 feet deep. The top of the fragipan is at a depth of 16 to 28 inches. The solum is from 5 to 20 percent coarse fragments above the Bx horizon and from 10 to 30 percent coarse fragments in the Bx horizon. In unlimed areas reaction is extremely acid to strongly acid throughout the profile.

The A horizon has hue of 7.5YR through 2.5Y, value of 3 or 4, and chroma of 1 through 4. The texture is dominantly silt loam, but in some areas it is loam.

The B1 horizon has hue of 7.5YR or 10YR, value of 4 and 5, and chroma of 3 through 6. The B2 horizon has hue of 7.5YR or 10YR, value of 5 through 7, and chroma of 1 or 2. The texture is silt loam or silty clay loam in the fine-earth fraction.

The Bx horizon has hue of 10YR through 5YR, value of 5, and chroma of 2 through 6. The texture ranges from loam to silty clay loam in the fine-earth fraction. The lower part of the B2 horizon and Bx horizon have ped faces that have chroma of 2 or less and have grayish or brownish mottles.

Armagh series

Soils of the Armagh series are clayey, mixed, mesic Typic Ochraquults.

These deep, poorly drained soils are in depressions on broad ridgetops and on benches. They formed in materials weathered from gray, acid clay shale. Slopes range from 0 to 8 percent.

The principal associated soils are the moderately well drained Wharton soils, the somewhat poorly drained Cavode soils, and the well drained Gilpin soils. These soils are on adjacent, steeper soils.

Typical pedon of Armagh silt loam, 0 to 8 percent slopes, in a wooded area in Warren County; near Henry's Mill; northeast of Route 666, three-tenths of a mile south of Route T526, on Forest Service road 413, east roadbank:

O1—1-1/2 inches to 1/2 inch; loose litter of leaves and stems.
O2—1/2 inch to 0 inch; mat of decaying leaves and stems bound by many fine roots.
A1—0 to 5 inches; very dark gray (10YR 3/1) silt loam; moderate fine granular structure; very friable, nonsticky, nonplastic; 5 percent coarse fragments; very strongly acid; abrupt wavy boundary.
B1g—5 to 12 inches; light brownish gray (10YR 6/2) silt loam; common fine distinct strong brown (7.5YR 5/6) mottles; moderate fine and medium subangular blocky structure; friable, slightly sticky, nonplastic; few thin gray (10YR 5/1) patches of clay films on ped faces; 5 percent coarse fragments; very strongly acid; clear wavy boundary.
B21tg—12 to 19 inches; gray (N6/) silty clay loam; many medium prominent reddish yellow (5YR 6/8) and yellowish red (5YR 5/8) mottles; weak moderate prismatic structure parting to moderate medium blocky; firm, sticky, plastic; few thin continuous grayish brown (10YR 5/2) clay films on ped faces; 5 percent coarse fragments; very strongly acid; clear wavy boundary.
B22tg—19 to 48 inches; olive gray (5Y 5/2) silty clay loam; many medium prominent red (2.5YR 4/6) and yellowish red (5YR 4/6) mottles; weak medium prismatic structure parting to weak medium blocky; very firm, sticky, plastic; few thin continuous gray (10YR 5/1) clay films on prism faces; 5 percent coarse fragments; very strongly acid; clear wavy boundary.
Cg—48 to 60 inches; olive gray (5Y 5/2) shaly silty clay loam; common medium distinct strong brown (7.5YR 5/6) and yellowish red (5YR 4/6) mottles; gray (10YR 6/1) ped faces; moderate coarse prismatic

structure; firm, slightly sticky, slightly plastic; 40 percent coarse fragments; very strongly acid.

The solum is 30 to 50 inches thick. Bedrock is at a depth of 4 to 6 feet. The upper part of the solum is from 5 to 15 percent coarse fragments, the lower part of the solum is 5 to 20 percent coarse fragments, and the C horizon is 30 to 50 percent coarse fragments. In unlimed areas reaction is very strongly acid or strongly acid throughout.

The A horizon has hue of 10YR or 2.5Y, value of 3 through 5, and chroma of 1 or 2. It is dominantly silt loam, but in some areas it is silty clay loam.

The B2 horizon has hue of 5Y through 10YR or neutral, value of 4 through 7, and chroma of 0 through 2. It ranges from silty clay loam to clay in the fine-earth fraction. The ped faces have chroma of 2 or less and the fine-earth fraction has distinct or prominent mottles of high chroma. The particle-size control section averages more than 35 percent clay.

The C horizon has hue of 5Y through 7.5YR, value of 5 or 6, and chroma of 2 through 4. It is silty clay loam or silty clay in the fine-earth fraction.

Atkins series

Soils of the Atkins series are fine-loamy, mixed, acid, mesic Typic Fluvaquents.

These deep, poorly drained soils are on first bottoms of flood plains. They formed in sediment washed from upland soils that derived from sandstone and shale. Slopes range from 0 to 3 percent.

The principal associated soils are the very poorly drained and poorly drained, nonacid Wayland soils, the moderately well drained Philo soils, and the well drained Pope soils.

Typical pedon of Atkins silty clay loam in a wooded area in Warren County; along Coldwell Creek in Southwest Township; three-tenths of a mile southwest of Selkirk Station on Route T304, and 200 feet east of road:

A1—0 to 8 inches; dark gray (10YR 4/1) silty clay loam; moderate medium and coarse granular structure; friable, slightly sticky, slighty plastic; very strongly acid; abrupt wavy boundary.

B21—8 to 15 inches; olive gray (5Y 4/2) silty clay loam; many medium prominent strong brown (7.5YR 5/6 and 7.5YR 5/8) and yellowish red (5YR 5/6) mottles; moderate coarse and very coarse granular structure; friable, slightly sticky, slightly plastic; very strongly acid; clear wavy boundary.

B22g—15 to 22 inches; dark gray (10YR 4/1) silty clay loam; common fine and medium distinct reddish brown (5YR 5/4) and yellowish red (5YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky and blocky; firm, sticky, plastic; very strongly acid; clear wavy boundary.

B23g—22 to 42 inches; gray (5Y 5/1) silty clay loam; common fine and medium distinct brown (7.5YR 5/4) and strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium blocky and subangular blocky; firm, slightly sticky, slightly plastic; very strongly acid; abrupt wavy boundary.

IIC—42 to 60 inches; light brownish gray (2.5Y 6/2) very gravelly loam; common fine and medium distinct strong brown (7.5YR 5/6 and 7.5YR 5/8) mottles; few fine distinct oxide coats on gravel; massive; friable, nonsticky, nonplastic; 60 percent coarse fragments; very strongly acid.

The solum is 30 to 50 inches thick. Bedrock is more than 5 feet deep. The solum is from 0 to 5 percent coarse fragments. In unlimed areas reaction is very strongly acid or strongly acid throughout.

The A horizon has hue of 10YR, value of 4 through 7, and chroma of 1 or 2. It is dominantly silty clay loam, but in some areas it is silt loam.

The B horizon has hue of 10YR through 5Y or neutral, value of 4 through 7, and chroma of 0 through 2. If hue is 10YR or 2.5Y and value is 4 or 5, the chroma is 0 or 1. The B horizon ranges from silt loam to silty clay loam in the fine-earth fraction.

The C horizon has hue of 10YR through 5Y, value of 5 or 6, and chroma of 0 through 8. The texture ranges from silty clay loam to loam in the fine-earth fraction.

Braceville series

Soils of the Braceville series are coarse-loamy, mixed, mesic Typic Fragiochrepts.

These moderately well drained soils are on glacial outwash terraces. They formed from water-deposited, stratified gravel, sand, and silt derived mostly from gray, noncalcareous sandstone and shale. They also contain small amounts of material derived from limestone. Slopes range from 0 to 8 percent.

The principal associated soils are the well drained Chenango soils and the somewhat poorly drained and poorly drained Rexford soils.

Typical pedon of Braceville gravelly silt loam, 0 to 8 percent slopes, in a wooded area in Warren County, 3-1/2 miles northwest of Columbus; one-half mile southeast of Tamatack Swamp, three-tenths of a mile north of Route T539, west side of road:

O1—2 inches to 1 inch; loose mat of pine needles and some decaying leaves.

O2—1 to 0 inch; dark grayish brown (10YR 4/2) decomposed organic matter.

A11—0 to 6 inches; dark brown (10YR 4/3) gravelly silt loam; weak fine granular structure; very friable; nonsticky, nonplastic; 15 percent coarse fragments; very strongly acid, clear wavy boundary.

A12—6 to 10 inches; dark yellowish brown (10YR 4/4) gravelly silt loam; moderate fine granular structure;

friable; nonsticky, nonplastic; coarse fragments; very strongly acid; clear wavy boundary.
B2—10 to 19 inches; brown (7.5YR 4/4) gravelly silt loam; moderate medium subangular blocky structure; friable, nonsticky, nonplastic; 15 percent coarse fragments; very strongly acid; clear wavy boundary.
Bx1—19 to 27 inches; dark yellowish brown (10YR 4/4) gravelly loam; few fine faint light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) mottles; weak very coarse prismatic structure parting to moderate thick platy; brittle; firm in place and friable when displaced, nonsticky, nonplastic; 20 percent coarse fragments; strongly acid; clear wavy boundary.
Bx2—27 to 35 inches; brown (10YR 5/3) gravelly loam; many fine faint light olive brown (2.5Y 5/4) and olive brown (2.5Y 4/4) mottles; weak very coarse prismatic structure parting to moderate thick platy; brittle; firm in place and friable when displaced, nonsticky, nonplastic; 20 percent coarse fragments; strongly acid; clear wavy boundary.
IIC—35 to 60 inches; grayish brown (10YR 5/2) stratified fine to coarse sand and gravel; single grained; loose; 40 percent coarse fragments; strongly acid.

The solum is 30 to 55 inches thick. Bedrock is at a depth of 5 to 50 feet or more. The top of the fragipan is at a depth of 15 to 30 inches. The solum is from 0 to 30 percent coarse fragments above the Bx horizon and from 20 to 50 percent coarse fragments in the Bx horizon and the C horizon. In unlimed areas reaction is very strongly acid to medium acid above the Bx horizon and strongly acid to slightly acid in the Bx and C horizons.

The A horizon has hue of 2.5Y through 7.5YR, value of 3 or 4, and chroma of 2 through 4. It is dominantly gravelly silt loam, but in some places it is gravelly loam.

The B2 horizon has hue of 2.5Y through 7.5YR, value of 4 or 5, and chroma of 3 or 4. Mottles that have chroma of 2 or less are between depths of 12 and 30 inches. Texture of the fine-earth fraction is silt loam or loam.

The Bx horizon has hue of 2.5Y through 10YR, value of 4 or 5, and chroma of 3 through 7. Texture of the fine-earth fraction is loam.

The C horizon has hue of 5YR through 5Y, value of 4 through 6, and chroma of 1 or 2. The texture of the fine-earth fraction ranges from silt loam to coarse sand. Stratified sand and gravel are common.

Brinkerton series

Soils of the Brinkerton series are fine-silty, mixed, mesic Typic Fragiaqualfs.

These poorly drained soils are on foot slopes. They formed in medium-textured colluvium derived from gray, acid shale and sandstone. Slopes range from 0 to 8 percent.

The principal associated soils are the moderately well drained Ernest soils and the well drained Hazleton and Gilpin soils. These soils are on adjacent and steeper slopes.

Typical pedon of Brinkerton silt loam, 0 to 8 percent slopes, from an abandoned farm in Warren County; in Triumph Township; near West Hickory Creek, 100 feet northwest of bridge on Route T362, 10 feet south of road edge:

O1—2 to 0 inches; loose layer of stems and leaves.
Ap—0 to 7 inches; dark grayish brown (2.5Y 4/2) silt loam; moderate medium granular structure; friable, slightly sticky, slightly plastic; 5 percent coarse fragments; strongly acid; abrupt smooth boundary.
B21tg—7 to 15 inches; light brownish gray (2.5Y 6/2) light silty clay loam; common fine to medium distinct strong brown (7.5YR 5/6) mottles; strong medium and coarse blocky structure; firm, slightly sticky, slightly plastic; common moderately thick clay films on ped faces; 10 percent coarse fragments; strongly acid; clear wavy boundary.
B22tg—15 to 28 inches; gray (10YR 6/1) silty clay loam; many medium to coarse prominent strong brown (7.5YR 5/6) mottles; moderate subangular blocky structure parting to weak thin and medium platy; firm, sticky, plastic; many thick clay films on ped faces; 10 percent coarse fragments; strongly acid; clear wavy boundary.
Bxg—28 to 44 inches; gray (N6/) channery silty clay loam; many medium to coarse distinct strong brown (7.5YR 5/6) mottles; moderate very coarse prismatic structure parting to moderate medium platy and moderate medium blocky; brittle; very firm, sticky, plastic; oxide coatings on ped faces; 15 percent coarse fragments; strongly acid; clear wavy boundary.
C—44 to 60 inches; gray (7.5Y 5/6) channery silt loam; common medium distinct strong brown (7.5Y 5/6) mottles; weak coarse prismatic structure; firm, slightly sticky, slightly plastic; thin clay coatings on prisms; 20 percent coarse fragments; strongly acid.

The solum is 40 to 50 inches thick. Bedrock is at a depth of 5 to 10 feet. The top of the fragipan is at a depth of 16 to 28 inches. The solum is from 0 to 10 percent coarse fragments above the Bx horizon, from 5 to 20 percent coarse fragments in the Bx horizon, and from 10 to 40 percent coarse fragments in the C horizon. In unlimed areas reaction is very strongly acid to medium acid in the solum and strongly acid or medium acid in the C horizon.

The Ap horizon has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 2 or 3. It is silt loam or, in some places, silty clay loam.

The Bt horizon has hue of 2.5Y or 10YR, value of 5 or 6, and chroma of 1 or 2. Fine to coarse mottles are present. The Bt horizon is silt loam or silty clay loam in the fine-earth fraction.

The Bx horizon has hue of 10YR or neutral, value of 5 or 6, and chroma of 0 through 2, and it is mottled. The texture is silty clay loam or silt loam in the fine-earth fraction.

The C horizon has hue of 5Y through 10YR, value of 5, and chroma of 1 through 3, and it is mottled. The texture is silt loam or loam in the fine-earth fraction.

Canadice series

Soils of the Canadice series are fine, illitic, mesic Typic Ochraqualfs.

These poorly drained soils are on old lakebeds. They formed in thick deposits of clayey, glacial sediments of lakes. Slopes range from 0 to 3 percent.

Within the survey area, Canadice soils occur only in Warren County in the Tamarack and Benson swamps.

The principal associated soils are the poorly drained and very poorly drained Chippewa soils, the somewhat poorly drained Venango soils, the poorly drained and somewhat poorly drained Rexford soils, and the very poorly drained Medihemists and Medisaprists. Canadice soils do not have a fragipan as does the Chippewa soils.

Typical pedon of Canadice silt loam in an abandoned field that is reverting to forest in Warren County; 4-1/2 miles east of Columbus; 1-4/10 miles northwest of U.S. Route 6 on Route T553, and 30 feet south of road:

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; friable, slightly sticky, slightly plastic; 5 percent coarse fragments; medium acid; clear wavy boundary.

B1g—3 to 7 inches; gray (10YR 5/1) silt loam; common fine distinct strong brown (7.5YR 5/6 and 7.5YR 5/8) mottles; moderate fine blocky structure; firm, slightly sticky, slightly plastic; 5 percent coarse fragments; slightly acid; clear wavy boundary.

B21tg—7 to 23 inches; gray (N6/ to N5/) silty clay loam; many medium prominent strong brown (7.5YR 5/6 and 7.5YR 5/8) mottles; moderate coarse prismatic structure parting to weak medium blocky; firm, slightly sticky, plastic; common thin clay films on ped faces; neutral; clear wavy boundary.

B22tg—23 to 40 inches; grayish brown (2.5Y 5/2) silty clay loam; many coarse prominent strong brown (7.5YR 5/6 and 7.5YR 5/8) mottles; moderate coarse prismatic structure parting to weak medium and coarse blocky; firm, slightly sticky, plastic; commmon thin clay films on ped faces; neutral; abrupt smooth boundary.

Cg—40 to 62 inches; gray (N5/) and dark gray (N4/) clay; massive; firm, sticky, plastic; neutral; slight effervescence at a depth of 60 inches.

The solum is 40 to 60 inches thick. Bedrock is at a depth of 5 to 30 feet or more. The soils are generally free of coarse fragments but can have a small percentage of fine gravel. In unlimed areas reaction is medium acid or slightly acid in the A1 and B1 horizons, slightly acid or neutral in the lower part of the B horizon, and neutral to moderately alkaline in the C horizon.

The A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly silt loam, but it can be silty clay loam.

The B1 horizon has hue of 10YR or 2.5Y, value of 5, and chroma of 0 through 3. The Bt horizon has hue of 2.5Y or is neutral, value of 4 through 6, and chroma of 0 through 2. It has common to many mottles of high chroma. The B1 horizon is silt loam or silty clay loam, and the Bt horizon is clay, silty clay loam, or silty clay. The particle-size control section is more than 35 percent clay.

The C horizon has hue of 10YR through 5Y or is neutral; value of 4 through 6; and chroma of 2 or less. It is clay, silty clay, on silty clay loam. In a few places the C horizon is underlain by glacial till.

Cavode series

Soils of the Cavode series are clayey, mixed, mesic Aeric Ochraquults.

These somewhat poorly drained soils are on broad ridgetops, hillsides, and benches on uplands. They formed in gray, weathered, acid clay shale and some interbedded siltstone and thin sandstone. Slopes range from 0 to 25 percent.

The principal associated soils are the moderately well drained Wharton soils and the poorly drained Armagh soils.

Typical pedon of Cavode silt loam, 0 to 8 percent slopes, in an abandoned field in Warren County; 1-3/4 miles northwest of Warren; four-tenths mile northwest of Route T480 on Route T481, and 60 feet south of road:

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam; weak medium granular structure; friable, slightly sticky, slightly plastic; strongly acid; clear wavy boundary.

B21t—5 to 8 inches; brown (10YR 5/3) silty clay loam; weak medium and coarse granular structure; friable, sticky, plastic; very strongly acid; clear wavy boundary.

B22t—8 to 12 inches; brown (10YR 5/3) silty clay loam; few fine distinct strong brown (7.5YR 5/6 and 7.5YR 5/8) mottles; weak medium subangular blocky structure; firm, sticky, plastic; very strongly acid; clear wavy boundary.

B23tg—12 to 24 inches; gray (10YR 6/1) silty clay; many medium distinct strong brown (7.5YR 5/6 and 7.5YR 5/8) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; firm, sticky, plastic; thick clay films on peds; very strongly acid; clear wavy boundary.

B3—24 to 40 inches; grayish brown (10YR 5/2) very shaly silty clay; weak coarse prismatic structure parting to moderate medium subangular blocky; firm,

sticky, plastic; thick gray (N6/) clay films on ped faces and coarse fragments; 55 percent coarse fragments; very strongly acid; clear wavy boundary.
Cg—40 to 60 inches; grayish brown (2.5Y 5/2) very shaly silty clay loam; common medium and coarse distinct strong brown (7.5YR 5/6 and 7.5YR 5/8) and yellowish red (5YR 5/6 and 5YR 5/8) mottles; weak coarse prismatic structure parting to moderate medium and coarse subangular blocky; very firm, sticky, plastic; 60 percent coarse fragments; very strongly acid.

The solum is 40 to 60 inches thick. Bedrock is at a depth of 3-1/2 to 6 feet. The upper part of the solum is from 0 to 15 percent coarse fragments and the lower part and the C horizon is from 10 to 80 percent coarse fragments. In unlimed areas reaction is very strongly acid or strongly acid throughout.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 through 4. Undisturbed soils have a thin A1 horizon that has hue of 10YR, value of 2, and chroma of 1 or 2. A2 horizon has hue of 10YR, value of 5, and chroma of 3 through 6. The texture is silt loam.

The upper part of the B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 through 6. The lower part of the B horizon has hue of 10YR through 5Y, value of 5 or 6, and chroma of 1 or 2. Texture of the fine-earth fraction is silty clay loam or silty clay. The particle-size control section is more than 35 percent clay.

The C horizon has hue of 5Y through 10YR, value of 4 through 6, and chroma of 1 through 4. Texture of the fine-earth fraction is silty clay loam, silty clay, or clay.

Chenango series

Soils of the Chenango series are loamy-skeletal, mixed, mesic Typic Dystrochrepts.

These well drained soils are on glacial outwash terraces. They formed in water-sorted gravelly and sandy material derived from gray sandstone, shale, and siltstone and from some limestone. Slopes range from 0 to 25 percent.

The principal associated soils are the moderately well drained Braceville soils and the somewhat poorly drained and poorly drained Rexford soils.

Typical pedon of Chenango gravelly silt loam, 0 to 3 percent slopes, in the Warren County Fairgrounds; one-half mile northwest of Pittsfield; on U.S. Route 6, one-third mile west of U.S. Route 6 at the terrace edge, 1,200 feet southeast of the old barn:

Ap—0 to 7 inches; dark brown (10YR 4/3) gravelly silt loam; weak fine granular structure; very friable, nonsticky, nonplastic; 15 percent coarse fragments; very strongly acid; clear wavy boundary.
B21—7 to 15 inches; dark yellowish brown (10YR 4/4) gravelly loam; weak fine granular structure; very friable, slightly sticky, nonplastic; 30 percent coarse fragments; very strongly acid; clear wavy boundary.
B22—15 to 30 inches; yellowish brown (10YR 5/4) gravelly loam; weak medium granular structure; very friable, slightly sticky, nonplastic; 40 percent coarse fragments; very strongly acid; clear wavy boundary.
IIC—30 to 60 inches; dark brown (10YR 4/3) very gravelly coarse sand; single grained; loose; 70 percent coarse fragments; strongly acid.

The solum is 24 to 50 inches thick. Bedrock is at a depth of 5 to 50 feet or more. The particle-size control section averages more than 35 percent coarse fragments. The A horizon is from 15 to 30 percent coarse fragments, the B horizon is from 20 to 60 percent coarse fragments, and the C horizon is 30 to 70 percent coarse fragments. In unlimed areas reaction is very strongly acid or strongly acid throughout the solum. The C horizon ranges from strongly acid in the upper part to the mildly alkaline in the lower part.

The Ap horizon has hue of 7.5YR through 2.5Y, value of 3 through 5, and chroma of 2 or 3. It is dominantly gravelly silt loam but is gravelly sandy loam in some areas.

The B horizon has hue of 2.5Y through 7.5YR. Value is 4 through 6 and chroma ranges from 3 through 6. The B horizon is dominantly loam but can be silt loam to fine sandy loam in the fine-earth fraction.

The C horizon has hue of 10YR or 2.5Y, value of 3 through 5, and chroma of 2 through 4. Texture of the fine-earth fraction ranges from loamy fine sand to sand.

Chippewa series

Soils of the Chippewa series are fine-loamy, mixed, mesic Typic Fragiaquepts.

These poorly drained and very poorly drained soils are on glaciated, broad uplands that have concave slopes. They formed in Wisconsin glacial till that is dominated by siltstone, sandstone, and shale fragments. Slopes range from 0 to 8 percent.

The principal associated soils are the moderately well drained Mardin soils and the somewhat poorly drained Venango soils.

Typical pedon of Chippewa silt loam, 0 to 8 percent slopes, in an abandoned field that is reverting to forest, in Warren County; in Sugar Grove Township; 2-1/2 miles east of Sugar Grove on T589, 60 feet north of road:

A1—0 to 6 inches; very dark gray (10YR 3/1) silt loam; moderate medium granular structure; friable, slightly sticky, nonplastic; 10 percent coarse fragments; very strongly acid; clear wavy boundary.
A21g—6 to 10 inches; dark gray (10YR 4/1) channery silt loam; few fine distinct yellowish brown (10YR 5/8) mottles; weak fine and very fine subangular blocky stucture; friable, slightly sticky, nonplastic; 15 percent coarse fragments; strongly acid; clear wavy boundary.
A22g—10 to 16 inches; olive gray (5Y 5/2) channery silt loam; many medium and coarse distinct yellowish

brown (10YR 5/8) mottles; weak fine subangular blocky structure; friable, slightly sticky, nonplastic; 20 percent coarse fragments; strongly acid; abrupt wavy boundary.

Bxg—16 to 40 inches; grayish brown (2.5Y 5/2) channery silt loam; common medium distinct olive (5Y 5/4) and common medium prominent yellowish brown (10YR 5/8) mottles; strong very coarse prismatic structure parting to weak medium subangular blocky; brittle; very firm, nonsticky, nonplastic; few fine pores with clay linings; 30 percent coarse fragments; strongly acid; clear wavy boundary.

Cg—40 to 60 inches; grayish brown (2.5Y 5/2) channery silt loam; common medium prominent yellowish brown (10YR 5/8) mottles; massive; firm, nonsticky, nonplastic; few pores; 35 percent coarse fragments; medium acid.

The solum is 36 to 56 inches thick. Bedrock is at a depth of 5 to 20 feet or more. The top of the fragipan is at a depth of 8 to 20 inches. The solum is from 0 to 35 percent coarse fragments above the Bx horizon and from 20 to 50 percent coarse fragments in the Bx and C horizons. In unlimed areas reaction is very strongly acid or strongly acid above the fragipan and strongly acid or medium acid in the Bx horizon.

The A1 horizon has hue of 10YR or 2.5Y, value of 2 through 4, and chroma of 1 or 2. Texture of the fine-earth fraction is dominantly silt loam, but in some places it is loam.

The A2g horizon has hue of 10YR through 5Y, value of 4 through 6, and chroma of 0 through 2, and it has mottles of high chroma. Texture of the fine-earth fraction is silt loam or loam and occasionally is light silty clay loam.

The Bx horizon has hue of 10YR through 5Y, value of 3 through 6, and chroma of 1 or 2, and it has mottles of high chroma. The texture is dominantly silt loam in the fine-earth fraction but ranges from silty clay loam to loam.

The C horizon has hue of 10YR through 5Y, value of 3 through 6, and chroma of 1 or 2. The texture is dominantly silt loam in the fine-earth fraction but ranges from silty clay loam to loam.

Cookport series

Soils of the Cookport series are fine-loamy, mixed, mesic Aquic Fragiudults.

These moderately well drained soils are on ridgetops. They are in the part of the Allegheny Plateau that has not been subject to glacial action. They formed from interbedded sandstone, siltstone, and, in a few places, shale. Slopes range from 0 to 15 percent.

The principal associated soils are the well drained Hazleton soils and the well drained, moderately deep Gilpin soils.

Typical pedon of Cookport silt loam, 3 to 8 percent slopes, in a wooded area in Warren County; 9 miles east of Warren; off Pa. Route 59, 1 mile south of Forest Service road 160 on Forest Service road 259, 300 feet east of road:

O1—3 inches to 1 inch; mat of loose forest litter.

O2—1 inch to 0 inch; black (N2/) decomposed organic matter; extremely acid; abrupt wavy boundary.

A1—0 to 3 inches; dark brown (10YR 3/3) silt loam; weak fine granular structure; friable, nonsticky, nonplastic; 5 percent coarse fragments; very strongly acid; abrupt wavy boundary.

A2—3 to 10 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine granular structure; friable, nonsticky, nonplastic; 5 percent coarse fragments; very strongly acid; clear wavy boundary.

B21t—10 to 16 inches; yellowish brown (10YR 5/6) loam; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; few thin discontinuous clay films on ped surfaces and in pores; 5 percent coarse fragments; very strongly acid; clear wavy boundary.

B22t—16 to 24 inches; yellowish brown (10YR 5/6) loam; common medium distinct gray (10YR 6/1) mottles; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; thin discontinuous clay films on ped faces and in pores; 10 percent coarse fragments; very strongly acid; clear wavy boundary.

Bx—24 to 40 inches; yellowish brown (10YR 5/4) channery loam; common medium distinct strong brown (7.5YR 5/6) and light gray (10YR 7/1) mottles; moderate coarse prismatic structure parting to weak thin and medium platy; brittle; firm, slightly sticky, slightly plastic; thin discontinuous clay films in pores; 30 percent coarse fragments; very strongly acid; clear wavy boundary.

C—40 to 60 inches; yellowish brown (10YR 5/4) very channery loam; common fine and medium distinct strong brown (7.5YR 5/6), reddish yellow (7.5YR 6/6), and gray (10YR 6/1) mottles; massive; firm, slightly sticky, nonplastic; 60 percent coarse fragments; strongly acid; clear wavy boundary.

R—60 inches; gray (10YR 5/1) massive sandstone bedrock.

The solum is 28 to 40 inches thick. Bedrock is at a depth of 3-1/2 to 6 feet. The top of the fragipan is at a depth of 16 to 27 inches. The solum is from 0 to 30 percent coarse fragments and the C horizon is from 15 to 60 percent coarse fragments. In unlimed areas the reaction is very strongly acid or strongly acid in all horizons.

The A horizon has hue of 10YR or 2.5Y, value of 2 through 5, and chroma of 2 through 4.

The B2 and Bx horizons are mostly hue of 10YR, but they range from 7.5YR and 2.5Y. Value is 4 or 5, and

chroma ranges from 4 through 8. Mottling is present. Texture is mostly loam in the fine-earth fraction but ranges from clay loam to sandy loam.

C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 through 4, and it is mottled. Texture is loam or sandy loam in the fine-earth fraction.

Ernest series

Soils of the Ernest series are fine-loamy, mixed, mesic Aquic Fragiudults.

These moderately well drained soils are on foot slopes and colluvial fans. They formed in colluvium from gray, acid shale, siltstone, and some sandstone. Slopes range from 3 to 35 percent.

The principal associated soils are the poorly drained Brinkerton soils and the well drained Gilpin and Hazleton soils.

Typical pedon of Ernest silt loam in an area of Ernest very stony silt loam, 0 to 25 percent slopes, in a wooded area in Warren County; 4-1/2 miles east of Warren on Route T499; 800 feet north of Route T499 on private logging road on west side of Hemlock Run; west road bank.

O2—1 inch to 0 inch; loose partially decayed leaf litter.
A1—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; very friable, nonsticky, nonplastic; 10 percent coarse fragments; very strongly acid; clear irregular boundary.
A2—4 to 8 inches; brown (10YR 5/3) silt loam; weak fine granular structure; friable, slightly sticky, slightly plastic; 10 percent coarse fragments; very strongly acid; clear wavy boundary.
B1—8 to 16 inches; yellowish brown (10YR 5/4) silt loam; moderate fine subangular blocky structure; friable, slightly sticky, slighlty plastic; 10 percent coarse fragments; very strongly acid; clear wavy boundary.
B21t—16 to 24 inches; brownish yellow (10YR 6/6) channery silt loam; many medium distinct light brownish gray (10YR 6/2) mottles; moderate fine and medium subangular blocky structure; firm, slightly sticky, slightly plastic; few thin clay films on ped faces; 20 percent coarse fragments; strongly acid; clear wavy boundary.
B22t—24 to 29 inches; brown (10YR 5/3) channery silty clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; moderate fine and medium subangular blocky structure; firm, slightly sticky, slightly plastic; common thin clay films on ped faces; 20 percent coarse fragments; strongly acid; clear wavy boundary.
Bx—29 to 42 inches; brown (10YR 4/3) channery silty clay loam; many fine to medium distinct light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) mottles; moderate very coarse prismatic structure parting to moderate medium and thick platy; brittle; firm, slightly sticky, slightly plastic; common thin clay films on ped faces; 20 percent coarse fragments; strongly acid; gradual wavy boundary.
C—42 to 60 inches; brown (10YR 5/3) channery silty clay loam; few medium gray (N 6/) mottles; massive; friable, sticky, plastic; few clay films in pores and on fragments; 25 percent coarse fragments; strongly acid.

The solum is 36 to 60 inches or more thick. Bedrock is at a depth of 5 feet or more. The top of the fragipan is at a depth of 20 to 30 inches. The solum is from 0 to 20 percent coarse fragments above the Bx horizon and 5 to 30 percent coarse fragments in the Bx and C horizons. In unlimed areas reaction is strongly acid or very strongly acid throughout.

The A horizon has hue of 10YR, value of 3 through 5, and chroma of 2 or 3. It is silt loam.

The B horizon has hue of 10YR or 7.5YR, value of 4 through 6, and chroma of 3 through 6. The lower part has mottles that have chroma of 2 or less. The texture is silt loam or silty clay loam in the fine-earth fraction.

The Bx horizon has hue of 10YR or 7.5YR, value of 4 through 6, and chroma of 3 through 6. Texture of the fine-earth fraction is silt loam or silty clay loam.

The C horizon has hue of 10YR and 7.5YR, value of 4 through 6, and chroma of 2 through 6 and is mottled. Texture of the fine-earth fraction is silt loam or silty clay loam.

Gilpin series

Soils of the Gilpin series are fine-loamy, mixed, mesic Typic Hapludults.

These moderately deep, well drained soils are on convex, dissected uplands. They formed from gray and brown, acid, interbedded shale, siltstone, and sandstone. Slopes range from 3 to 60 percent.

The principal associated soils are the well drained Hazleton soils, the moderately well drained Ernest soils, and the moderately well drained Wharton soils.

Typical pedon of Gilpin channery silt loam, 15 to 25 percent slopes, in a wooded area in Warren County; 1-1/2 miles northwest of Warren; one-half mile south of Route T481 on Route T480, east roadbank:

O1—2 inches to 0 inch; loose layer of leaves, twigs, and stems.
A1—0 to 2 inches; black (10YR 2/1) silt loam; weak fine granular structure; friable; slightly sticky, nonplastic; 10 percent coarse fragments; extremely acid; clear wavy boundary.
A2—2 to 7 inches; grayish brown (10YR 5/2) channery silt loam; weak fine granular structure; friable, slightly sticky, slightly plastic; 20 percent coarse fragments; very strongly acid; clear wavy boundary.
B21t—7 to 14 inches; yellowish brown (10YR 5/4) channery silt loam; weak medium subangular blocky

structure; friable, slightly sticky, slightly plastic; common thin clay films on ped faces and in pores; 20 percent coarse fragments; very strongly acid; clear wavy boundary.

B22t—14 to 27 inches; yellowish brown (10YR 5/4) shaly silt loam; moderate medium subangular blocky structure; friable, slightly sticky, slightly plastic; few thin clay films on ped faces and in pores; 30 percent coarse fragments; very strongly acid; clear wavy boundary.

C—27 to 30 inches; brown (10YR 5/3) very shaly silt loam; weak thin platy structure; friable, slightly sticky, slightly plastic; few clay films on coarse fragments; 80 percent coarse fragments; very strongly acid; clear wavy boundary.

R—30 inches; light olive brown (2.5Y 5/4) thin-layered siltstone and fine-grained sandstone bedrock; very strongly acid.

The solum is 18 to 36 inches thick. Bedrock is at a depth of 20 to 40 inches. The individual horizons of the solum are 10 to 40 percent coarse fragments, and the C horizon is 30 to 90 percent coarse fragments. In unlimed areas reaction throughout is extremely acid to strongly acid.

The A horizon has hue of 10YR, value of 2 through 5, and chroma of 1 through 4. It is dominantly silt loam, but in some places it is loam.

The Bt horizon has hue of 7.5YR through 2.5Y, value of 5, and chroma of 4 through 8. It is dominantly silt loam in the fine-earth fraction but ranges from silty clay loam to loam.

The C horizon has hue of 7.5YR through 2.5Y, value of 5, and chroma of 3 through 8. It is loam to silty clay loam in the fine-earth fraction.

Hanover series

Soils of the Hanover series are fine-loamy, mixed, mesic Typic Fragiudults.

These moderately well drained and well drained soils are on terminal moraines and on plateaus and hillsides covered by glacial till. They are over sandstone and shale. Slopes range from 0 to 40 percent.

The principal associated soils are the somewhat poorly drained Alvira soils, the poorly drained Shelmadine soils, and the well drained Lordstown soils.

Typical pedon of Hanover silt loam, 8 to 15 percent slopes, in a wooded area in Warren County; in Southwest Township; 1-1/4 miles east of Enterprise on Route T303, south roadbank:

O1—2-1/2 inches to 1 inch; layer of loose litter.

O2—1 inch to 0 inch; mat of decaying litter bound by many fine roots.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; very friable; 5 percent coarse fragments; very strongly acid; abrupt wavy boundary.

A2—4 to 10 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine granular structure; very friable, nonsticky, nonplastic; 5 percent coarse fragments; very strongly acid; clear wavy boundary.

B21t—10 to 16 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; firm, slightly sticky, nonplastic; few to common thin clay films on ped faces; 10 percent coarse fragments; strongly acid; clear wavy boundary.

B22t—16 to 27 inches; light yellowish brown (10YR 6/4) silt loam; few fine faint strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; firm, slightly sticky, nonplastic; common thin clay films on ped faces; 5 percent coarse fragments; very strongly acid; clear wavy boundary.

Bx1—27 to 42 inches; yellowish brown (10YR 5/4) silt loam; common fine distinct strong brown (7.5YR 5/6) and grayish brown (10YR 5/2) mottles; moderate very coarse prismatic structure parting to weak medium subangular blocky; some indication of platiness; brittle; very firm, sticky, plastic; thin gray (10YR 6/1) silt and clay films on prism faces; 10 percent coarse fragments; very strongly acid; clear wavy boundary.

Bx2—42 to 60 inches; yellowish brown (10YR 5/4) gravelly loam; common medium prominent yellowish red (5YR 5/6) and grayish brown (10YR 5/2) mottles; moderate very coarse prismatic structure parting to weak fine subangular blocky; brittle; very firm, nonsticky, nonplastic; thin light brownish gray (2.5 6/2) clay and silt films on prism faces; 25 percent coarse fragments; very strongly acid.

The solum is more than 50 inches thick. Bedrock is at a depth of 5 feet or more. The top of the fragipan is 16 to 30 inches. The solum is from 2 to 25 percent coarse fragments. In unlimed areas reaction is very strongly acid or strongly acid throughout.

The A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 2. The A2 horizon has hue of 10YR or 7.5YR, value of 4 through 6, and chroma of 2 through 4. The A horizon is dominantly silt loam, but in a few places it is loam.

The B2t horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 through 6. The texture of the fine-earth fraction is dominantly silt loam, but it can be loam.

The Bx horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 through 6 and is mottled. The texture is silt loam or loam in the fine-earth fraction.

Hazleton series

Soils of the Hazleton series are loamy-skeletal, mixed, mesic, Typic Dystrochrepts.

These well drained soils are on convex uplands. They formed from gray and brown, acid sandstone. Slopes range from 0 to 80 percent.

The principal associated soils are the moderately well drained Cookport soils; the moderately deep, well

drained Gilpin soils; and the moderately well drained Ernest soils.

Typical pedon of Hazleton sandy loam from an area of Hazleton very stony sandy loam, 0 to 8 percent slopes, in a wooded area in Warren County; in Watson Township; one-half mile southeast of Route Pa. 337 on Route 61031, 500 feet west of the road.

O1—3 to 2 inches; dark brown (7.5YR 3/2) recent leaf litter.
O2—2 inches to 0 inch; dark reddish brown (5YR 2/2) partially decayed forest litter; abrupt wavy boundary.
A2—0 to 2 inches; dark gray (10YR 4/1) sandy loam; weak fine granular structure; very friable, nonsticky, nonplastic; 5 percent coarse fragments; very strongly acid; abrupt wavy boundary.
B21hir—2 to 4 inches; dark reddish brown (5YR 3/3) sandy loam; weak medium granular structure; very friable, nonsticky, slightly plastic; 5 percent coarse fragments; very strongly acid; abrupt wavy boundary.
B22ir—4 to 6 inches; yellowish red (5YR 4/6) channery sandy loam; weak, very fine granular structure; very friable, nonsticky, nonplastic; 15 percent coarse fragments; very strongly acid; clear wavy boundary.
B23—6 to 15 inches; reddish yellow (7.5YR 6/6) channery sandy loam; weak fine subangular blocky structure; very friable, nonsticky, nonplastic; 40 percent coarse fragments; very strongly acid; gradual wavy boundary.
B24—15 to 22 inches; strong brown (7.5YR 5/6) channery sandy loam; weak fine subangular blocky structure; friable, nonsticky, nonplastic; 45 percent coarse fragments; very strongly acid; gradual wavy boundary.
B25—22 to 32 inches; reddish yellow (7.5YR 6/8) very channery sandy loam; weak fine subangular blocky structure; friable, nonsticky, nonplastic; 60 percent coarse fragments; very strongly acid; gradual wavy boundary.
C—32 to 56 inches; reddish yellow (7.5YR 6/6) very channery coarse sandy loam; massive; friable, nonsticky, nonplastic; 60 percent coarse fragments; very strongly acid; diffuse wavy boundary.
R—56 inches; yellowish brown (10YR 5/6) sandstone bedrock.

The solum is 25 to 50 inches thick. Bedrock is at a depth of 3-1/2 to 6 feet or more. The solum is from 5 to 70 percent coarse fragments, and the C horizon is from 35 to 80 percent coarse fragments. The particle-size control section averages more than 35 percent coarse fragments. In unlimed areas reaction is extremely acid to strongly acid in all horizons.

The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 1 through 4. The texture is dominantly sandy loam in the fine-earth fraction, but in some areas it is loam.

The Bhir and Bir horizons have hue of 5YR, value of 3 or 4, and chroma of 3 through 6.

The lower part of the B horizon has hue of 5YR through 10YR, value of 3 through 6, and chroma of 3 through 8. The texture is dominantly sandy loam in the fine-earth fraction but ranges through loam.

The C horizon has hue of 5YR through 2.5Y, value of 3 through 6, and chroma of 3 through 8. The texture is dominantly sandy loam in the fine-earth fraction but ranges through loam.

Lordstown series

Soils of the Lordstown series are coarse-loamy, mixed, mesic Typic Dystrochrepts.

These moderately deep, well drained soils are on convex hilltops and hillsides in the glaciated parts of the survey area. They formed from glacial drift and the underlying, frost-worked, acid sandstone and shale. Slopes range from 3 to 70 percent.

The principal associated soils are the deep, moderately well drained Mardin soils; the somewhat poorly drained Venango soils in the more recently glaciated areas; the deep, moderately well drained Hanover soils; and the somewhat poorly drained Alvira soils in those areas of older glaciation.

Typical pedon of Lordstown channery silt loam in an area of Lordstown soils, 25 to 70 percent slopes, in a wooded area in Warren County; 1 mile southeast of Wrightsville; eight-tenths of a mile off U.S. Route 6 on Route T463, east roadbank:

O1—1/2 inch to 0 inch; loose layer of grass and stems.
A11—0 to 2 inches; dark grayish brown (10YR 4/2) channery silt loam; moderate fine granular structure; very friable, nonsticky, nonplastic; 15 percent coarse fragments; very strongly acid; clear wavy boundary.
A12—2 to 7 inches; dark brown (10YR 4/3) channery silt loam; moderate fine and medium granular structure; very friable, nonsticky, nonplastic; 20 percent coarse fragments; very strongly acid; clear wavy boundary.
B1—7 to 12 inches; light yellowish brown (10YR 6/4) channery silt loam; weak very fine subangular blocky structure; friable, nonsticky, nonplastic; 30 percent coarse fragments; very strongly acid; clear wavy boundary.
B1—12 to 21 inches; yellowish brown (10YR 5/6) channery silt loam; moderate fine subangular blocky structure; friable, nonsticky, nonplastic; 35 percent coarse fragments; very strongly acid; clear wavy boundary.
B22—21 to 28 inches; yellowish brown (10YR 5/6) channery silt loam; moderate fine and medium subangular blocky structure; firm, nonsticky, nonplastic; 30 percent coarse fragments; very strongly acid; clear wavy boundary.
B23—28 to 38 inches; yellowish brown (10YR 5/4) channery silt loam; moderate medium subangular blocky structure; firm, nonsticky, nonplastic; 35 percent coarse fragments; very strongly acid; abrupt wavy boundary.

R—38 inches; thin-layered fractured gray (10YR 5/1) sandstone and siltstone bedrock.

The solum is 20 to 40 inches thick. Bedrock is at a depth of 20 to 40 inches. The solum is from 15 to 35 percent coarse fragments. The C horizon is from 20 to 60 percent coarse fragments. In unlimed areas reaction is very strongly acid or strongly acid throughout the profile.

The A horizon has hue of 7.5YR through 2.5Y, value of 3 through 5, and chroma of 2 through 4. The texture of the fine-earth fraction is dominantly silt loam, but in some areas it is loam.

The B horizon has hue of 7.5YR through 2.5Y, value of 4 through 6, and chroma of 3 through 6. The texture is silt loam or loam in the fine-earth fraction.

Where present, the C horizon has hue of 7.5YR through 5Y, value of 3 through 6, and chroma of 2 through 4. The texture ranges from silt loam to fine sandy loam in the fine-earth fraction.

Mardin series

Soils of the Mardin series are coarse-loamy, mixed, mesic Typic Fragiochrepts.

These moderately well drained soils are on convex, dissected uplands in the more recently glaciated sections of Warren County. They formed from glacial till derived mostly from local bedrock of shale and sandstone. Slopes range from 0 to 25 percent.

The principal associated soils are the somewhat poorly drained Venango soils, the poorly drained and very poorly drained Chippewa soils, and the well drained Lordstown soils.

Typical pedon of Mardin gravelly silt loam, 3 to 8 percent slopes, in a wooded area in Warren County; in Sugar Grove Township; 2 miles north of Chandlers Valley on Route T460, east roadbank:

O1—1 to 0 inch; mat of loose stems and leaves.
A11—0 to 3 inches; dark gray (10YR 4/1) gravelly silt loam; weak fine granular structure; very friable, slightly sticky, nonplastic; 15 percent coarse fragments; very strongly acid; clear wavy boundary.
A12—3 to 8 inches; dark brown (10YR 4/3) gravelly silt loam; weak fine granular structure; very friable, slightly sticky, nonplastic; 15 percent coarse fragments; very strongly acid; clear wavy boundary.
B21—8 to 14 inches; yellowish brown (10YR 5/4) gravelly silt loam; weak fine granular structure; friable, slightly sticky, nonplastic; 15 percent coarse fragments; very strongly acid; clear wavy boundary.
B22—14 to 21 inches; brown (10YR 5/3) gravelly silt loam; weak medium subangular blocky structure; firm, slightly sticky, nonplastic; 15 percent coarse fragments; very strongly acid; clear wavy boundary.
Bx1—21 to 34 inches; dark brown (10YR 4/3) gravelly silt loam; common medium faint strong brown (7.5YR 5/6) and grayish brown (10YR 5/2) mottles and prism faces; moderate very coarse prismatic structure parting to moderate fine blocky; brittle; firm, slightly sticky, nonplastic; few thin clay films in pores; 25 percent coarse fragments; strongly acid; clear wavy boundary.
Bx2—34 to 64 inches; dark brown (10YR 4/3) gravelly loam; common medium distinct strong brown (7.5YR 5/6) and grayish brown (10YR 5/2) mottles and prism faces; moderate very coarse prismatic structure parting to moderate medium blocky; brittle; very firm, slightly sticky, nonplastic; few fine distinct black concretions; few thin clay films on ped faces; 30 percent coarse fragments; strongly acid.

The solum is 40 to 70 inches thick. Bedrock is at a depth of 5 to 20 feet or more. The top of the fragipan is at a depth of 14 to 26 inches. The solum ranges from 10 to 35 percent coarse fragments above the Bx horizon and from 20 to 60 percent coarse fragments in the Bx and C horizons. In unlimed areas reaction is very strongly acid or strongly acid in the solum.

The A horizon has hue of 7.5YR to 2.5Y, value of 3 or 4, and chroma of 1 through 4. Texture of the fine-earth fraction is dominantly silt loam, but in some areas it is loam.

The B2 horizon has hue of 7.5YR to 2.5Y, value of 4 through 6, and chroma of 3 through 8. The texture is silt loam or loam in the fine-earth fraction.

The Bx horizon has hue of 7.5YR through 5Y, value of 3 through 5, and chroma of 2 through 4. The texture is silt loam or loam in the fine-earth fraction.

The C horizon has hue of 7.5YR through 5Y, value of 3 through 5, and chroma of 2 through 4. The texture is either silt loam or loam in the fine-earth fraction.

Medihemists

Medihemists consist of deep, very poorly drained organic soils. These soils are in swamps. They formed in organic material derived from partly decomposed plant remains. Slopes range from 0 to 1 percent.

Medihemists are commonly near Medisaprists, Canadice, Rexford, and Chippewa soils. Medisaprists are organic soils, but Canadice, Rexford, and Chippewa are mineral soils. Medisaprists are more decomposed than Medihemists.

Because of the variability of these soils, a typical pedon is not described. Medihemists have organic layers that range from 51 inches to 30 feet of more in thickness. Bedrock is at a depth of 6 feet or more. The organic volume is more than one-third but less than two-thirds unrubbed fiber content. These soils are extremely acid to strongly acid throughout.

Medihemists dominantly have hue of 10YR through 5YR, value of 2 through 5, and chroma of 1 through 4. The organic material is dominantly hemic and has woody, herbaceous, and sphagnum fibers.

Bedrock or mineral soils are under the organic material.

Medisaprists

Medisaprists consist of deep, very poorly drained organic soils. These soils are in swamps. They formed in organic material derived from well decomposed plant remains. Slopes range from 0 to 1 percent.

Medisaprists are commonly near Canadice, Chippewa, Rexford and Medihemists soils. Medihemists are organic soils, but Canadice, Chippewa, and Rexford are mineral soils. Medihemists are not as decomposed as Medisaprists.

Because of the variability of these soils, a typical pedon is not described. Medisaprists have organic layers that range from 51 inches to 30 feet or more in thickness. Bedrock is more than 6 feet deep. The organic volume is less than one-third unrubbed fiber. These soils are extremely acid to strongly acid throughout.

Medisaprists dominantly have hue of 10YR through 5YR, value of 2 through 5, and chroma of 1 through 4. The organic material is dominantly sapric and has some woody and herbaceous fibers.

Bedrock or mineral soils are under the organic material.

Philo series

Soils of the Philo series are coarse-loamy, mixed, mesic Fluvaquentic Dystrochrepts.

These moderately well drained soils are on flood plains. They formed in alluvial sediments washed from soils that derived mainly from acid sandstone, siltstone, and shale. Slopes range from 0 to 3 percent.

The principal associated soils are the well drained Pope soils, the very poorly drained and poorly drained Wayland soils, and the poorly drained Atkins soils.

Typical pedon of Philo silt loam in a wooded area in Warren County; 4 miles southwest of Tidioute; on Route T362, 100 feet downstream from West Hickory Creek bridge, east roadbank:

O2—1-1/2 inches to 1/2 inch; loose layer of leaves and stems.
O1—1/2 inch to 0 inch; mat of decaying litter bound by many fine roots.
A1—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; very friable, slightly sticky, slightly plastic; very strongly acid; abrupt wavy boundary.
B1—7 to 14 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; very strongly acid; clear wavy boundary.
B21—14 to 22 inches; yellowish brown (10YR 5/4) sandy loam; weak fine and medium subangular blocky structure; friable, slightly sticky,.slightly plastic; strongly acid clear wavy boundary.
B22—22 to 36 inches; yellowish brown (10YR 5/6) sandy loam; few fine faint light brownish gray (10YR 6/2) and strong brown (7.5YR 5/8) mottles; weak fine and medium subangular blocky structure; friable, slightly sticky, nonplastic; strongly acid; gradual wavy boundary.
IIC1—36 to 45 inches; light brownish gray (10YR 6/2) loarny sand; common medium prominent yellowish red (5YR 5/6) mottles; single grained; loose, nonsticky, nonplastic; 5 percent coarse fragments; strongly acid; clear wavy boundary.
IIC2—45 to 60 inches; dark grayish brown (10YR 4/2) stratified sand and gravel; medium acid.

The solum is 20 to 48 inches thick. Bedrock is at a depth of 3-1/2 to 12 feet or more. Mottles of low chroma are at a depth of 12 to 24 inches. The solum ranges from 0 to 20 percent coarse fragments, and the C horizon is 0 to 50 percent coarse fragments. In unlimed areas reaction is very strongly acid to medium acid throughout.

The A horizon has hue of 10YR and 7.5YR, value of 2 through 4, and chroma of 2 or 3. It is dominantly silt loam but ranges to sandy loam.

The B horizon has hue of 10YR and 7.5YR, value of 4 through 6, and chroma of 3 through 6. It has mottles of low chroma between 12 and 24 inches. The texture is dominantly silt loam in the fine-earth fraction but ranges to sandy loam.

The C horizon has hue of 7.5YR through 2.5Y, value of 4 through 6, and chroma of 0 through 2, and it is mottled. Texture of the fine-earth fraction ranges from sand to silt loam.

Pope series

Soils of the Pope series are coarse-loamy, mixed, mesic Fluventic Dystrochrepts.

These well drained soils are on flood plains. They formed in alluvial sediments washed from soils that derived mainly from acid sandstone, siltstone, and shale. Slopes range from 0 to 3 percent.

The principal associated soils are the moderately well drained Philo soils, the very poorly drained and poorly drained Wayland soils, and the poorly drained Atkins soils.

Typical pedon of Pope loam in an idle field in Warren County; in Conewango Township; 1-1/2 miles north of North Warren on U.S. Route 62, 1,200 feet north of Route 61049, 30 feet west of Conewango Creek:

A1—0 to 7 inches; dark grayish brown (10YR 4/2) loam; moderate medium granular structure; friable, slightly sticky, slightly plastic; 5 percent coarse fragments; medium acid; clear smooth boundary.
B21—7 to 14 inches; brown (10YR 4/3) loam; moderate medium subangular blocky structure; friable, slightly

sticky, slightly plastic; 5 percent coarse fragments; medium acid; abrupt wavy boundary.
B22—14 to 31 inches; dark yellowish brown (10YR 4/4) loam; weak coarse and medium subangular blocky structure; friable, slightly sticky, slightly plastic; 5 percent coarse fragments; strongly acid; clear wavy boundary.
B23—31 to 38 inches; brown (10YR 4/3) silt loam; weak medium and coarse subangular blocky structure; friable, slightly sticky, slightly plastic; few thin clay films in pores; 5 percent coarse fragments; strongly acid; gradual wavy boundary.
B24—38 to 49 inches; brown (10YR 4/3) silt loam; few fine distinct light olive gray (5Y 6/2) and strong brown (7.5YR 5/6) mottles; weak medium and coarse subangular blocky structure; friable, slightly sticky, slightly plastic; few thin clay films in pores; 5 percent coarse fragments; strongly acid; abrupt wavy boundary.
IIC—49 to 60 inches; brown (10YR 4/3) gravelly loamy coarse sand; single grained; loose, nonsticky, nonplastic; 40 percent coarse fragments; strongly acid.

The solum is 30 to 50 inches thick. Bedrock is at a depth of 5 feet or more. The solum is from 0 to 20 percent coarse fragments to a depth of about 40 inches and from 0 to 70 percent coarse fragments below. In unlimed areas reaction is extremely acid to strongly acid throughout.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 through 4. It is dominantly loam but ranges from silt loam to sandy loam.

The B horizon has hue of 10YR or 7.5YR, value of 4 through 6, and chroma of 3 through 6. Texture of the fine-earth fraction ranges from sandy loam to silt loam.

The C horizon has hue of 10YR or 7.5YR, value of 4 through 6, and chroma of 3 through 6. Texture of the fine-earth fraction is loamy sand, sandy loam, or loam.

Rexford series

Soils of the Rexford series are coarse-loamy, mixed, mesic Aeric Fragiaquepts.

These somewhat poorly drained and poorly drained soils are on glacial outwash terraces or terraces along streams. They formed in water-sorted materials derived mostly from gray, acid sandstone and shale. Slopes range from 0 to 8 percent.

The principal associated soils are the moderately well drained Braceville soils and the well drained Chenango soils.

Typical pedon of Rexford loam, 0 to 8 percent slopes, in a hayfield in Warren County; in Freehold Township; 3-1/4 miles northwest of Lottsville, two-tenths of a mile west of Little Brokenstraw Creek on Route T561, north roadbank.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam; weak fine granular structure; very friable, nonsticky, nonplastic; less than 10 percent coarse fragments; medium acid; clear wavy boundary.
B21—9 to 14 inches; yellowish brown (10YR 5/4) silt loam; few fine faint strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; friable, nonsticky, nonplastic, less than 5 percent coarse fragments; medium acid; clear wavy boundary.
B22—14 to 24 inches; grayish brown (2.5Y 5/2) sandy loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak fine and medium subangular blocky structure; firm, nonsticky, nonplastic; medium acid; clear wavy boundary.
IIBx—24 to 36 inches; grayish brown (2.5Y 5/2) gravelly sandy loam; few fine distinct strong brown (7.5YR 5/6) mottles; moderate very coarse prismatic structure parting to moderate thick and medium platy; brittle; very firm, nonsticky, nonplastic; 30 percent coarse fragments; medium acid; clear wavy boundary.
IIIC—36 to 60 inches; olive brown (2.5Y 4/4) sandy loam; common medium distinct strong brown (7.5YR 5/6) mottles; massive; loose; strongly acid.

The solum is 24 to 50 inches thick. The fragipan ranges from 15 to 24 inches. The solum is from 0 to 40 percent coarse fragments. In unlimed areas reaction is very strongly acid to medium acid above the Bx horizon and strongly acid to slightly acid in the Bx and C horizons.

The Ap horizon has hue of 10YR, value of 4, and chroma of 1 or 2. It is loam.

The upper part of the B horizon has hue of 7.5YR through 2.5Y, value of 4 through 6, and chroma of 3 or 4. It has mottles of high chroma. The lower part of the B horizon has hue of 7.5YR through 2.5Y, value of 4 through 6, and chroma of 1 or 2, and it is mottled. The texture is silt loam to sandy loam in the fine-earth fraction.

The Bx horizon has hue of 5Y through 5YR, value of 4 through 6, and chroma of 1 through 4, and it is mottled. The texture ranges from silt loam to sandy loam in the fine-earth fraction.

The C horizon has hue of 5Y through 5YR, value of 4 or 5, and chroma of 3 or 4, and it is mottled. The texture in the fine-earth fraction ranges from silt loam to sandy loam. In some pedons the C horizon is stratified sand and gravel.

Scio series

Soils of the Scio series are coarse-silty, mixed, mesic Aquic Dystrochrepts.

These moderately well drained soils are on low terraces or old alluvial fans. They formed in water-deposited silt and very fine sand. Slopes range from 0 to 3 percent.

The principal associated soils are the well drained Unadilla soils; the well drained Chenango soils on higher-lying terraces; and the well drained Pope soils and the moderately well drained Philo soils on adjacent flood plains.

Typical pedon of Scio silt loam in a cultivated field in Warren County; in Brokenstraw Township at Irvine; 500 feet west of Brokenstraw Creek, 400 feet south of old U.S. Route 6.

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) silt loam; moderate fine and medium granular structure; friable; nonsticky, nonplastic; very strongly acid; abrupt smooth boundary.

B21—11 to 19 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable, slightly sticky; nonplastic; strongly acid; clear wavy boundary.

B22—19 to 33 inches; brown (10YR 5/3) silt loam; common fine distinct strong brown (7.5YR 5/6 and 7.5YR 5/8), and light brownish gray (10YR 6/2) mottles; weak fine and medium subangular blocky structure; friable, slightly sticky, nonplastic; strongly acid; clear wavy boundary.

B23—33 to 44 inches; dark brown (10YR 4/3) silt loam; common fine prominent yellowish red (5YR 5/6 and 5YR 5/8) mottles; weak fine and medium subangular blocky structure; friable, nonsticky, nonplastic; thin gray (10YR 6/1) silt coatings on ped faces; strongly acid; clear wavy boundary.

IIC—44 to 60 inches; grayish brown (10YR 5/2) gravelly loamy sand; common medium distinct yellowish brown (10YR 5/6 and 10YR 5/8) mottles; single grained; loose, nonsticky, nonplastic; 30 percent gravel; strongly acid.

The solum is 20 to 45 inches thick. Material contrasting to the texture of the solum is at a depth of 40 inches or more. The solum is from 0 to 5 percent coarse fragments above 40 inches and 5 to 60 percent coarse fragments below. In unlimed areas reaction is very strongly acid to medium acid within a depth of 40 inches and strongly acid to mildly alkaline below.

The Ap horizon has hue of 7.5YR or 10YR, value of 3 through 5, and chroma of 2 or 3. It is dominantly silt loam, but in some areas it is very fine sandy loam.

The B horizon has hue of 7.5YR through 5Y, value of 4 or 5, and chroma of 3 through 6. It is mottled in the lower part. The texture is silt loam or very fine sandy loam in the fine-earth fraction.

The C horizon has hue of 7.5YR through 5Y, value of 4 through 6, and chroma of 1 through 4. The texture ranges from silt loam to loamy sand in the fine-earth fraction. In some pedons the C horizon is stratified sand and gravel.

Shelmadine series

Soils of the Shelmadine series are fine-loamy, mixed, mesic Typic Fragiaquults.

These poorly drained soils are on upland flats and in depressions, in drainageways and on foot slopes. They formed from pre-Wisconsin age glacial till derived from acid shale, siltstone, and sandstone. Slopes range from 0 to 15 percent.

The principal associated soils are the moderately well drained and well drained Hanover soils and the somewhat poorly drained Alvira soils. In some places the well drained, moderately deep Lordstown soils are on adjacent, steeper slopes.

Typical pedon of Shelmadine silt loam, 3 to 15 percent slopes, in a Warren County idle field; in Spring Creek Township; 4-1/2 miles west of Garland, 1.1 miles northwest of Route T395 on Route T427, south side of road.

O2—1/2 inch to 0 inch; mat of decaying leaves and stems.

A1—0 to 5 inches; dark gray (10YR 4/1) silt loam; moderate fine to coarse granular structure; friable; nonsticky, nonplastic; 5 percent coarse fragments; very strongly acid; clear wavy boundary.

B1g—5 to 11 inches; light brownish gray (10YR 6/2) silt loam; many medium distinct and prominent strong brown (7.5YR 5/8), reddish yellow (7.5YR 6/8) and reddish brown (5YR 4/3) mottles; weak fine subangular blocky structure; firm, slightly sticky, nonplastic; 5 percent coarse fragments; very strongly acid; clear wavy boundary.

B2tg—11 to 26 inches; gray (10YR 5/1) silty clay loam; many medium distinct and prominent reddish yellow (7.5YR 6/8), yellowish red (5YR 5/8), reddish yellow (5YR 6/8), and gray (10YR 5/1) mottles; moderate coarse prismatic structure parting to weak medium and coarse subangular blocky; firm, sticky, plastic; common thin clay films on ped faces; 5 percent coarse fragments; very strongly acid; clear wavy boundary.

Bxg—26 to 42 inches; dark yellowish brown (10YR 4/4) silt loam; many medium distinct yellowish red (5YR 5/8) and gray (10YR 6/1) mottles; moderate very coarse prismatic structure parting to moderate medium subangular blocky and moderate thick platy; brittle; very firm, slightly sticky, slightly plastic; few thin clay films on ped faces; grayish brown (10YR 5/2) coatings on ped faces; 5 percent coarse fragments; very strongly acid; gradual wavy boundary.

C—42 to 60 inches; dark brown (10YR 4/3) channery loam; common medium distinct strong brown (7.5YR 5/6) and gray (N 5/) mottles; massive; firm, slightly sticky, slightly plastic; many fine black concretions; 20 percent coarse fragments; very strongly acid.

The solum is 40 to 60 inches thick. Bedrock is at a depth of 5 feet or more. The solum is from 5 to 25 percent coarse fragments, and the C horizon is from 15 to 80 percent coarse fragments. The fragipan is at a depth of 18 to 30 inches. In unlimed areas reaction is extremely acid to strongly acid throughout.

The A horizon has hue of 10YR or 2.5Y, value of 3 through 5, and chroma of 1 or 2. The texture of the fine-earth fraction is dominantly silt loam, but in some areas it is loam.

The Bg horizon has hue of 10YR or 2.5Y, value of 4 through 6, and chroma of 1 or 2, and it is mottled. Faces of peds have coatings that have chroma of 2 or less. The texture is silty clay loam or silt loam in the fine-earth fraction.

The Bx horizon has hue of 7.5YR through 2.5Y, value of 4 through 6, and chroma of 2 through 4, and it is mottled. Coatings on the faces of peds have chroma of 2 or less. The texture of the fine-earth fraction is loam to silty clay loam.

The C horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 1 through 3. Few to many mottles are present. Texture of the fine-earth fraction is silt loam or loam.

Udorthents

Udorthents consist of deep, moderately well drained and well drained soils resulting from stripping and replacing of or mixing of various soils during the process of constructing housing and commerical sites. These soils are on flood plains and foot slopes. Slopes range from 0 to 15 percent.

Udorthents are near Unadilla, Chenango, Pope, and Ernest soils.

A typical pedon is not given because of the variability of these soils.

The solum ranges from 0 to 12 inches in thickness. Bedrock is usually at a depth of 6 feet or more. The solum ranges from 10 to 75 percent coarse fragments throughout. Reaction ranges from extremely acid to neutral throughout.

If present, the A horizon has hue of 10YR to 2.5Y, value of 3 through 5, and chroma of 1 through 3. Texture ranges from sandy loam to silt loam in the fine-earth fraction.

If present, the B horizon has hue of 7.5Y through 2.5Y, value of 3 through 5, chroma of 1 through 6, and it can be mottled. It ranges from sandy loam to silty clay loam in the fine-earth fraction.

The C horizon has hue of 7.5YR through 5Y, value of 3 through 5, chroma of 1 through 6, and it can be mottled. Texture ranges from sand to silty clay loam in the fine-earth fraction.

Unadilla series

Soils of the Unadilla series are coarse-silty, mixed, mesic Typic Dystrochrepts.

These well drained soils are on low terraces that are only a few feet above flood level. The soils are occasionally flooded. They formed in water-deposited sediments that are high in silt and very fine sand. Slopes range from 0 to 3 percent.

The principal associated soils are the moderately well drained Scio soils in similar positions on the landscape as the Unadilla soils. The well drained Chenango soils and the moderately well drained Braceville soils are on nearby, higher outwash terraces. The well drained Pope, the moderately well drained Philo, and the poorly drained and very poorly drained Wayland soils are on the adjacent flood plains.

Typical pedon of Unadilla silt loam, 0 to 3 percent slopes, in a cultivated field in Warren County; in Columbus Township; 2-1/2 miles southwest of Bear Lake, one-quarter mile west of Route 61018 on Route T539, 40 feet north of road:

Ap—0 to 10 inches; dark brown (10YR 4/3) silt loam; moderate fine granular structure; friable, nonsticky, nonplastic; medium acid; abrupt smooth boundary.

B21—10 to 25 inches; dark yellowish brown (10YR 4/4) silt loam; moderate very fine and fine subangular blocky structure; friable, nonsticky, nonplastic; strongly acid; clear wavy boundary.

B22—25 to 42 inches; yellowish brown (10YR 5/4) silt loam; moderate and weak medium subangular blocky structure; firm, slightly sticky, nonplastic; strongly acid; clear wavy boundary.

IIC—42 to 60 inches; dark brown (10YR 4/3) gravelly sand; single grained; nonsticky, nonplastic, loose; 35 percent coarse fragments; medium acid.

The solum is 20 to 50 inches thick. Materials that strongly contrast to the solum are at a depth of 40 inches or more. The solum is from 0 to 5 percent coarse fragments, and the IIC horizon is from 0 to 60 percent coarse fragments. In unlimed areas reaction is very strongly acid to medium acid in the solum and strongly acid to mildly alkaline in the C horizon.

The Ap horizon has hue of 7.5YR through 2.5Y, value of 3 through 5, and chroma of 2 through 4. It is dominantly silt loam, but in some places it is very fine sandy loam.

The B horizon has hue of 7.5YR through 2.5Y, value of 4 through 6, and chroma of 4 through 6. The texture is dominantly silt loam in the fine-earth fraction but can be very fine sandy loam.

The IIC horizon has hue of 7.5YR through 5Y, value of 4 or 5, and chroma of 2 through 4. The texture dominantly is sand or loamy sand but can range to silt loam in thin subhorizons in the fine-earth fraction.

Venango series

Soils of the Venango series are fine-loamy, mixed, mesic Aeric Fragiaqualfs.

These somewhat poorly drained soils are on broad, dissected uplands in the more recently glaciated sections of Warren County. They formed from glacial till which derived mostly from the local shale and sandstone bedrock but which, in places, also shows some weathered limestone material. Slopes range from 0 to 15 percent.

The principal associated soils are the moderately well drained Mardin soils, the poorly drained and very poorly drained Chippewa soils, and the well drained Lordstown soils.

Typical pedon of Venango silt loam, 3 to 8 percent slopes, in an idle field in Warren County; in Freehold Township; 2-1/4 miles east of Bear Lake, three-tenths of a mile east of Pa. Route 958 on Route T561, 20 feet south of road edge:

O1—1/2 inch to 0 inch; loose litter of leaves and stems.
A1—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam; weak very fine and fine granular structure; friable, slightly sticky, nonplastic; less than 5 percent coarse fragments; very strongly acid; clear wavy boundary.
A2—4 to 11 inches; brown (10YR 5/3) silt loam; weak fine and medium subangular blocky structure; friable, slightly sticky, slightly plastic; 10 percent coarse fragments; very strongly acid; clear wavy boundary.
B2—11 to 19 inches; yellowish brown (10YR 5/4) silt loam; common fine distinct strong brown (7.5YR 5/8) and light brownish gray (10YR 6/2) mottles; weak very fine and fine subangular blocky structure; friable, slightly sticky, slightly plastic; thin gray (10YR 5/1) coatings on ped faces; 10 percent coarse fragments; strongly acid; clear smooth boundary.
Bx1—19 to 30 inches; brown (10YR 5/3) silt loam; many medium distinct strong brown (7.5YR 5/8) mottles; weak very coarse prismatic structure parting to moderate medium blocky; brittle; firm, nonsticky, nonplastic; thin patchy gray (10YR 5/1) clay films in pores and on ped faces; 10 percent coarse fragments; strongly acid; clear smooth boundary.
Bx2—30 to 46 inches; dark yellowish brown (10YR 4/4) channery loam; many coarse distinct light brownish gray (10YR 6/2) mottles; weak very coarse prismatic structure parting to moderate medium blocky; brittle; firm, nonsticky, nonplastic; few thin gray (10YR 5/1) clay films on ped faces and in pores; 15 percent coarse fragments; slightly acid; clear smooth boundary.
C1—46 to 62 inches; olive brown (2.5Y 4/4) gravelly silt loam; common fine and medium distinct gray (10YR 5/1) mottles; massive; firm, slightly sticky, nonplastic; 20 percent coarse fragments; neutral.

The solum is 36 to 72 inches thick. Bedrock is at a depth of 5 feet or more. The top of the fragipan ranges in depth from 14 to 28 inches. The solum is from 0 to 25 percent coarse fragments above the Bx horizon. The Bx horizon and C horizon are from 5 to 40 percent coarse fragments. In unlimed areas reaction is extremely acid to medium acid above the Bx horizon and strongly acid to slightly acid in the Bx horizon. The C horizon is neutral to moderately alkaline.

The A1 horizon has hue of 10YR and 2.5Y, value of 2 and 3, and chroma of 1 or 2. It is dominantly silt loam, but in some places it is loam.

The A2 horizon has hue of 10YR and 2.5Y, value of 5 and 6, and chroma of 2 through 4. It dominantly is silt loam but can be loam.

The B2 horizon has hue of 10YR and 2.5Y, value of 4 and 5, and chroma of 3 and 4 and is mottled. Faces of peds have chroma of 1 or 2. The texture is dominantly silt loam in the fine-earth fraction but ranges from light silty clay loam to loam.

The Bx horizon has hue of 10YR through 5Y, value of 4 and 5, and chroma of 2 through 6, and is mottled. The vertical prism faces and faces of peds have clay or silt coatings that have hue of 10YR through 5Y; value of 4 through 6; and chroma of 0, 1, or 2. Texture of the fine-earth fraction is silt loam or loam.

The C horizon has hue of 10YR through 5Y, value of 4 or 5, and chroma of 2 through 4. Texture of the fine-earth fraction is loam or silt loam.

Wayland series

Soils of the Wayland series are fine-silty, mixed, nonacid, mesic Mollic Fluvaquents.

These poorly drained and very poorly drained soils are on depressed parts of flood plains. They formed in alluvial sediments washed from soils that derived mainly from glacial till of Wisconsin Age. Slopes range from 0 to 3 percent.

The principal associated soils are the well drained Pope soils, the moderately well drained Philo soils, and the poorly drained Atkins soils. The Wayland soils are nonacid; the Atkins soils are acid.

Typical pedon of Wayland silt loam in a pasture in Warren County; in Farmington Township; 2-1/2 miles northwest of Akeley, 135 feet southwest of the New York-Pennsylvania boundary marker, on the west bank of Conewango Creek:

A11g—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam; common fine distinct dark reddish brown (5YR 3/3) mottles; moderate medium and coarse granular structure; friable, slightly sticky, slightly plastic; neutral; clear wavy boundary.
A12g—7 to 13 inches; very dark grayish brown (2.5Y 3/2) silt loam; many fine distinct dark reddish brown (5YR 3/4) mottles; moderate medium and fine subangular blocky structure; friable, slightly sticky, slightly plastic; medium acid; clear wavy boundary.
Bg—13 to 28 inches; grayish brown (2.5Y 5/2) silt loam; many fine prominent reddish brown (5YR 4/4) and yellowish red (5YR 5/8) mottles; weak medium

prismatic structure parting to fine and medium subangular blocky; friable, slightly sticky, slightly plastic; few thin clay films in pores; medium acid; abrupt wavy boundary.

C1g—28 to 36 inches; gray (5Y 6/1) silty clay loam; many medium distinct strong brown (7.5YR 5/6) and yellowish brown (10YR 5/4) mottles; massive; firm, sticky, plastic; medium acid; gradual wavy boundary.

C2g—36 to 64 inches; gray (5Y 5/1) silt loam; common to many coarse prominent yellowish brown (10YR 5/4 and 10YR 5/8) and strong brown (7.5YR 5/6) mottles; massive; firm in place, friable displaced, slightly sticky, slightly plastic; medium acid.

The silty deposits that are over stratified materials range from 36 to 60 inches or more in thickness. Bedrock is at a depth of 5 feet or more. The solum does not have any coarse fragments to a depth of 60 inches. In unlimed areas reaction is strongly acid to mildly alkaline to a depth of 24 inches and medium acid to moderately alkaline below 24 inches.

The A1 horizon has hue of 10YR and 2.5Y, value of 2 or 3, and chroma of 0 through 2. It is dominantly silt loam, but in some places it is silty clay loam.

The B horizon has hue of 7.5YR through 5Y, value of 3 through 6, and chroma of 0 through 2, and it is mottled. It is dominantly silt loam but ranges to silty clay loam.

The C horizon has hue of 7.5YR through 5Y, value of 3 through 6, and chroma of 0 through 2 and is mottled. It ranges from silty clay loam to sandy loam.

Wharton series

Soils of the Wharton series are fine-loamy, mixed, mesic Aquic Hapludults.

These moderately well drained soils are on broad ridges, benches, and concave hillsides. They formed in gray, weathered, acid clay shale and some interbedded siltstone and sandstone. Slopes range from 3 to 25 percent.

The principal associated soils are the somewhat poorly drained Cavode soils and the poorly drained Armagh soils. Ernest and Gilpin soils are on nearby slopes. Ernest soils have a fragipan and are moderately well drained. Gilpin soils are well drained and less than 40 inches to bedrock.

Typical pedon of Wharton silt loam, 3 to 8 percent slopes, in a wooded area in Forest County; in Jenks Township; 1-3/4 miles northeast of During, three-tenths of a mile south of Forest Service road 124 on Forest Service road 227, west roadbank:

O2—1-1/2 inches to 1/2 inch; loose layer of leaves, stems, and twigs.

O1—1/2 inch to 0 inch; decaying mat of forest litter bound by many fine roots.

A1— 0 to 2 inches; dark brown (7.5YR 3/2) silt loam; weak fine granular structure; very friable, nonsticky, nonplastic; very strongly acid; clear wavy boundary.

A2—2 to 7 inches; yellowish brown (10YR 5/4) silt loam; weak medium granular structure; very friable, nonsticky, nonplastic; very strongly acid; clear wavy boundary.

B21t—7 to 18 inches; yellowish brown (10YR 5/4) silty clay loam; weak medium subangular blocky structure; friable, sticky, plastic; 5 percent coarse fragments; very strongly acid; clear wavy boundary.

B22t—18 to 31 inches; strong brown (7.5YR 5/6) silty clay loam; common medium distinct gray (N 5/) and strong brown (7.5YR 6/8) mottles; moderate medium prismatic structure parting to moderate medium blocky; firm, sticky, plastic; common thick clay films on ped faces; 10 percent coarse fragments; very strongly acid; clear wavy boundary.

B23t—31 to 35 inches; yellowish brown (10YR 5/6) shaly silty clay loam; common medium distinct light brownish gray (2.5Y 6/2) and light yellowish brown (2.5Y 6/4) mottles; moderate medium blocky structure; firm, sticky, plastic; common thick clay films on peds; 15 percent coarse fragments; strongly acid; clear wavy boundary.

B24t—35 to 47 inches; brownish yellow (10YR 6/6) silty clay loam; common medium distinct strong brown (7.5YR 5/6) and reddish yellow (7.5YR 6/6) mottles; moderate coarse prismatic structure parting to moderate medium blocky; very firm, sticky, plastic; gray (N 6/) common thick clay films on prism faces; 5 percent coarse fragments; strongly acid; clear wavy boundary.

C—47 to 60 inches; dark grayish brown (10YR 4/2) shaly silt loam; few fine distinct brown (7.5YR 5/2) mottles; moderate coarse prismatic structure; very firm, slightly sticky, slightly plastic; 30 percent coarse fragments; strongly acid.

The solum is 30 to 60 inches thick. Bedrock is at a depth of 3-1/2 to 6 feet. The A and B horizons are from 0 to 20 percent coarse fragments, and the C horizon is from 20 to 80 percent coarse fragments. In unlimed areas reaction is very strongly acid or strongly acid in the solum and extremely acid or very strongly acid in the C horizon.

The A1 horizon has hue of 10YR and 7.5YR, value of 2 or 3, and chroma of 0 through 3. The A2 horizon has hue of 10YR or 7.5YR, value of 5 through 8, and chroma of 1 through 4. The A horizon is silt loam.

The B horizon has hue of 10YR and 7.5YR, value of 4 through 6, and chroma of 4 through 6. Mottles have low chroma within 24 inches of the surface. The texture is dominantly silty clay loam in the fine-earth fraction, but some pedons have a thin subhorizon of clay, heavy silt loam, or heavy clay loam.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 through 6, and they are mottled.

Texture ranges from silt loam to clay in the fine-earth fraction.

Wooster series

Soils of the Wooster series are fine-loamy, mixed mesic Typic Fragiudalfs.

Soils in the survey area are taxadjuncts to the Wooster series because they have a higher percentage of coarse fragments in the B2t, Bx, and C horizons than is typical for the series.

These well drained soils are on terminal moraines of Wisconsin Age. They are found only in Warren County. They formed from gravelly till that derived dominantly from shale and sandstone, but they also contain some weathered limestone materials. Slopes range from 3 to 25 percent.

The principal associated soils are the moderately well drained Mardin soils and the somewhat poorly drained Venango soils.

Typical pedon of Wooster gravelly silt loam, 3 to 8 percent slopes, on the edge of a farm lane in Warren County; in Spring Creek Township; 2-3/4 miles northeast of the village of Spring Creek, 3.1 miles north of Pa. Route 77 on Route T336, 170 feet southeast on east roadbank of farm lane:

O1—1/2 inch to 0 inch; loose layer of leaves and stems.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; very friable, nonsticky, nonplastic; 10 percent coarse fragments; very strongly acid; abrupt wavy boundary.

A2—2 to 10 inches; brown (10YR 5/3) gravelly silt loam; weak fine granular structure; very friable, nonsticky, nonplastic; 20 percent coarse fragments; very strongly acid; clear wavy boundary.

B1—10 to 13 inches; yellowish brown (10YR 5/4) gravelly silt loam; weak very fine subangular blocky structure; very friable, nonsticky, nonplastic; 20 percent coarse fragments; very strongly acid; clear wavy boundary.

B2t—13 to 27 inches; yellowish brown (10YR 5/4) gravelly silt loam; weak fine subangular blocky structure; friable, slightly sticky, nonplastic; thin patchy clay films on ped faces; 30 percent coarse fragments; strongly acid; clear wavy boundary.

Bx—27 to 42 inches; yellowish brown (10YR 5/4) gravelly loam; weak very coarse prismatic structure parting to weak fine blocky; brittle; firm, slightly sticky, nonplastic; thin clay films on prism faces; 35 percent coarse fragments; strongly acid; clear wavy boundary.

C—42 to 60 inches; yellowish brown (10YR 5/4) very gravelly sandy loam; massive; friable, nonsticky, nonplastic; few fine distinct manganese stains; 50 percent coarse fragments; strongly acid.

The solum is 40 to 80 inches thick. Bedrock is at a depth of more than 5 feet. The top of the fragipan ranges from 18 to 36 inches of the surface. The solum is from 10 to 35 percent coarse fragments above the Bx horizon and from 20 to 50 percent coarse fragments in the Bx and C horizons. In unlimed areas reaction is very strongly acid to medium acid in the solum and strongly acid to neutral in the C horizon.

The A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The texture of the fine-earth fraction dominantly is silt loam, but in some places it is loam.

The A2 horizon has hue of 10YR, value of 5 and 6, and chroma of 3 and 4. The texture of the fine-earth fraction dominantly is silt loam but can be loam.

The B horizon has hue of 10YR and 7.5YR, value of 4 or 5, and chroma of 3 through 6. The texture dominantly is silt loam in the fine-earth fraction but ranges from light clay loam to loam.

The Bx horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 through 6. Texture of the fine-earth fraction dominantly is loam but ranges to light silty clay loam.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. Texture of the fine-earth fraction dominantly is sandy loam but ranges to silt loam.

formation of the soils

This section discusses the factors of soil formation.

Climate and plant and animal life are the active forces that change the parent material into a soil that has genetically related horizons. The effects of climate and plant and animal life are influenced by relief and by the nature of the parent material. In some cases the parent material dominates the other factors in profile formation. Finally, time is needed to change the parent material into a soil profile. A long time usually is needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made about the effects of any one unless conditions are specified for the other four. Many processes of soil formation are unknown.

parent material

Parent material is the unconsolidated mass from which a soil forms. It is composed of varying amounts of sand, silt, and clay and has various kinds and amounts of chemicals. All the other soil forming factors affect parent material, but the parent material determines the chemical and mineralogical composition of the soil.

In Warren and Forest Counties most of the soils on uplands formed in material weathered from interbedded shale, siltstone, and sandstone. The gray, clayey Armagh soil shows the dominance of gray, clay shale. The shaly subsoil of the Gilpin and Lordstown soils shows the dominance of brown and gray shale and sandstone in their parent material. The channery and sandy subsoil of Hazleton soils shows the dominance of sandstone in the parent material. The subsoil of soils on flood plains, such as Pope, Philo, Wayland, and Atkins, reflects the stratified nature of alluvium.

climate

Precipitation, as well as temperature, humidity, and wind, has been important in the formation of the soils. Precipitation is about 43 inches; 1 month to 3 months is snow. Ample precipitation and a dense or clayey substratum have caused a high water table in many soils. This water table accounts for the grayish color of the wetter soils, such as Atkins and Armagh soils. Climate also has affected the soils by its influence on the vegetation.

plant and animal life

Vegetation, micro-organisms, earthworms, and other forms of life contribute to soil formation. The kind and quantity of vegetation are important, and these depend on the parent material and the climate.

The climate of Warren and Forest Counties favors the growth of hardwood trees, and many of the soils formed under forests. Leaves, twigs, roots and entire plants accumulate on the surface of wooded soils. Organic matter is added to to the soil as plant remains decompose by the action of micro-organisms, earthworms, and other forms of life. The uprooting of trees also influences soil formation by mixing the soil and loosening the underlying material.

Man also has influenced the direction and rate of soil formation. He has altered the soils by drainage, by changing the vegetation, by tilling and compacting the soils, and by changing the amount of organic matter.

relief

Relief affects both surface runoff and internal drainage. Surface runoff influences the degree of erosion and, in turn, affects soil depth. Internal drainage affects the weathering of soil material and bedrock. Steep soils commonly have restricted depth because of rapid runoff and erosion. The steep and very steep Lordstown and Gilpin soils, for example, lose soil material almost as fast as it forms. Ernest and Brinkerton soils, however, are further downslope. They receive the constant movement of soil material downslope and are increased in depth.

time

The effect of climate, relief, and living organisms on parent material that is changing into soil is governed by the amount of time these factors have been in action. The degree of horizon development generally indicates the age of a soil. The Pope, Philo, Wayland, and Atkins soils, which are on flood plains, are younger than most other soils in the county. Organic matter has accumulated on the surface of these soils, but the lower horizons are less distinct than those in most soils on uplands. In the uplands, Hazleton soils have horizons that show some changes have taken place, but these changes are not the result of advanced weathering and soil formation. Weathering of these soils has been

slowed by the effects of topography and parent materials. Alvira, Shelmadine, and Hanover soils have developed profiles having distinct horizons.

geology

By Dr. Edward J. Ciolkosz, professor of Soil Genesis and Morphology, The Pennsylvania State University.

During most of the Paleozoic time, 600 to 230 million years ago, a large area of the eastern United States, including Warren and Forest Counties, was covered by a shallow sea (*4, 15*). This sea received sandy, silty, and clayey sediments at various times during the Paleozoic Era. At the close of the Paleozoic Era, a great force was exerted on these sediments from the southeast, and the sediments were raised above sea level and folded into large mountains. The intensity of that force weakened from the southeast to the northwest, however, so that the sediments underlying the Warren and Forest County area were not folded into mountains but were only raised above sea level. During the deposition and folding process, these sediments were compacted and cemented into the bedrock that now underlies these counties. This bedrock is of the Pennsylvanian Age, 310 to 280 million years ago; the Mississippian Age, 350 to 310 million years ago; and the Devonian Age, 405 to 350 million years ago (*6, 14, 15*).

The rocks of the Pennsylvanian Age are composed of the Allegheny Group, which is an alternating sequence of sandstone, shale, limestone, and coal, and the Pottsville Group, which is made up of sandstone, conglomerates with thin shales, and some local and mineable coal. The rocks of Mississippian Age are composed of the Pocono Group, which is made up of predominantely grey, cross-bedded conglomerates that are hard and massive and sandstone with some shale. The rocks of Devonian Age are composed of the Oswayo Formation, greenish gray shale, siltstone, and sandstone; the Cattaraugus Formation, gray and brown shale and sandstone; and the Conneaut Group, alternating gray, brown, greenish, and purplish shale and siltstone.

The post Paleozoic time in this area was primarily one of several cycles of erosion in which the landscape was worn down to a flat, featureless plain and then raised again by geologic forces. The last cycle of upwarping and erosion was interupted about 1 million years ago by the advance of glacial ice from the northwest. During the ice age, or Pleistocene time, it is believed that glacial ice moved over and retreated from the northern part of the United States four times (*6*). Two or possibly three of these major ice advances entered Warren County (*14*), but they did not cover the entire county. The older advances covered the northwestern half of Warren County, but the most recent advance covered only the northwest quarter of the county. Because Forest County is south of Warren County, only the northwestern part of it was glaciated by the older ice advance. Both the older advances, the Illionian Glaciation and the Wisconsin Glaciation (early and late) ice advances, left a significant record of their presence.

As the glacial ice advanced over the area, it ground down the hilltops and filled in the valleys, thus reducing the relief of the area. In addition to scouring the landscape, the glacial ice deposited large amounts of glacial till on the uplands and side slopes and deposited glacial outwash and lacustrine sediments in the river valleys. These glacial materials, which were derived from the bedrock of the area, are the parent material for about one-half of the soils in Warren County and only a small number of the soils in Forest County. Although the glacial ice advance reduced the relief of the area by grinding away and filling, it did not obscure the preglacial topography. The major ridges and mountains of today were in place prior to glaciation.

In Warren County the bedrock has greatly affected the type of glacial deposits found. In the northwestern part of the county, the bedrock is primarily gray shales and sandstone of Devonian Age. These rock matrials have given rise to the glacial till of grayish brown silt loam to loam in which the Vanango, Mardin, and Lordstown soils formed. The Hanover, Alvira, and Shelmadine soils formed in a similar but older glacial till. Areas not subject to glaciation include southeastern Warren County and all of Forest County with the exception of the northwestern part. The soils in these areas formed in the residuum of the Mississippian and Pennsylvanian bedrock or in colluvial deposits of side slopes. The Mississippian and Pennsylvanian bedrock in these areas are primarily sandstone, which is the parent material of the very extensive Hazleton and Cookport soils. The Gilpin and Cavode soils formed from the shaly members of the Mississippian and Pennsylvanian bedrock or from the Devonian shale where the overlying, younger sandstone has been eroded away. In the valleys the glacial outwash that forms the terraces is the parent material for the Chenango and Braceville soils. The reworked glacial outwash and recent alluvium from the uplands is the parent material for the Wayland soils.

The mineral industries of Warren and Forest Counties are not extensive. In both counties the glacial outwash deposits, kames and kame terraces are being mined for sand and gravel (*3*). In addition, both counties produce petroleum from shallow wells and some natural gas.

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glossary

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.

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

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

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 fragment.

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) 15.2 to 38.1 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.

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.

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.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

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.

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 does not provide a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

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.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

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 7.5 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 (7.5 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

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 upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

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 A or B 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, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock 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.

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.

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 (7.5 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.

Low strength. The soil is not strong enough to support loads.

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. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

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.

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 0.20 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.

Pitting (in tables). Pits caused by melting ground ice. They form on the soil after plant cover is removed.

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. 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 outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The 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.

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 underlying material. 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.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

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.

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.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 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 mm 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 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.

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. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

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. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

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.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

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.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-74 at Warren, Pennsylvania]

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average daily	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days[1]	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	33.9	17.5	25.7	60	-11	9	2.70	1.80	3.51	8	16.6
February	36.0	17.3	26.7	61	-12	7	2.38	1.50	3.17	8	15.9
March	44.4	24.8	34.6	76	0	52	3.22	1.98	4.33	9	11.3
April	59.4	35.0	47.2	85	14	234	3.65	2.31	4.86	10	3.1
May	69.9	44.0	57.0	90	26	527	4.03	2.93	5.04	10	.1
June	78.9	53.5	66.2	94	35	786	4.53	3.01	5.90	8	.0
July	82.2	57.6	69.9	94	42	927	4.11	2.58	5.48	8	.0
August	80.3	56.5	68.4	93	39	880	3.86	2.57	5.04	7	.0
September	73.5	50.6	62.0	91	31	660	3.72	1.99	5.13	7	.0
October	62.4	40.0	51.2	83	22	353	3.28	1.35	4.83	7	1.0
November	48.2	31.9	40.1	73	10	78	3.85	2.67	4.93	11	8.2
December	37.0	22.9	30.0	63	-3	30	3.23	2.05	4.29	10	17.6
Yearly:											
Average	58.8	37.6	48.3	---	---	---	---	---	---	---	---
Extreme	---	---	---	95	-15	---	---	---	---	---	---
Total	---	---	---	---	---	4,543	42.56	38.38	46.62	103	73.8

[1] A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-74 at Warren, Pennsylvania]

Probability	Temperature		
	24°F or lower	28°F or lower	32°F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 3	May 20	May 28
2 years in 10 later than--	April 28	May 14	May 23
5 years in 10 later than--	April 20	May 3	May 15
First freezing temperature in fall:			
1 year in 10 earlier than--	October 13	September 26	September 22
2 years in 10 earlier than--	October 19	October 2	September 27
5 years in 10 earlier than--	November 1	October 15	October 8

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-74 at Warren, Pennsylvania]

Probability	Daily minimum temperature during growing season		
	Higher than 24°F	Higher than 28°F	Higher than 32°F
	Days	Days	Days
9 years in 10	175	140	126
8 years in 10	182	148	133
5 years in 10	195	164	145
2 years in 10	207	180	158
1 year in 10	214	189	165

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Warren county	Forest county	Total--	
				Area	Extent
		Acres	Acres	Acres	Pct
AaA	Alvira silt loam, 0 to 3 percent slopes	2,813	10	2,823	0.3
AaB	Alvira silt loam, 3 to 8 percent slopes	12,919	85	13,004	1.5
AaC	Alvira silt loam, 8 to 15 percent slopes	17,847	29	17,876	2.1
AbC	Alvira very stony silt loam, 0 to 15 percent slopes	12,693	0	12,693	1.5
AgB	Armagh silt loam, 0 to 8 percent slopes	1,998	1,184	3,182	0.4
AhB	Armagh very stony silt loam, 0 to 8 percent slopes	572	189	761	0.1
At	Atkins silty clay loam	1,617	29	1,646	0.2
BcB	Braceville gravelly silt loam, 0 to 8 percent slopes	5,179	283	5,462	0.6
BkB	Brinkerton silt loam, 0 to 8 percent slopes	3,771	1,689	5,460	0.6
BnB	Brinkerton very stony silt loam, 0 to 8 percent slopes	2,153	2,625	4,778	0.6
Ca	Canadice silt loam	981	0	981	0.1
CdB	Cavode silt loam, 0 to 8 percent slopes	8,066	9,657	17,723	2.1
CdC	Cavode silt loam, 8 to 15 percent slopes	10,293	1,057	11,350	1.3
CdD	Cavode silt loam, 15 to 25 percent slopes	3,400	0	3,400	0.4
CeC	Cavode very stony silt loam, 0 to 25 percent slopes	12,276	4,916	17,192	2.0
ChA	Chenango gravelly silt loam, 0 to 3 percent slopes	3,021	7	3,028	0.4
ChB	Chenango gravelly silt loam, 3 to 8 percent slopes	2,928	166	3,094	0.4
ChC	Chenango gravelly silt loam, 8 to 15 percent slopes	1,214	117	1,331	0.2
ChD	Chenango gravelly silt loam, 15 to 25 percent slopes	635	7	642	0.1
CpB	Chippewa silt loam, 0 to 8 percent slopes	4,081	10	4,091	0.5
CtA	Cookport silt loam, 0 to 3 percent slopes	2,655	11,738	14,393	1.7
CtB	Cookport silt loam, 3 to 8 percent slopes	5,223	15,769	20,992	2.4
CtC	Cookport silt loam, 8 to 15 percent slopes	3,956	4,488	8,444	1.0
CvC	Cookport very stony silt loam, 0 to 15 percent slopes	40,535	57,368	97,903	11.4
EsB	Ernest silt loam, 3 to 8 percent slopes	2,465	1,212	3,677	0.4
EsC	Ernest silt loam, 8 to 15 percent slopes	6,122	3,262	9,384	1.1
EvD	Ernest very stony silt loam, 0 to 25 percent slopes	32,801	30,520	63,321	7.4
GnB	Gilpin channery silt loam, 3 to 8 percent slopes	2,057	1,349	3,406	0.4
GnC	Gilpin channery silt loam, 8 to 15 percent slopes	4,011	1,479	5,490	0.6
GnD	Gilpin channery silt loam, 15 to 25 percent slopes	8,883	3,932	12,815	1.5
GpF	Gilpin soils, 25 to 60 percent slopes	26,740	19,005	45,745	5.3
GsC	Gilpin very stony silt loam, 8 to 15 percent slopes	2,919	1,833	4,752	0.6
HnB	Hanover silt loam, 3 to 8 percent slopes	4,417	88	4,505	0.5
HnC	Hanover silt loam, 8 to 15 percent slopes	7,361	22	7,383	0.9
HnD	Hanover silt loam, 15 to 25 percent slopes	14,762	3	14,765	1.7
HoF	Hanover soils, steep	6,984	0	6,984	0.8
HsD	Hanover very stony silt loam, 0 to 25 percent slopes	9,705	5	9,710	1.1
HtA	Hazleton channery sandy loam, 0 to 3 percent slopes	2,615	3,569	6,184	0.7
HtB	Hazleton channery sandy loam, 3 to 8 percent slopes	5,997	3,547	9,544	1.1
HtC	Hazleton channery sandy loam, 8 to 15 percent slopes	4,333	3,251	7,584	0.9
HtD	Hazleton channery sandy loam, 15 to 25 percent slopes	8,187	2,240	10,427	1.2
HvB	Hazleton very stony sandy loam, 0 to 8 percent slopes	21,009	13,920	34,929	4.1
HvD	Hazleton very stony sandy loam, 8 to 25 percent slopes	39,631	35,287	74,918	8.7
HvF	Hazleton very stony sandy loam, 25 to 80 percent slopes	40,764	17,271	58,035	6.8
LdB	Lordstown channery silt loam, 3 to 8 percent slopes	1,091	0	1,091	0.1
LdC	Lordstown channery silt loam, 8 to 15 percent slopes	1,284	0	1,284	0.1
LdD	Lordstown channery silt loam, 15 to 25 percent slopes	1,887	0	1,887	0.2
LtF	Lordstown soils, 25 to 70 percent slopes	14,827	0	14,827	1.7
MaA	Mardin gravelly silt loam, 0 to 3 percent slopes	1,332	0	1,332	0.2
MaB	Mardin gravelly silt loam, 3 to 8 percent slopes	9,813	0	9,813	1.1
MaC	Mardin gravelly silt loam, 8 to 15 percent slopes	13,056	0	13,056	1.5
MaD	Mardin gravelly silt loam, 15 to 25 percent slopes	11,752	0	11,752	1.3
MdD	Mardin very stony silt loam, 0 to 25 percent slopes	2,419	0	2,419	0.3
Mm	Medihemists and Medisaprists, ponded	831	0	831	0.1
Ph	Philo silt loam	4,528	1,705	6,233	0.7
Pn	Pits, gravel	145	34	179	*
Po	Pope loam	1,760	174	1,934	0.2
ReA	Rexford loam, 0 to 8 percent slopes	6,421	42	6,463	0.8
Sc	Scio silt loam	1,157	275	1,432	0.2
ShC	Shelmadine silt loam, 3 to 15 percent slopes	7,887	0	7,887	0.9
SvC	Shelmadine very stony silt loam, 0 to 15 percent slopes	2,940	0	2,940	0.3
Ud	Udorthents, smooth	408	16	424	*
UnA	Unadilla silt loam, 0 to 3 percent slopes	2,245	121	2,366	0.3
VeA	Venango silt loam, 0 to 3 percent slopes	7,545	0	7,545	0.9
VeB	Venango silt loam, 3 to 8 percent slopes	29,268	0	29,268	3.4
VeC	Venango silt loam, 8 to 15 percent slopes	18,906	0	18,906	2.2
VsC	Venango very stony silt loam, 8 to 15 percent slopes	2,265	0	2,265	0.3
Wa	Wayland silt loam	11,708	2,980	14,688	1.7
WhB	Wharton silt loam, 3 to 8 percent slopes	3,162	5,023	8,185	1.0

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Warren county	Forest county	Total-- Area	Total-- Extent
		Acres	Acres	Acres	Pct
WhC	Wharton silt loam, 8 to 15 percent slopes	1,838	3,279	5,117	0.6
WhD	Wharton silt loam, 15 to 25 percent slopes	905	783	1,688	0.2
WoB	Wooster gravelly silt loam, 3 to 8 percent slopes	2,775	0	2,775	0.3
WoC	Wooster gravelly silt loam, 8 to 15 percent slopes	1,393	0	1,393	0.2
WoD	Wooster gravelly silt loam, 15 to 25 percent slopes	453	0	453	0.1
	Water	9,000	3,000	12,000	1.4
	Total	587,590	270,650	858,240	100.0

* Less than 0.1 percent.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Corn silage	Oats	Wheat	Alfalfa hay	Grass-legume hay	Pasture
	Bu	Ton	Bu	Bu	Ton	Ton	AUM*
AaA---- Alvira	95	19	60	---	---	3.0	6.0
AaB---- Alvira	95	19	60	---	---	3.0	6.0
AaC---- Alvira	90	18	55	---	---	3.0	6.0
AbC---- Alvira	---	---	---	---	---	---	---
AgB---- Armagh	80	16	60	---	---	2.5	5.0
AhB---- Armagh	---	---	---	---	---	---	---
At---- Atkins	100	20	60	---	---	3.0	5.5
BcB---- Braceville	105	21	80	40	4.5	3.5	8.5
BkB---- Brinkerton	90	18	60	---	---	2.5	5.0
BnB---- Brinkerton	---	---	---	---	---	---	---
Ca---- Canadice	75	15	60	---	---	2.5	5.0
CdB---- Cavode	85	17	65	---	---	3.0	5.5
CdC---- Cavode	80	16	60	---	---	3.0	5.5
CdD---- Cavode	75	15	55	---	---	2.5	4.5
CeC---- Cavode	---	---	---	---	---	---	---
ChA---- Chenango	100	20	80	40	4.5	3.5	8.5
ChB---- Chenango	100	20	80	40	4.5	3.5	8.5
ChC---- Chenango	90	18	75	35	4.5	3.5	8.5
ChD---- Chenango	80	16	65	30	4.0	3.5	7.5
CpB---- Chippewa	80	16	60	---	---	2.5	5.0
CtA---- Cookport	100	20	65	40	3.5	3.0	6.0

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Corn silage	Oats	Wheat	Alfalfa hay	Grass-legume hay	Pasture
	Bu	Ton	Bu	Bu	Ton	Ton	AUM*
CtB---- Cookport	100	20	65	40	3.5	3.0	6.0
CtC---- Cookport	90	18	60	35	3.5	3.0	5.5
CvC---- Cookport	---	---	---	---	---	---	---
EsB---- Ernest	100	20	65	40	3.5	3.0	6.5
EsC---- Ernest	95	19	60	35	3.5	3.0	6.0
EvD---- Ernest	---	---	---	---	---	---	---
GnB---- Gilpin	90	18	65	40	3.5	3.0	7.0
GnC---- Gilpin	85	17	60	35	3.5	3.0	7.0
GnD---- Gilpin	80	16	55	30	3.0	2.5	6.0
GpF---- Gilpin	---	---	---	---	---	---	---
GsC---- Gilpin	---	---	---	---	---	---	---
HnB---- Hanover	120	24	75	45	4.5	4.0	7.5
HnC---- Hanover	110	22	70	40	4.5	3.5	6.5
HnD---- Hanover	100	20	60	35	4.0	3.0	6.0
HoF, HsD---- Hanover	---	---	---	---	---	---	---
HtA---- Hazleton	125	25	75	45	4.5	3.5	8.0
HtB---- Hazleton	125	25	75	45	4.5	3.5	8.0
HtC---- Hazleton	115	23	70	40	4.5	3.5	8.0
HtD---- Hazleton	110	22	60	35	4.0	3.0	7.5
HvB---- Hazleton	---	---	---	---	---	---	---
HvD---- Hazleton	---	---	---	---	---	---	---
HvF---- Hazleton	---	---	---	---	---	---	---
LdB---- Lordstown	85	17	75	35	3.5	3.0	6.5

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Corn silage	Oats	Wheat	Alfalfa hay	Grass-legume hay	Pasture
	Bu	Ton	Bu	Bu	Ton	Ton	AUM*
LdC---- Lordstown	85	17	70	35	3.5	3.0	6.5
LdD---- Lordstown	80	16	65	30	3.0	3.0	5.5
LtF---- Lordstown	---	---	---	---	---	---	---
MaA---- Mardin	90	18	70	40	4.0	3.0	7.5
MaB---- Mardin	90	18	70	40	4.0	3.0	7.5
MaC---- Mardin	85	17	65	35	4.0	3.0	7.5
MaD---- Mardin	80	16	65	30	3.5	3.0	6.5
MdD---- Mardin	---	---	---	---	---	---	---
Mm---- Medihemists and Medisaprists	---	---	---	---	---	---	---
Ph---- Philo	130	26	80	45	4.5	3.5	8.5
Pn.** Pits							
Po---- Pope	130	26	80	45	5.0	4.0	8.0
ReA---- Rexford	80	16	65	---	---	3.0	5.5
Sc---- Scio	110	22	85	45	4.5	3.5	8.5
ShC---- Shelmadine	85	17	60	---	---	2.5	5.0
SvC---- Shelmadine	---	---	---	---	---	---	---
Ud.** Udorthents							
UnA---- Unadilla	120	24	75	45	5.0	3.5	6.5
VeA---- Venango	90	18	70	---	3.5	3.0	6.5
VeB---- Venango	90	18	70	---	3.5	3.0	6.5
VeC---- Venango	90	18	70	---	3.5	3.0	6.5
VsC---- Venango	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Corn silage	Oats	Wheat	Alfalfa hay	Grass-legume hay	Pasture
	Bu	Ton	Bu	Bu	Ton	Ton	AUM*
Wa---------- Wayland	100	20	70	---	---	3.5	6.5
WhB---------- Wharton	90	18	65	40	3.5	3.0	6.5
WhC---------- Wharton	80	16	60	35	3.5	3.0	6.5
WhD---------- Wharton	70	14	55	30	3.0	2.5	5.5
WoB---------- Wooster	110	22	70	40	4.5	4.5	7.5
WoC---------- Wooster	105	21	65	35	4.5	4.5	7.0
WoD---------- Wooster	100	20	60	30	4.0	3.5	6.5

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	10,484	---	---	---
II	98,962	54,175	38,665	6,122
III	201,758	108,598	93,160	---
IV	79,430	57,829	21,601	---
V	---	---	---	---
VI	327,086	6,984	---	320,102
VII	127,086	60,572	---	66,514
VIII	---	---	---	---
Not classified	13,434	---	---	---

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
AaA, AaB---------- Alvira	3w	Slight	Moderate	Moderate	Moderate	Northern red oak----	70	Eastern white pine, yellow-poplar, Norway spruce, Japanese larch, white spruce.
						Yellow-poplar-------	75	
AaC, AbC---------- Alvira	3w	Moderate	Moderate	Moderate	Moderate	Northern red oak----	70	Eastern white pine, yellow-poplar, Norway spruce, Japanese larch, white spruce.
						Yellow-poplar-------	75	
AgB, AhB---------- Armagh	3w	Slight	Severe	Severe	Severe	Northern red oak----	75	Eastern white pine, Norway spruce.
At---------- Atkins	1w	Slight	Severe	Severe	Moderate	Pin oak----------	90	Eastern white pine, white spruce.
						Red maple----------	---	
						American sycamore---	---	
BcB---------- Braceville	2o	Slight	Slight	Slight	Slight	Northern red oak----	80	Yellow-poplar, Japanese larch, Norway spruce, eastern white pine, black cherry.
						White ash----------	80	
						Sugar maple---------	80	
						Black cherry--------	80	
						Yellow-poplar-------	90	
BkB, BnB---------- Brinkerton	2w	Slight	Severe	Severe	Moderate	Northern red oak----	77	Eastern white pine, white spruce, red maple, yellow-poplar.
Ca---------- Canadice	5w	Slight	Severe	Severe	Moderate	Red maple----------	50	Eastern white pine, white spruce.
						Eastern white pine--	55	
CdB---------- Cavode	2w	Slight	Moderate	Moderate	Moderate	Northern red oak----	83	Eastern white pine, yellow-poplar, black cherry, Norway spruce, white spruce.
						Yellow-poplar-------	95	
CdC---------- Cavode	2w	Moderate	Moderate	Moderate	Moderate	Northern red oak----	83	Eastern white pine, yellow-poplar, black cherry, Norway spruce, white spruce.
						Yellow-poplar-------	95	
CdD---------- Cavode	2r	Severe	Moderate	Moderate	Moderate	Northern red oak----	83	Eastern white pine, yellow-poplar, black cherry, Norway spruce, white spruce.
						Yellow-poplar-------	95	
CeC---------- Cavode	2w	Slight	Moderate	Moderate	Moderate	Northern red oak----	83	Eastern white pine, yellow-poplar, black cherry, Norway spruce, white spruce.
						Yellow-poplar-------	95	
ChA, ChB, ChC------ Chenango	2o	Slight	Slight	Slight	Slight	Sugar maple---------	70	Eastern white pine, red pine, Japanese larch.
						Northern red oak----	80	
ChD---------- Chenango	2r	Slight	Moderate	Slight	Slight	Sugar maple---------	70	Eastern white pine, red pine, Japanese larch.
						Northern red oak----	80	
CpB---------- Chippewa	5w	Slight	Severe	Severe	Severe	Red maple----------	50	White spruce, European alder.
						White ash----------	60	

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
CtA, CtB, CtC--- Cookport	2w	Slight	Moderate	Slight	Slight	Northern red oak----	76	Yellow-poplar, eastern white pine, black cherry, Japanese larch, Norway spruce.
						Black cherry--------	86	
						Yellow-poplar-------	90	
						White ash----------	80	
						Sugar maple---------	80	
CvC--- Cookport	2w	Slight	Moderate	Slight	Slight	Northern red oak----	76	Yellow-poplar, eastern white pine, Japanese larch, Norway spruce.
						Black cherry--------	86	
						Yellow-poplar-------	90	
						White ash----------	80	
						Sugar maple---------	80	
EsB--- Ernest	2w	Slight	Moderate	Slight	Slight	Northern red oak----	80	Eastern white pine, Norway spruce, Japanese larch.
						Yellow-poplar-------	89	
						White ash----------	80	
						Sugar maple---------	80	
						Black cherry--------		
EsC--- Ernest	2w	Moderate	Moderate	Slight	Slight	Northern red oak----	80	Eastern white pine, Norway spruce, Japanese larch.
						Yellow-poplar-------	89	
						White ash----------	80	
						Sugar maple---------	80	
						Black cherry--------	80	
EvD--- Ernest	2w	Severe	Moderate	Slight	Slight	Northern red oak----	80	Eastern white pine, Norway spruce, Japanese larch.
						Yellow-poplar-------	89	
						White ash----------	80	
						Sugar maple---------	80	
						Black cherry--------	80	
GnB, GnC, GsC--- Gilpin	2o	Slight	Slight	Slight	Slight	Northern red oak----	80	Japanese larch, Virginia pine, eastern white pine, black cherry, yellow-poplar.
						Yellow-poplar-------	95	
GnD--- Gilpin	2r	Moderate	Moderate	Slight	Slight	Northern red oak----	80	Japanese larch, Virginia pine, eastern white pine, black cherry, yellow-poplar.
						Yellow-poplar-------	95	
GpF--- Gilpin	2r	Severe	Severe	Slight	Slight	Northern red oak----	80	Japanese larch, Virginia pine, eastern white pine, black cherry, yellow-poplar.
						Yellow-poplar-------	95	
HnB, HnC--- Hanover	1o	Slight	Slight	Slight	Slight	Northern red oak----	93	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, northern red oak.
						Eastern white pine--	76	
						Red pine------------	76	
						White oak----------	---	
						Black walnut--------	---	
						Black cherry--------	---	
						Sugar maple---------	---	
						White ash----------	---	
						Yellow-poplar-------	---	
HnD, HoF*--- Hanover	1r	Moderate	Moderate	Slight	Slight	Northern red oak----	93	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, northern red oak.
						Eastern white pine--	76	
						Red pine------------	76	
						White oak----------	---	
						Black walnut--------	---	
						Black cherry--------	---	
						Sugar maple---------	---	
						White ash----------	---	
						Yellow-poplar-------	---	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
HsD---------- Hanover	1r	Moderate	Moderate	Slight	Slight	Northern red oak----	93	Yellow-poplar, white ash, red pine, Virginia pine.
						Eastern white pine--	76	
						Red pine----------	76	
						White oak----------	---	
						Sugar maple---------	---	
						White ash----------	---	
						Slippery elm--------	---	
						American beech------	---	
						American sycamore---	---	
HtA, HtB, HtC------ Hazleton	3o	Slight	Slight	Slight	Slight	Northern red oak----	70	Japanese larch, eastern white pine, Norway spruce, Austrian pine, black cherry.
						Yellow-poplar-------	80	
HtD---------- Hazleton	3r	Slight	Moderate	Slight	Slight	Northern red oak----	70	Japanese larch, eastern white pine, Norway spruce, Austrian pine, black cherry.
						Yellow-poplar-------	80	
HvB---------- Hazleton	3o	Slight	Slight	Slight	Slight	Northern red oak----	70	Japanese larch, eastern white pine, Norway spruce, Austrian pine, black cherry.
						Yellow-poplar-------	80	
HvD---------- Hazleton	3r	Slight	Moderate	Slight	Slight	Northern red oak----	70	Japanese larch, eastern white pine, Norway spruce, Austrian pine, black cherry.
						Yellow-poplar-------	80	
HvF---------- Hazleton	3r	Moderate	Severe	Slight	Slight	Northern red oak----	70	Japanese larch, eastern white pine, Norway spruce, Austrian pine, black cherry.
						Yellow-poplar-------	80	
LdB, LdC---------- Lordstown	3o	Slight	Slight	Slight	Slight	Northern red oak----	70	Eastern white pine, Japanese larch, red pine, Norway spruce.
						Sugar maple---------	73	
						White ash----------	75	
LdD---------- Lordstown	3r	Slight	Moderate	Slight	Slight	Northern red oak----	70	Eastern white pine, Japanese larch, red pine, Norway spruce.
						Sugar maple---------	73	
						White ash----------	75	
LtF*---------- Lordstown	3r	Moderate	Severe	Slight	Slight	Northern red oak----	70	Eastern white pine, Japanese larch, red pine, Norway spruce.
						Sugar maple---------	73	
						White ash----------	75	
MaA, MaB, MaC------ Mardin	3o	Slight	Slight	Slight	Slight	Sugar maple---------	70	Red pine, Japanese larch, Norway spruce, eastern white pine, white spruce.
						Northern red oak----	70	
						Black cherry--------	70	
						White ash----------	70	
MaD, MdD---------- Mardin	3r	Slight	Moderate	Slight	Slight	Sugar maple---------	70	Red pine, Japanese larch, Norway spruce, eastern white pine, white spruce.
						Northern red oak----	70	
						Black cherry--------	70	
						White ash----------	70	
Ph---------- Philo	1w	Slight	Moderate	Slight	Slight	Northern red oak----	86	Eastern white pine, yellow-poplar.
						Yellow-poplar-------	102	
						Virginia pine-------	74	
						Black oak----------	85	
						White oak----------	85	
						White ash----------	85	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
Po---------- Pope	2o	Slight	Slight	Slight	Slight	Northern red oak----	80	Eastern white pine, yellow-poplar, black walnut, black cherry, Norway spruce, Japanese larch.
						Yellow-poplar-------	102	
						Eastern white pine--	89	
						Virginia pine-------	74	
ReA---------- Rexford	3w	Slight	Moderate	Moderate	Moderate	Northern red oak----	70	Black cherry, Japanese larch, Norway spruce, white spruce, eastern white pine.
						White ash----------	70	
						Sugar maple---------	70	
						Black cherry--------	70	
Sc---------- Scio	2o	Slight	Slight	Slight	Slight	Northern red oak----	75	Japanese larch, eastern white pine, red pine, Norway spruce, white spruce.
						White ash----------	85	
						Sugar maple---------	70	
						Black cherry--------	80	
						Eastern hemlock-----	70	
						Eastern white pine--	85	
ShC---------- Shelmadine	3w	Slight	Severe	Severe	Severe	Northern red oak----	70	Eastern white pine, red maple, Norway spruce.
						Black cherry--------	70	
SvC---------- Shelmadine	3w	Slight	Severe	Severe	Severe	Northern red oak----	70	Eastern white pine, red maple, Norway spruce.
						Black cherry--------	70	
UnA---------- Unadilla	2o	Slight	Slight	Slight	Slight	Sugar maple---------	70	Eastern white pine, Norway spruce, black cherry, Japanese larch, red pine, white spruce.
						Eastern white pine--	85	
						Northern red oak----	80	
						Black cherry--------	80	
						White ash----------	95	
VeA, VeB, VeC------ Venango	2w	Slight	Moderate	Moderate	Moderate	Northern red oak----	83	Yellow-poplar, red pine, white ash, Virginia pine.
						White oak----------	75	
						White ash----------	75	
						Sugar maple---------	79	
						American sycamore---	---	
						Yellow-poplar	95	
VsC---------- Venango	2w	Slight	Moderate	Moderate	Moderate	Northern red oak----	83	Yellow-poplar, white ash, Virginia pine, red pine.
						White ash----------	75	
						Sugar maple---------	79	
						Slippery elm--------	---	
						American beech------	---	
						White oak----------	---	
						American sycamore---	---	
Wa---------- Wayland	4w	Slight	Severe	Severe	Severe	Red maple----------	65	White spruce, European alder.
WhB---------- Wharton	2o	Slight	Slight	Slight	Slight	Northern red oak----	76	Eastern white pine, yellow-poplar.
						Yellow-poplar-------	90	
WhC---------- Wharton	2r	Moderate	Slight	Slight	Slight	Northern red oak----	76	Eastern white pine, yellow-poplar.
						Yellow-poplar-------	90	
WhD---------- Wharton	2r	Severe	Moderate	Slight	Slight	Northern red oak----	76	Eastern white pine, yellow-poplar.
						Yellow-poplar-------	90	
WoB, WoC---------- Wooster	1o	Slight	Slight	Slight	Slight	Northern red oak----	86	Eastern white pine, black walnut, yellow-poplar, white ash, northern red oak, red pine, black cherry.
						Yellow-poplar-------	96	
						Sugar maple---------	85	
						White oak----------	---	
						White ash----------	---	
						Black walnut--------	---	
						Black cherry--------	---	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
WoD---------- Wooster	1r	Moderate	Moderate	Slight	Slight	Northern red oak----	86	Eastern white pine, black walnut, yellow-poplar, white ash, northern red oak, red pine, black cherry.
						Yellow-poplar-------	96	
						Sugar maple---------	85	
						White oak----------	---	
						White ash----------	---	
						Black walnut--------	---	
						Black cherry--------	---	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AaA, AaB---------- Alvira	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
AaC---------- Alvira	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.
AbC---------- Alvira	Severe: wetness.	Severe: wetness.	Severe: slope, wetness, large stones.	Severe: wetness.	Severe: wetness.
AgB---------- Armagh	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
AhB---------- Armagh	Severe: wetness.	Severe: wetness.	Severe: wetness, large stones.	Severe: wetness.	Severe: wetness.
At---------- Atkins	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
BcB---------- Braceville	Moderate: wetness, small stones.	Moderate: wetness, small stones.	Severe: small stones.	Moderate: wetness.	Moderate: wetness, small stones.
BkB---------- Brinkerton	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
BnB---------- Brinkerton	Severe: wetness.	Severe: wetness.	Severe: wetness, large stones.	Severe: wetness.	Severe: wetness.
Ca---------- Canadice	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
CdB---------- Cavode	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
CdC---------- Cavode	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.
CdD---------- Cavode	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: slope, wetness.
CeC---------- Cavode	Severe: wetness.	Severe: wetness.	Severe: slope, wetness, large stones.	Severe: wetness.	Severe: wetness.
ChA, ChB---------- Chenango	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight----------	Moderate: small stones.
ChC---------- Chenango	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight----------	Moderate: small stones, slope.
ChD---------- Chenango	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
CpB---------- Chippewa	Severe: wetness, percs slowly, excess humus.	Severe: wetness, percs slowly, excess humus.	Severe: wetness, percs slowly, excess humus.	Severe: wetness, excess humus.	Severe: wetness.
CtA---------- Cookport	Moderate: percs slowly, wetness.	Moderate: wetness, percs slowly.	Moderate: small stones.	Severe: erodes easily.	Moderate: wetness.
CtB---------- Cookport	Moderate: percs slowly, wetness.	Moderate: wetness, percs slowly.	Moderate: slope, small stones.	Severe: erodes easily.	Moderate: wetness.
CtC---------- Cookport	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope, wetness.
CvC---------- Cookport	Moderate: slope, wetness, large stones.	Moderate: slope, large stones, wetness.	Severe: slope, large stones.	Moderate: wetness.	Moderate: slope, large stones, wetness.
EsB---------- Ernest	Moderate: percs slowly, wetness.	Moderate: wetness, percs slowly.	Moderate: slope, small stones.	Severe: erodes easily.	Moderate: wetness.
EsC---------- Ernest	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: wetness, slope.
EvD---------- Ernest	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Moderate: wetness, slope.	Severe: slope.
GnB---------- Gilpin	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: large stones.	Moderate: thin layer, small stones.
GnC---------- Gilpin	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: small stones, slope.	Moderate: large stones.	Moderate: slope, small stones.
GnD---------- Gilpin	Severe: slope.	Severe: slope.	Severe: small stones, slope.	Moderate: slope, large stones.	Severe: slope.
GpF*---------- Gilpin	Severe: slope.	Severe: slope.	Severe: small stones, slope.	Severe: slope.	Severe: slope.
GsC---------- Gilpin	Moderate: large stones, slope.	Moderate: large stones, slope.	Severe: slope, small stones, large stones.	Moderate: large stones.	Moderate: slope, thin layer, large stones.
HnB---------- Hanover	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Severe: erodes easily.	Moderate: wetness.
HnC---------- Hanover	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope, wetness.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
HnD Hanover	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
HoF* Hanover	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
HsD Hanover	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Moderate: slope, wetness.	Severe: slope.
HtA, HtB Hazleton	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones, droughty.
HtC Hazleton	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: small stones, slope.	Slight	Moderate: slope, small stones.
HtD Hazleton	Severe: slope.	Severe: slope.	Severe: small stones, slope.	Moderate: slope.	Severe: slope.
HvB Hazleton	Moderate: large stones.	Moderate: large stones.	Severe: small stones, large stones.	Slight	Moderate: large stones, droughty.
HvD Hazleton	Severe: slope.	Severe: slope.	Severe: slope, small stones, large stones.	Moderate: slope.	Severe: slope.
HvF Hazleton	Severe: slope.	Severe: slope.	Severe: slope, small stones, large stones.	Severe: slope.	Severe: slope.
LdB Lordstown	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones, thin layer.
LdC Lordstown	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, thin layer, slope.
LdD Lordstown	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
LtF* Lordstown	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
MaA, MaB Mardin	Severe: percs slowly.	Severe: percs slowly.	Severe: small stones, percs slowly.	Moderate: wetness.	Moderate: small stones, wetness.
MaC Mardin	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, small stones, percs slowly.	Moderate: wetness.	Moderate: small stones, slope, wetness.
MaD Mardin	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, small stones, percs slowly.	Moderate: slope, wetness.	Severe: slope.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
MdD---------- Mardin	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: large stones, slope, small stones.	Moderate: slope, wetness.	Severe: slope.
Mm*: Medihemists.					
Medisaprists.					
Ph---------- Philo	Severe: floods.	Moderate: wetness.	Moderate: floods, wetness.	Moderate: wetness.	Moderate: floods, wetness.
Pn*. Pits					
Po---------- Pope	Severe: floods.	Slight----------	Moderate: floods.	Slight----------	Moderate: floods.
ReA---------- Rexford	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Sc---------- Scio	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
ShC---------- Shelmadine	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.
SvC---------- Shelmadine	Severe: wetness.	Severe: wetness.	Severe: slope, wetness, large stones.	Severe: wetness.	Severe: wetness.
Ud*. Udorthents					
UnA---------- Unadilla	Severe: floods.	Slight----------	Slight----------	Slight----------	Slight.
VeA, VeB---------- Venango	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, erodes easily.	Severe: wetness.
VeC---------- Venango	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness, erodes easily.	Severe: wetness.
VsC---------- Venango	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: large stones, slope, wetness.	Severe: wetness.	Severe: wetness.
Wa---------- Wayland	Severe: floods, wetness, excess humus.	Severe: wetness, excess humus.	Severe: excess humus, wetness, floods.	Severe: wetness, excess humus.	Severe: wetness, floods.
WhB---------- Wharton	Moderate: percs slowly, wetness.	Moderate: wetness, percs slowly.	Moderate: slope, percs slowly, wetness.	Moderate: wetness.	Moderate: wetness.
WhC---------- Wharton	Moderate: slope, percs slowly, wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Moderate: wetness.	Moderate: slope, wetness.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
WhD---------- Wharton	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, wetness.	Severe: slope.
WoB---------- Wooster	Moderate: percs slowly.	Moderate: percs slowly.	Severe: small stones.	Slight----------	Moderate: small stones.
WoC---------- Wooster	Moderate: percs slowly, slope.	Moderate: slope, percs slowly.	Severe: slope, small stones.	Slight----------	Moderate: small stones, slope.
WoD---------- Wooster	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
AaA---- Alvira	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
AaB---- Alvira	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
AaC---- Alvira	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AbC---- Alvira	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
AgB---- Armagh	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
AhB---- Armagh	Very poor.	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
At---- Atkins	Poor	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
BcB---- Braceville	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
BkB---- Brinkerton	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
BnB---- Brinkerton	Very poor.	Poor	Good	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
Ca---- Canadice	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
CdB---- Cavode	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CdC---- Cavode	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CdD---- Cavode	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
CeC---- Cavode	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
ChA, ChB, ChC---- Chenango	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
ChD---- Chenango	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
CpB---- Chippewa	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
CtA---- Cookport	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
CtB---- Cookport	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CtC---- Cookport	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

TABLE 9.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
CvC---- Cookport	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
EsB---- Ernest	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
EsC---- Ernest	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
EvD---- Ernest	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
GnB---- Gilpin	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
GnC---- Gilpin	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
GnD---- Gilpin	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
GpF*, GsC---- Gilpin	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
HnB---- Hanover	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
HnC---- Hanover	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
HnD---- Hanover	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
HoF*---- Hanover	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
HsD---- Hanover	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
HtA, HtB---- Hazleton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
HtC---- Hazleton	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
HtD---- Hazleton	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
HvB---- Hazleton	Very poor.	Poor	Good	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
HvD, HvF---- Hazleton	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
LdB---- Lordstown	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
LdC---- Lordstown	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
LdD---- Lordstown	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
LtF*---- Lordstown	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
MaA---- Mardin	Fair	Good	Good	Fair	Fair	Poor	Poor	Good	Fair	Poor.
MaB---- Mardin	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
MaC---- Mardin	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
MaD---- Mardin	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
MdD---- Mardin	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Mm*: Medihemists.										
Medisaprists.										
Ph---- Philo	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Pn*. Pits										
Po---- Pope	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ReA---- Rexford	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
Sc---- Scio	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
ShC---- Shelmadine	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
SvC---- Shelmadine	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Ud*. Udorthents										
UnA---- Unadilla	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
VeA---- Venango	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
VeB---- Venango	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
VeC---- Venango	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
VsC---- Venango	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Wa---- Wayland	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
WhB---- Wharton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
WhC---------- Wharton	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
WhD---------- Wharton	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
WoB---------- Wooster	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WoC---------- Wooster	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
WoD---------- Wooster	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AaA, AaB---------- Alvira	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, wetness.	Severe: wetness.
AaC, AbC---------- Alvira	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: frost action, wetness.	Severe: wetness.
AgB, AhB---------- Armagh	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action, low strength.	Severe: wetness.
At---------- Atkins	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness, frost action.	Severe: wetness, floods.
BcB---------- Braceville	Severe: wetness, cutbanks cave.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: wetness.	Moderate: wetness.
BkB, BnB---------- Brinkerton	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action, low strength.	Severe: wetness.
Ca---------- Canadice	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness.	Severe: wetness.
CdB---------- Cavode	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength, wetness.	Severe: wetness.
CdC---------- Cavode	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: frost action, low strength, wetness.	Severe: wetness.
CdD---------- Cavode	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness, low strength.	Severe: slope, wetness.
CeC---------- Cavode	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: frost action, low strength, wetness.	Severe: wetness.
ChA---------- Chenango	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: small stones.
ChB---------- Chenango	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: small stones.
ChC---------- Chenango	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: small stones, slope.
ChD---------- Chenango	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
CpB---------- Chippewa	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
CtA---------- Cookport	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, low strength.	Moderate: wetness.
CtB---------- Cookport	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: slope, wetness.	Moderate: wetness, low strength.	Moderate: wetness.
CtC---------- Cookport	Severe: wetness.	Moderate: slope, wetness.	Severe: wetness.	Severe: slope.	Moderate: slope, wetness, low strength.	Moderate: slope, wetness.
CvC---------- Cookport	Severe: wetness.	Moderate: slope, wetness.	Severe: wetness.	Severe: slope.	Moderate: slope, wetness, low strength.	Moderate: slope, large stones, wetness.
EsB---------- Ernest	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength.	Moderate: wetness.
EsC---------- Ernest	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: low strength.	Moderate: wetness, slope.
EvD---------- Ernest	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
GnB---------- Gilpin	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Moderate: slope.	Moderate: frost action.	Moderate: thin layer, small stones.
GnC---------- Gilpin	Moderate: slope, depth to rock.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, small stones.
GnD, GpF*--------- Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
GsC---------- Gilpin	Moderate: slope, depth to rock.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, thin layer, small stones.
HnB---------- Hanover	Moderate: dense layer, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: slope, wetness.	Moderate: frost action, wetness.	Moderate: wetness.
HnC---------- Hanover	Moderate: dense layer, wetness, slope.	Moderate: slope, wetness.	Severe: wetness.	Severe: slope.	Moderate: slope, frost action, wetness.	Moderate: slope, wetness.
HnD, HoF*, HsD---- Hanover	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
HtA---------- Hazleton	Moderate: depth to rock, large stones.	Moderate: large stones.	Moderate: large stones, depth to rock.	Moderate: large stones.	Moderate: frost action, large stones.	Moderate: small stones, droughty.
HtB---------- Hazleton	Moderate: depth to rock, large stones.	Moderate: large stones.	Moderate: large stones, depth to rock.	Moderate: slope, large stones.	Moderate: frost action, large stones.	Moderate: small stones, droughty.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
HtC---------- Hazleton	Moderate: depth to rock, slope, large stones.	Moderate: slope, large stones.	Moderate: slope, large stones, depth to rock.	Severe: slope.	Moderate: slope, frost action, large stones.	Moderate: slope, small stones.
HtD---------- Hazleton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
HvB---------- Hazleton	Moderate: depth to rock, large stones.	Moderate: large stones.	Moderate: large stones, depth to rock.	Moderate: slope, large stones.	Moderate: frost action, large stones.	Moderate: large stones.
HvD, HvF---------- Hazleton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
LdB---------- Lordstown	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock, frost action.	Moderate: large stones, thin layer.
LdC---------- Lordstown	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: slope, depth to rock, frost action.	Moderate: large stones, thin layer, slope.
LdD, LtF*---------- Lordstown	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope.
MaA---------- Mardin	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: frost action, wetness.	Moderate: small stones, wetness.
MaB---------- Mardin	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: slope, wetness.	Moderate: frost action, wetness.	Moderate: small stones, wetness.
MaC---------- Mardin	Severe: wetness.	Moderate: slope, wetness.	Severe: wetness.	Severe: slope.	Moderate: slope, frost action, wetness.	Moderate: small stones, slope, wetness.
MaD, MdD---------- Mardin	Severe: slope, wetness.	Severe: slope.	Severe: slope, wetness.	Severe: slope.	Severe: slope.	Severe: slope.
Mm*: Medihemists. Medisaprists.						
Ph---------- Philo	Severe: cutbanks cave, wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: floods.	Moderate: floods, wetness.
Pn*. Pits						
Po---------- Pope	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
ReA---------- Rexford	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
Sc---------- Scio	Severe: wetness, cutbanks cave.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Moderate: wetness.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
ShC, SvC---------- Shelmadine	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: wetness, frost action.	Severe: wetness.
Ud*. Udorthents						
UnA---------- Unadilla	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: frost action.	Slight.
VeA, VeB---------- Venango	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
VeC, VsC---------- Venango	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, slope.	Severe: wetness, frost action.	Severe: wetness.
Wa---------- Wayland	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: low strength, wetness, floods.	Severe: wetness, floods.
WhB---------- Wharton	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: slope, wetness, shrink-swell.	Severe: frost action, low strength.	Moderate: wetness.
WhC---------- Wharton	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope, wetness.
WhD---------- Wharton	Severe: slope, wetness.	Severe: slope.	Severe: slope, wetness.	Severe: slope.	Severe: slope, frost action, low strength.	Severe: slope.
WoB---------- Wooster	Moderate: wetness.	Slight---------	Moderate: wetness.	Moderate: slope.	Moderate: frost action.	Moderate: small stones.
WoC---------- Wooster	Moderate: slope, wetness.	Moderate: slope.	Moderate: slope, wetness.	Severe: slope.	Moderate: slope, frost action.	Moderate: small stones, slope.
WoD---------- Wooster	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AaA---------- Alvira	Severe: percs slowly, wetness.	Moderate: depth to rock.	Severe: wetness, depth to rock.	Severe: wetness.	Poor: wetness.
AaB---------- Alvira	Severe: percs slowly, wetness.	Moderate: slope, depth to rock.	Severe: wetness, depth to rock.	Severe: wetness.	Poor: wetness.
AaC---------- Alvira	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness, depth to rock.	Severe: wetness.	Poor: wetness.
AbC---------- Alvira	Severe: percs slowly, wetness.	Severe: slope.	Severe: depth to rock, wetness.	Severe: wetness.	Poor: wetness.
AgB---------- Armagh	Severe: percs slowly, wetness.	Moderate: slope, depth to rock.	Severe: wetness, depth to rock, too clayey.	Severe: wetness.	Poor: wetness, too clayey, hard to pack.
AhB---------- Armagh	Severe: percs slowly, wetness.	Moderate: slope, depth to rock.	Severe: wetness, depth to rock, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
At---------- Atkins	Severe: floods, wetness, percs slowly.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Poor: wetness.
BcB---------- Braceville	Severe: percs slowly, wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
BkB, BnB---------- Brinkerton	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Ca---------- Canadice	Severe: wetness, percs slowly.	Slight----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
CdB---------- Cavode	Severe: percs slowly, wetness.	Moderate: slope, depth to rock.	Severe: wetness, depth to rock, too clayey.	Severe: wetness.	Poor: too clayey, wetness.
CdC---------- Cavode	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness, depth to rock, too clayey.	Severe: wetness.	Poor: too clayey, wetness.
CdD---------- Cavode	Severe: slope, percs slowly, wetness.	Severe: slope.	Severe: depth to rock, wetness, slope.	Severe: slope, wetness.	Poor: slope, too clayey, wetness.
CeC---------- Cavode	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness, depth to rock, too clayey.	Severe: wetness.	Poor: too clayey, wetness.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
ChA, ChB---------- Chenango	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
ChC---------- Chenango	Severe: poor filter.	Severe: slope, seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
ChD---------- Chenango	Severe: poor filter, slope.	Severe: slope, seepage.	Severe: slope, seepage, too sandy.	Severe: slope, seepage.	Poor: seepage, too sandy, small stones.
CpB---------- Chippewa	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Poor: small stones, wetness.
CtA, CtB---------- Cookport	Severe: wetness, percs slowly.	Moderate: depth to rock, seepage.	Severe: wetness, depth to rock.	Moderate: wetness, depth to rock.	Fair: area reclaim, wetness.
CtC---------- Cookport	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, depth to rock.	Moderate: slope, wetness, depth to rock.	Fair: area reclaim, wetness, slope.
CvC---------- Cookport	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, depth to rock.	Moderate: slope, wetness, depth to rock.	Fair: area reclaim, wetness, slope.
EsB---------- Ernest	Severe: percs slowly, wetness.	Moderate: seepage, slope.	Severe: wetness.	Moderate: wetness.	Poor: small stones.
EsC---------- Ernest	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness.	Moderate: slope, wetness.	Poor: small stones.
EvD---------- Ernest	Severe: wetness, percs slowly, slope.	Severe: slope.	Severe: slope, wetness.	Severe: slope.	Poor: slope, small stones.
GnB---------- Gilpin	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
GnC---------- Gilpin	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
GnD, GpF*---------- Gilpin	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: slope, area reclaim, thin layer.
GsC---------- Gilpin	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: thin layer, large stones, area reclaim.
HnB---------- Hanover	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness.	Moderate: wetness.	Fair: too clayey, small stones.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
HnC---------- Hanover	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Moderate: wetness, slope.	Fair: too clayey, small stones, slope.
HnD, HoF*, HsD------ Hanover	Severe: wetness, percs slowly, slope.	Severe: slope.	Severe: slope, wetness.	Severe: slope.	Poor: slope.
HtA, HtB---------- Hazleton	Severe: poor filter.	Severe: seepage.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: small stones.
HtC---------- Hazleton	Severe: poor filter.	Severe: slope, seepage.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: small stones.
HtD---------- Hazleton	Severe: poor filter, slope.	Severe: slope, seepage.	Severe: slope, seepage, depth to rock.	Severe: slope, seepage.	Poor: slope, small stones.
HvB---------- Hazleton	Severe: poor filter.	Severe: seepage.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: small stones.
HvD, HvF---------- Hazleton	Severe: poor filter, slope.	Severe: slope, seepage.	Severe: slope, seepage, depth to rock.	Severe: slope, seepage.	Poor: slope, small stones.
LdB---------- Lordstown	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
LdC---------- Lordstown	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
LdD, LtF*---------- Lordstown	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Poor: area reclaim, slope, thin layer.
MaA---------- Mardin	Severe: percs slowly, wetness.	Moderate: seepage.	Severe: wetness.	Moderate: wetness.	Poor: small stones.
MaB---------- Mardin	Severe: percs slowly, wetness.	Moderate: slope, seepage.	Severe: wetness.	Moderate: wetness.	Poor: small stones.
MaC---------- Mardin	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness.	Moderate: slope, wetness.	Poor: small stones.
MaD---------- Mardin	Severe: slope, percs slowly, wetness.	Severe: slope.	Severe: slope, wetness.	Severe: slope.	Poor: slope, small stones.
MdD---------- Mardin	Severe: slope, percs slowly, wetness.	Severe: slope.	Severe: slope, wetness.	Severe: slope.	Poor: small stones, slope.

See footnote at end of table.

TABLE 11--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Mm*: Medihemists. Medisaprists.					
Ph---------- Philo	Severe: floods, wetness, poor filter.	Severe: floods, wetness, seepage.	Severe: floods, depth to rock, seepage.	Severe: floods, wetness.	Fair: area reclaim, wetness, thin layer.
Pn*. Pits					
Po---------- Pope	Severe: floods.	Severe: seepage, floods.	Severe: floods, seepage.	Severe: floods, seepage.	Good.
ReA---------- Rexford	Severe: percs slowly, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: wetness.
Sc---------- Scio	Severe: wetness, poor filter.	Severe: seepage.	Severe: seepage, wetness.	Severe: wetness.	Fair: wetness, thin layer.
ShC, SvC---------- Shelmadine	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Ud*. Udorthents					
UnA---------- Unadilla	Severe: poor filter.	Severe: floods, seepage.	Severe: seepage.	Moderate: floods.	Fair: thin layer.
VeA, VeB---------- Venango	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: wetness.	Severe: wetness.	Poor: wetness.
VeC, VsC---------- Venango	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Wa---------- Wayland	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
WhB---------- Wharton	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
WhC---------- Wharton	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness.	Moderate: wetness, slope.	Fair: slope, too clayey.
WhD---------- Wharton	Severe: slope, percs slowly, wetness.	Severe: slope.	Severe: slope, wetness.	Severe: slope.	Poor: slope.
WoB---------- Wooster	Severe: percs slowly.	Moderate: seepage, slope.	Slight----------	Slight----------	Fair: small stones.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
WoC---------- Wooster	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope, small stones.
WoD---------- Wooster	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AaA, AaB, AaC, AbC---- Alvira	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, wetness.
AgB, AhB---------- Armagh	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
At---------- Atkins	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
BcB---------- Braceville	Fair: wetness.	Probable----------	Probable----------	Poor: small stones, area reclaim.
BkB, BnB---------- Brinkerton	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Ca---------- Canadice	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey, thin layer.
CdB, CdC---------- Cavode	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
CdD---------- Cavode	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness, slope.
CeC---------- Cavode	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
ChA, ChB, ChC--------- Chenango	Good----------	Probable----------	Probable----------	Poor: small stones, area reclaim.
ChD---------- Chenango	Fair: slope.	Probable----------	Probable----------	Poor: slope, small stones, area reclaim.
CpB---------- Chippewa	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, area reclaim, small stones.
CtA, CtB, CtC--------- Cookport	Fair: low strength, wetness, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
CvC---------- Cookport	Fair: area reclaim, wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
EsB, EsC---------- Ernest	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
EvD---------- Ernest	Fair: low strength, wetness, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
GnB, GnC---------- Gilpin	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
GnD---------- Gilpin	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
GpF*---------- Gilpin	Poor: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
GsC---------- Gilpin	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, small stones.
HnB---------- Hanover	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
HnC---------- Hanover	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, slope.
HnD---------- Hanover	Fair: wetness, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
HoF*---------- Hanover	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
HsD---------- Hanover	Fair: wetness, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
HtA, HtB, HtC--------- Hazleton	Fair: area reclaim, thin layer, large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
HtD---------- Hazleton	Fair: slope, area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
HvB---------- Hazleton	Fair: area reclaim, thin layer, large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
HvD---------- Hazleton	Fair: slope, area reclaim, large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
HvF---------- Hazleton	Severe: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
LdB, LdC---------- Lordstown	Poor: thin layer, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
LdD---------- Lordstown	Poor: thin layer, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
LtF*---------- Lordstown	Poor: slope, thin layer, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
MaA, MaB, MaC---------- Mardin	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
MaD---------- Mardin	Fair: slope, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
MdD---------- Mardin	Fair: slope, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, area reclaim, small stones.
Mm*: Medihemists. Medisaprists.				
Ph---------- Philo	Fair: area reclaim, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
Pn*. Pits				
Po---------- Pope	Good----------	Improbable: excess fines.	Improbable: excess fines.	Good.
ReA---------- Rexford	Poor: wetness, thin layer.	Probable----------	Probable----------	Poor: wetness, small stones, area reclaim.
Sc---------- Scio	Fair: wetness.	Probable----------	Probable----------	Fair: area reclaim.
ShC---------- Shelmadine	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, area reclaim.
SvC---------- Shelmadine	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, large stones, area reclaim.
Ud*. Udorthents				
UnA---------- Unadilla	Good----------	Probable----------	Probable----------	Moderate: area reclaim.
VeA, VeB, VeC, VsC---- Venango	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, wetness.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Wa---------- Wayland	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
WhB, WhC---------- Wharton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
WhD---------- Wharton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones, area reclaim.
WoB, WoC---------- Wooster	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
WoD---------- Wooster	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
AaA---------- Alvira	Moderate: depth to rock.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Rooting depth, percs slowly, wetness.	Percs slowly, wetness, rooting depth.
AaB---------- Alvira	Moderate: depth to rock, slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Rooting depth, percs slowly, wetness.	Percs slowly, wetness, rooting depth.
AaC---------- Alvira	Severe: slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Wetness, rooting depth, slope.
AbC---------- Alvira	Severe: slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Large stones, rooting depth, slope.	Large stones, wetness, slope.
AgB---------- Armagh	Moderate: depth to rock, slope.	Severe: piping, hard to pack, wetness.	Severe: slow refill.	Percs slowly, frost action, slope.	Wetness, percs slowly.	Wetness, percs slowly.
AhB---------- Armagh	Moderate: depth to rock, slope.	Severe: piping, hard to pack, wetness.	Severe: slow refill.	Percs slowly, frost action, slope.	Wetness, percs slowly, large stones.	Wetness, percs slowly, large stones.
At---------- Atkins	Severe: seepage.	Severe: piping, wetness.	Severe: slow refill.	Floods, frost action, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
BcB---------- Braceville	Severe: seepage.	Severe: seepage.	Severe: no water.	Slope, percs slowly.	Wetness, rooting depth, percs slowly.	Percs slowly, rooting depth, droughty.
BkB---------- Brinkerton	Moderate: slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Percs slowly, wetness, rooting depth.	Percs slowly, wetness, rooting depth.
BnB---------- Brinkerton	Moderate: slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Percs slowly, wetness, large stones.	Wetness, large stones, rooting depth.
Ca---------- Canadice	Slight---------	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly---	Erodes easily, wetness, percs slowly.	Wetness, percs slowly, erodes easily.
CdB---------- Cavode	Moderate: depth to rock, slope.	Severe: piping, wetness.	Severe: no water.	Slope, percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.
CdC, CdD, CeC----- Cavode	Severe: slope.	Severe: piping, wetness.	Severe: no water.	Slope, percs slowly, frost action.	Wetness, percs slowly, slope.	Wetness, percs slowly, slope.
ChA, ChB---------- Chenango	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy------	Droughty.
ChC, ChD---------- Chenango	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, too sandy.	Slope, droughty.
CpB---------- Chippewa	Moderate: slope.	Severe: piping, wetness.	Severe: slow refill.	Percs slowly, frost action, slope.	Wetness, rooting depth, percs slowly.	Wetness, rooting depth, percs slowly.
CtA---------- Cookport	Moderate: depth to rock.	Severe: piping.	Severe: no water.	Percs slowly---	Erodes easily, wetness, rooting depth.	Erodes easily, rooting depth.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
CtB---------- Cookport	Moderate: depth to rock, slope.	Severe: piping.	Severe: no water.	Slope, percs slowly.	Erodes easily, wetness, rooting depth.	Erodes easily, rooting depth.
CtC---------- Cookport	Severe: slope.	Severe: piping.	Severe: no water.	Slope, percs slowly.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
CvC---------- Cookport	Severe: slope.	Severe: piping.	Severe: no water.	Slope, percs slowly.	Wetness, rooting depth, slope.	Slope, rooting depth, percs slowly.
EsB---------- Ernest	Moderate: slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Erodes easily, rooting depth, percs slowly.	Erodes easily, rooting depth, percs slowly.
EsC---------- Ernest	Severe: slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Slope, erodes easily, rooting depth.	Rooting depth, slope, erodes easily.
EvD---------- Ernest	Severe: slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Slope, large stones, wetness.	Large stones, slope, rooting depth.
GnB---------- Gilpin	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock, large stones.	Depth to rock, large stones.
GnC, GnD, GpF*---- Gilpin	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, large stones.	Slope, depth to rock, large stones.
GsC---------- Gilpin	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
HnB---------- Hanover	Moderate: slope.	Severe: piping.	Severe: no water.	Slope----------	Erodes easily, wetness.	Erodes easily, rooting depth.
HnC, HnD, HoF*, HsD---------- Hanover	Severe: slope.	Severe: piping.	Severe: no water.	Slope----------	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
HtA, HtB---------- Hazleton	Severe: seepage.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Large stones, too sandy.	Large stones, droughty.
HtC, HtD---------- Hazleton	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, too sandy.	Large stones, slope, droughty.
HvB---------- Hazleton	Severe: seepage.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Large stones, too sandy.	Large stones, droughty.
HvD, HvF---------- Hazleton	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Large stones, slope, too sandy.	Large stones, slope, droughty.
LdB---------- Lordstown	Moderate: seepage, depth to rock, slope.	Severe: piping, thin layer.	Severe: no water.	Deep to water	Depth to rock	Depth to rock.
LdC, LdD, LtF*---- Lordstown	Severe: slope.	Severe: piping, thin layer.	Severe: no water.	Deep to water	Slope, depth to rock.	Slope, depth to rock.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
MaA---------- Mardin	Slight---------	Moderate: piping.	Severe: no water.	Percs slowly---	Wetness, rooting depth, percs slowly.	Rooting depth, percs slowly.
MaB---------- Mardin	Moderate: slope.	Moderate: piping.	Severe: no water.	Slope, percs slowly.	Wetness, rooting depth, percs slowly.	Rooting depth, percs slowly.
MaC, MaD---------- Mardin	Severe: slope.	Moderate: piping.	Severe: no water.	Slope, percs slowly.	Slope, wetness, rooting depth.	Slope, wetness, rooting depth.
MdD---------- Mardin	Severe: slope.	Moderate: piping.	Severe: no water.	Slope, percs slowly.	Slope, large stones, wetness.	Slope, large stones, rooting depth.
Mm*: Medihemists. Medisaprists.						
Ph---------- Philo	Severe: seepage.	Severe: piping.	Moderate: deep to water.	Floods---------	Wetness--------	Favorable.
Pn*. Pits						
Po---------- Pope	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Favorable------	Favorable.
ReA---------- Rexford	Moderate: seepage.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly, rooting depth.	Percs slowly, wetness, rooting depth.
Sc---------- Scio	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Cutbanks cave, frost action.	Erodes easily, wetness.	Erodes easily.
ShC, SvC---------- Shelmadine	Severe: slope.	Severe: wetness.	Severe: no water.	Percs slowly, frost action, slope.	Wetness, rooting depth, slope.	Percs slowly, rooting depth, slope.
Ud*. Udorthents						
UnA---------- Unadilla	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water, frost action.	Erodes easily	Erodes easily.
VeA---------- Venango	Slight---------	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
VeB---------- Venango	Moderate: slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.
VeC, VsC---------- Venango	Severe: slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
Wa---------- Wayland	Slight---------	Severe: piping, wetness.	Severe: slow refill.	Percs slowly, floods, frost action.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
WhB---------- Wharton	Moderate: depth to rock, slope.	Moderate: thin layer, piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Wetness, percs slowly.	Percs slowly.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
WhC, WhD---------- Wharton	Severe: slope.	Moderate: thin layer, piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Wetness, slope, percs slowly.	Slope, percs slowly.
WoB---------- Wooster	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Rooting depth, erodes easily.	Erodes easily, rooting depth.
WoC, WoD---------- Wooster	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth, erodes easily.	Slope, erodes easily, rooting depth.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AaA, AaB, AaC---- Alvira	0-7	Silt loam--------	ML	A-4	0-5	90-100	80-95	70-90	50-80	---	---
	7-21	Silt loam, silty clay loam, gravelly loam.	CL, CL-ML, GM-GC, SM-SC	A-4, A-6	0-10	65-100	55-90	50-90	35-85	25-40	5-15
	21-60	Gravelly silt loam, gravelly loam, silty clay loam.	CL, CL-ML, GM-GC, SM-SC	A-4, A-6, A-2	0-20	65-95	45-90	40-90	30-85	25-40	5-15
AbC---------- Alvira	0-7	Very stony silt loam.	ML, SM	A-4	3-15	70-100	60-95	55-90	40-80	---	---
	7-21	Silt loam, silty clay loam, gravelly loam.	CL, CL-ML, GM-GC, SM-SC	A-4, A-6	0-10	65-100	55-90	50-90	35-85	25-40	5-15
	21-60	Gravelly silt loam, gravelly loam, silty clay loam.	CL, CL-ML, GM-GC, SM-SC	A-4, A-6, A-2	0-20	65-95	45-90	40-90	30-85	25-40	5-15
AgB---------- Armagh	0-12	Silt loam--------	ML	A-4, A-6	0-5	95-100	90-100	80-95	75-85	---	---
	12-48	Silty clay loam, silty clay, shaly clay.	ML, CL, MH	A-4, A-6, A-7	0-5	80-95	65-90	60-85	55-85	35-55	9-25
	48-60	Shaly silty clay, shaly silty clay loam.	GC, SM, GM, SC	A-4, A-6, A-2, A-7	0-40	55-90	40-70	25-60	15-45	30-45	9-18
AhB---------- Armagh	0-12	Very stony silt loam.	ML	A-4, A-6	3-15	95-100	90-100	80-95	75-85	---	---
	12-48	Silty clay loam, silty clay, shaly clay.	ML, CL, MH	A-4, A-6, A-7	0-5	80-95	65-90	60-85	55-85	35-55	9-25
	48-60	Shaly silty clay, shaly silty clay loam.	GC, SM, GM, SC	A-4, A-6, A-2, A-7	0-40	55-90	40-70	25-60	15-45	30-45	9-18
At---------- Atkins	0-8	Silty clay loam	ML, CL, CL-ML	A-4, A-6	0	90-100	85-100	75-100	60-95	20-40	3-20
	8-42	Silty clay loam, silt loam, sandy loam.	SM, SC, ML, CL	A-4, A-6	0-5	90-100	85-100	65-100	45-85	20-40	3-20
	42-60	Stratified silty clay loam to very gravelly loam.	SM, CL, GM, ML	A-2, A-4, A-6	0-15	60-100	50-100	40-95	30-85	20-40	1-15
BcB---------- Braceville	0-10	Gravelly silt loam.	ML, SM, CL, GM	A-4, A-2, A-1	0-10	65-90	60-80	40-70	20-55	---	---
	10-19	Gravelly sandy loam, silt loam, gravelly loam.	ML, SM, GM-GC, CL-ML	A-2, A-4, A-1	0-10	65-100	60-100	40-100	20-90	15-35	*NP-10
	19-35	Gravelly sandy loam, gravelly silt loam.	ML, SM, GM-GC, CL-ML	A-2, A-4, A-1	0-10	65-100	40-75	25-75	15-65	15-35	NP-10
	35-60	Stratified sand and gravel.	GM, SM, GW-GM, GP-GM	A-1, A-2, A-4	0-15	40-100	35-80	25-70	10-50	<30	NP-5
BkB---------- Brinkerton	0-7	Silt loam--------	ML	A-4, A-6	0-10	90-100	85-100	85-100	75-100	---	---
	7-28	Silty clay loam, silt loam.	ML	A-4, A-6, A-7	0-10	90-100	85-100	85-100	65-100	30-45	5-15
	28-44	Silt loam, shaly loam, channery silty clay loam.	ML	A-4, A-6, A-7	0-10	75-100	70-100	65-100	55-100	30-45	5-15
	44-60	Silt loam, shaly loam, channery silt loam.	ML, SM, SC, CL	A-4, A-6, A-2	0-10	70-90	35-85	30-85	25-75	30-40	5-15

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
BnB---------- Brinkerton	0-7	Very stony silt loam.	ML	A-4, A-6	3-20	90-100	85-100	85-100	75-100	---	---
	7-28	Silty clay loam, silt loam.	ML	A-4, A-6, A-7	0-10	90-100	85-100	85-100	65-100	30-45	5-15
	28-44	Silt loam, shaly loam, channery silty clay loam.	ML	A-4, A-6, A-7	0-10	75-100	70-100	65-100	55-100	30-45	5-15
	44-60	Silt loam, shaly loam, channery silt loam.	ML, SM, SC, CL	A-4, A-6, A-2	0-10	70-90	35-85	30-85	25-75	30-40	5-15
Ca---------- Canadice	0-7	Silt loam--------	ML, MH, OL, OH	A-7	0	100	95-100	85-100	65-95	40-65	10-25
	7-40	Silty clay, clay, silty clay loam.	CL, CH, MH, ML	A-7	0	100	95-100	85-100	70-95	45-65	20-30
	40-62	Silty clay, clay, silty clay loam.	CL, CH, MH, ML	A-7	0	100	95-100	85-100	70-95	45-65	20-30
CdB, CdC, CdD---- Cavode	0-8	Silt loam--------	ML, CL	A-4	0-5	90-100	80-100	80-95	75-95	---	---
	8-24	Silty clay loam, silty clay.	ML, CL, CL-ML	A-4, A-7, A-6, A-5	0-5	85-100	80-100	80-95	70-95	25-50	4-20
	24-60	Shaly silty clay loam, silty clay, clay.	ML, CL, GC, GM	A-2, A-4, A-6	0-45	50-100	35-100	30-80	25-75	25-45	2-15
CeC---------- Cavode	0-8	Very stony silt loam.	ML, CL	A-4	3-15	90-100	80-100	80-95	75-95	---	---
	8-24	Silty clay loam, silty clay.	ML, CL, CL-ML	A-4, A-7, A-6, A-5	0-5	85-100	80-100	80-95	70-95	25-50	4-20
	24-60	Shaly silty clay loam, silty clay, clay.	ML, CL, GC, GM	A-2, A-4, A-6	0-45	50-100	35-100	30-80	25-75	25-45	2-15
ChA, ChB, ChC, ChD---------- Chenango	0-7	Gravelly silt loam.	ML, SM, GM	A-2, A-4, A-1	5-15	55-85	55-80	35-80	15-70	<35	NP-10
	7-30	Gravelly silt loam, gravelly fine sandy loam, very gravelly silt loam.	ML, GM, SM	A-2, A-4, A-1	5-10	35-80	30-75	25-75	15-65	<40	NP-10
	30-60	Very gravelly loamy coarse sand, very gravelly sand, gravelly loamy fine sand.	GW, GM, SM, SP	A-1	5-10	25-65	20-60	10-50	1-20	---	NP
CpB---------- Chippewa	0-6	Silt loam--------	ML, OL	A-7, A-5	0-5	80-100	75-100	65-95	55-85	40-50	5-15
	6-16	Channery silt loam, loam, channery silty clay loam.	GM, ML, SM-SC, CL-ML	A-4	5-10	65-85	60-85	45-85	35-75	25-35	5-10
	16-40	Very channery silt loam, channery loam, channery silty clay loam.	CL, GC, SC, CL-ML	A-2, A-4	10-15	60-80	55-70	45-70	30-65	15-25	5-10
	40-60	Very channery silt loam, channery loam, channery silty clay loam.	GM, ML, CL-ML, SM	A-2, A-4	10-15	60-80	55-70	45-70	30-65	25-35	5-10

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
CtA, CtB, CtC---- Cookport	0-10	Silt loam--------	ML, CL, SM, SC	A-2, A-4, A-6	0-5	85-100	80-100	60-85	30-85	20-40	1-15
	10-24	Sandy clay loam, clay loam, channery loam.	ML, CL, SM, SC	A-4, A-6	0-15	85-100	65-100	55-95	40-75	20-40	4-20
	24-40	Sandy clay loam, clay loam, channery loam.	ML, CL, SM, SC	A-4, A-6	0-15	85-100	65-100	55-95	40-75	20-40	4-20
	40-60	Very channery sandy loam, channery loam.	ML, CL, SM-SC, GM-GC	A-2, A-4, A-6	0-15	60-100	40-95	35-95	30-75	20-40	1-15
	60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
CvC---------- Cookport	0-10	Very stony silt loam.	ML, CL, SM, SC	A-2, A-4, A-6	2-40	75-95	60-70	50-60	30-55	20-40	1-15
	10-24	Sandy clay loam, clay loam, channery loam.	ML, CL, SM, SC	A-4, A-6	0-15	85-100	65-100	55-95	40-75	20-40	4-20
	24-40	Sandy clay loam, clay loam, channery loam.	ML, CL, SM, SC	A-4, A-6	0-15	85-100	65-100	55-95	40-75	20-40	4-20
	40-60	Very channery sandy loam, channery loam.	ML, CL, SM-SC, GM-GC	A-2, A-4, A-6	0-15	60-100	40-95	35-95	30-75	20-40	1-15
	60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
EsB, EsC---------- Ernest	0-8	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-10	85-100	80-100	70-95	60-95	20-40	4-15
	8-29	Silty clay loam, silt loam, channery silt loam.	ML, CL, CL-ML	A-4, A-6, A-7	0-15	75-95	70-95	65-90	55-90	25-50	6-22
	29-42	Channery silt loam, channery loam, silty clay loam.	ML, CL, GM, SC	A-4, A-6, A-7	0-20	70-95	55-95	55-90	45-90	20-45	4-18
	42-60	Channery silt loam, silt loam, silty clay loam.	ML, CL, GM, SC	A-4, A-6, A-7	0-20	70-95	45-95	45-90	40-90	25-50	6-22
EvD---------- Ernest	0-8	Very stony silt loam.	ML, CL, CL-ML	A-4, A-6	3-15	65-80	60-80	55-75	55-70	20-40	4-15
	8-29	Silty clay loam, silt loam, channery silt loam.	ML, CL, CL-ML	A-4, A-6, A-7	0-15	75-95	70-95	65-90	55-90	25-50	6-22
	29-42	Channery silt loam, channery loam, silty clay loam.	ML, CL, GM, SC	A-4, A-6, A-7	0-20	70-95	55-95	55-90	45-90	20-45	4-18
	42-60	Channery silt loam, silt loam, silty clay loam.	ML, CL, GM, SC	A-4, A-6, A-7	0-20	70-95	45-95	45-90	40-90	25-50	6-22
GnB, GnC, GnD, GpF**---------- Gilpin	0-7	Channery silt loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-90	45-85	35-75	30-70	20-40	4-15
	7-27	Channery loam, shaly silt loam, silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	27-30	Channery loam, very channery silt loam, very shaly silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
GsC---------- Gilpin	0-7	Very stony silt loam.	GC, CL, SC, CL-ML	A-2, A-4, A-6	10-40	50-90	45-85	35-75	30-70	20-40	4-15
	7-27	Shaly silt loam, channery loam, silty clay loam.	GM-GC, CL, CL-ML, SC	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	27-30	Channery loam, very channery silt loam, very shaly silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
HnB, HnC, HnD, HoF**---------- Hanover	0-10	Silt loam--------	ML	A-4	0-1	95-100	85-100	75-95	70-90	25-35	NP-10
	10-27	Loam, silt loam, gravelly loam.	CL, ML	A-4, A-6	0-2	85-100	65-100	60-90	55-85	30-40	6-15
	27-60	Loam, silt loam, gravelly loam.	CL, CL-ML	A-4, A-6	0-5	85-100	65-95	55-80	50-70	20-40	4-15
HsD---------- Hanover	0-10	Very stony silt loam.	ML	A-4	2-15	95-100	85-100	75-95	70-90	25-35	NP-10
	10-27	Loam, silt loam, gravelly loam.	ML, CL	A-4, A-6	0-5	85-100	65-100	60-90	55-85	30-40	6-15
	27-60	Loam, silt loam, gravelly loam.	CL, CL-ML	A-4, A-6	0-5	85-100	65-95	55-80	50-70	20-40	4-15
HtA, HtB, HtC, HtD---------- Hazleton	0-6	Channery sandy loam.	ML, GM, SM	A-2, A-4	0-15	60-85	60-80	60-75	35-55	---	---
	6-32	Channery sandy loam, loam, very channery loam.	GM, SM, ML, SC	A-2, A-4, A-1	0-50	60-95	45-90	35-70	20-55	<30	NP-8
	32-56	Channery loam, very channery sandy loam, very channery loamy sand.	GM, SM, SC, GC	A-2, A-1, A-4	0-60	55-80	35-75	25-65	15-50	<30	NP-8
	56	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
HvB, HvD, HvF---- Hazleton	0-6	Very stony sandy loam.	ML, GM, SM	A-4, A-2	5-15	85-95	75-90	50-70	35-55	---	---
	6-32	Channery sandy loam, channery loam, loam.	GM, SM, ML, SC	A-2, A-4, A-1	0-50	60-95	45-90	35-70	20-55	<30	NP-8
	32-56	Channery loam, very channery sandy loam, very channery loamy sand.	GM, SM, SC, GC	A-2, A-1, A-4	5-60	55-80	35-75	25-65	15-50	<30	NP-8
	56	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
LdB, LdC, LdD, LtF**---------- Lordstown	0-7	Channery silt loam.	ML, GM, SM	A-4	5-20	65-85	50-75	50-75	40-65	<30	NP-4
	7-38	Channery silt loam, channery loam.	ML, GM, SM	A-4	5-10	65-85	50-75	50-75	40-65	<30	NP-4
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
MaA, MaB, MaC, MaD---------- Mardin	0-8	Gravelly silt loam.	GM, ML, CL, GC	A-4	0-5	60-80	55-75	45-75	35-70	25-35	5-10
	8-21	Channery silt loam, loam, gravelly loam.	CL, GC, CL-ML, SM-SC	A-4	5-10	60-90	55-90	45-90	35-80	15-25	5-10
	21-64	Channery loam, channery silt loam, very channery loam.	CL, GC, SC, CL-ML	A-2, A-4, A-1	10-25	40-80	35-75	30-70	20-65	20-30	5-10
MdD---------- Mardin	0-8	Very stony silt loam.	GM, ML, CL, GC	A-4	5-10	65-75	60-70	50-70	35-60	25-35	5-10
	8-21	Channery silt loam, loam, gravelly loam.	CL, GC, SC, CL-ML	A-4	5-10	60-90	55-90	45-90	35-80	15-25	5-10
	21-64	Channery loam, channery silt loam, very channery loam.	CL, GC, SC, CL-ML	A-2, A-4, A-1	10-25	40-80	35-75	30-70	20-65	20-30	5-10
Mm**: Medihemists.											
Medisaprists.											
Ph---------- Philo	0-7	Silt loam--------	ML, SM, CL-ML	A-4	0-5	95-100	80-100	60-90	45-80	20-35	1-10
	7-36	Silt loam, loam, sandy loam.	ML, SM, CL-ML	A-4	0-5	95-100	75-100	70-90	45-80	20-35	1-10
	36-60	Stratified sand to silt loam.	GM, SM, ML, CL-ML	A-2, A-4	0-5	60-95	50-90	40-85	30-80	15-30	1-10
Pn**. Pits											
Po---------- Pope	0-7	Loam----------	ML, CL, SM, CL-ML	A-4	0	85-100	75-100	70-100	45-90	<30	NP-10
	7-49	Gravelly sandy loam, silt loam, loam.	SM, SM-SC, ML, CL-ML	A-2, A-4	0	85-100	70-100	50-95	25-75	<30	NP-7
	49-60	Sandy loam, gravelly loamy sand.	SM, SM-SC, ML, GM	A-2, A-1, A-4	0-20	45-100	35-100	30-95	15-70	<30	NP-7
ReA---------- Rexford	0-24	Loam----------	ML, CL, SM, SC	A-4, A-2	0-5	95-100	80-100	75-95	30-90	15-35	NP-10
	24-36	Gravelly sandy loam, loam, silt loam.	ML, SM, GM	A-2, A-4	0-10	60-100	50-100	40-85	25-70	20-35	NP-7
	36-60	Gravelly sandy loam, loam, silt loam.	ML, SM, GM	A-2, A-4	0-15	60-90	50-80	35-65	25-55	<30	NP
Sc---------- Scio	0-11	Silt loam--------	ML	A-4	0	100	95-100	90-100	70-90	<20	NP-4
	11-44	Silt loam, very fine sandy loam.	ML	A-4	0	100	95-100	90-100	70-90	<20	NP-4
	44-60	Stratified very gravelly sand to silt loam.	ML, SM, SP, GP-GM	A-4, A-2, A-1, A-3	0	35-95	30-90	15-85	2-80	<10	NP-4

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
ShC---------- Shelmadine	0-5	Silt loam--------	ML	A-4	0-5	80-100	75-95	70-90	65-85	---	---
	5-26	Silt loam, channery silty clay loam, shaly silt loam.	ML, CL	A-4, A-6	0-10	80-100	75-95	60-90	50-80	25-40	3-15
	26-42	Silt loam, channery loam, shaly silty clay loam.	ML, CL	A-4, A-6	0-15	80-100	75-95	60-90	50-80	25-40	3-15
	42-60	Channery silt loam, very channery loam, shaly loam.	GM, ML, SM	A-2, A-4, A-1	0-15	50-80	35-75	25-70	20-65	25-35	3-10
SvC---------- Shelmadine	0-5	Very stony silt loam.	ML	A-4	3-10	70-100	65-95	60-90	50-85	---	---
	5-26	Silt loam, channery silty clay loam, shaly silt loam.	ML, CL	A-4, A-6	0-10	80-100	75-95	60-90	50-80	25-40	3-15
	26-42	Silt loam, channery loam, shaly silty clay loam.	ML, CL	A-4, A-6	0-10	80-100	75-95	60-90	50-80	25-40	3-15
	42-60	Channery silt loam, very channery loam, shaly loam.	GM, SM, ML	A-4, A-2, A-1	0-15	50-80	35-75	25-70	20-65	25-35	3-10
Ud**. Udorthents											
UnA---------- Unadilla	0-10	Silt loam--------	ML	A-4	0	100	95-100	90-100	70-90	<35	NP-10
	10-42	Silt loam, very fine sandy loam.	ML, CL-ML	A-4	0	100	95-100	90-100	70-90	<25	NP-10
	42-60	Very gravelly sand, gravelly sand, loamy sand.	GM, GP, SM, SP	A-2, A-1, A-3	0-10	35-100	25-95	10-70	1-30	---	NP
VeA, VeB, VeC---- Venango	0-11	Silt loam--------	ML, CL-ML, CL	A-4	0	90-100	80-100	75-95	65-85	22-35	4-10
	11-19	Silt loam, clay loam, gravelly loam.	CL, ML, SM, SC	A-4, A-6, A-7	0-5	80-100	65-100	55-85	40-85	25-45	5-15
	19-46	Loam, silt loam, gravelly loam.	CL, ML, SM, SC	A-4, A-6	0-10	75-95	65-95	60-90	40-80	20-35	3-14
	46-62	Loam, silt loam, gravelly loam.	CL, ML, SM, SC	A-4, A-6	0-10	75-95	65-95	60-90	40-80	20-35	3-14
VsC---------- Venango	0-11	Very stony silt loam.	ML, CL, SM, SC	A-4	0-10	80-100	70-90	60-90	45-80	22-35	4-10
	11-19	Silt loam, clay loam, gravelly loam.	SM, ML, CL, SC	A-4, A-6, A-7	0-10	90-100	70-95	55-95	40-85	25-45	5-15
	19-46	Loam, silt loam, gravelly loam.	SM, ML, SC, CL	A-4, A-6	0-10	75-95	65-95	60-90	40-80	20-35	3-14
	46-62	Loam, silt loam, gravelly loam.	SM, ML, SC, CL	A-4, A-6	0-10	75-95	65-95	60-90	40-80	20-35	3-14
Wa---------- Wayland	0-7	Silt loam--------	ML, OL	A-7, A-5	0	100	95-100	90-100	70-95	40-50	5-15
	7-36	Silt loam, silty clay loam.	ML, CL-ML, CL	A-6, A-4, A-7	0	100	95-100	90-100	70-95	25-45	5-15
	36-64	Stratified silt loam to fine sandy loam.	CL, CL-ML	A-4	0	95-100	90-100	80-95	60-90	15-25	5-10

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
WhB, WhC, WhD---- Wharton	0-7	Silt loam--------	ML, CL	A-4, A-6	0-5	95-100	90-100	80-95	70-90	---	---
	7-47	Clay loam, shaly silty clay loam, shaly silt loam.	ML, CL	A-7, A-6	0-25	75-100	70-100	65-95	60-90	30-45	10-25
	47-60	Silt loam, shaly clay, very shaly silt loam.	ML, GM, SM	A-4, A-6, A-7, A-2	0-50	45-100	30-100	25-95	25-90	30-45	5-15
WoB, WoC, WoD---- Wooster	0-10	Gravelly silt loam.	CL, ML, SM, SC	A-6, A-4	0-10	75-95	65-80	60-80	45-70	25-40	4-14
	10-27	Loam, gravelly loam, silt loam.	ML, CL	A-4, A-6	0-10	85-100	65-90	55-85	50-75	30-40	6-15
	27-42	Loam, silt loam, gravelly loam.	CL, CL-ML	A-6, A-4	0-15	80-90	60-75	55-70	50-60	25-40	4-15
	42-60	Loam, gravelly loam, sandy loam.	ML, CL, SM, SC	A-4, A-6, A-2	0-15	75-90	50-75	45-85	30-70	20-35	3-12

* NP means nonplastic.
** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cm³	In/hr	In/in	pH				Pct
AaA, AaB, AaC----	0-7	10-20	1.40-1.60	0.6-2.0	0.16-0.20	3.6-5.5	Low----------	0.32	3-2	1-2
Alvira	7-21	18-35	1.40-1.60	0.6-2.0	0.14-0.18	3.6-5.5	Low----------	0.37		
	21-60	18-35	1.50-1.70	0.06-0.2	0.08-0.12	3.6-5.5	Low----------	0.28		
AbC----------	0-7	10-20	1.40-1.60	0.6-2.0	0.14-0.20	3.6-5.5	Low----------	0.17	3-2	1-2
Alvira	7-21	18-35	1.40-1.60	0.6-2.0	0.14-0.18	3.6-5.5	Low----------	0.37		
	21-60	18-35	1.50-1.70	0.06-0.2	0.08-0.12	3.6-5.5	Low----------	0.28		
AgB----------	0-12	15-32	1.20-1.40	0.6-2.0	0.18-0.22	4.5-5.5	Low----------	0.24	3	1-4
Armagh	12-48	35-55	1.30-1.60	0.06-0.2	0.10-0.14	4.5-5.5	Moderate-----	0.28		
	48-60	25-55	1.20-1.60	0.06-0.6	0.08-0.12	4.5-5.5	Moderate-----	0.17		
AhB----------	0-12	15-32	1.20-1.40	0.6-2.0	0.18-0.22	4.5-5.5	Low----------	0.15	3	---
Armagh	12-48	35-55	1.30-1.60	0.06-0.2	0.10-0.14	4.5-5.5	Moderate-----	0.28		
	48-60	25-55	1.20-1.60	0.06-0.6	0.08-0.12	4.5-5.5	Moderate-----	0.17		
At----------	0-8	22-30	1.20-1.40	0.6-2.0	0.14-0.22	4.5-5.5	Low----------	0.28	5	2-4
Atkins	8-42	18-35	1.20-1.50	0.06-0.2	0.14-0.18	4.5-5.5	Low----------	0.28		
	42-60	10-35	1.20-1.50	0.2-6.0	0.08-0.18	4.5-5.5	Low----------	0.28		
BcB----------	0-10	10-25	1.20-1.40	0.2-2.0	0.08-0.12	4.5-6.0	Low----------	0.20	3	1-3
Braceville	10-19	10-25	1.20-1.50	0.2-2.0	0.08-0.12	4.5-6.0	Low----------	0.24		
	19-35	10-25	1.30-1.60	0.06-0.6	0.06-0.10	5.1-6.5	Low----------	0.24		
	35-60	5-25	1.20-1.40	2.0-20	0.03-0.06	5.1-6.5	Low----------	0.20		
BkB----------	0-7	15-30	1.20-1.40	0.6-2.0	0.18-0.24	4.5-6.0	Low----------	0.32	3	1-4
Brinkerton	7-28	15-35	1.20-1.50	0.6-2.0	0.14-0.18	4.5-6.0	Moderate-----	0.37		
	28-44	15-35	1.40-1.70	0.06-0.2	0.08-0.12	4.5-6.0	Moderate-----	0.32		
	44-60	15-25	1.20-1.60	0.06-0.6	0.14-0.18	5.1-6.0	Low----------	0.20		
BnB----------	0-7	15-35	1.20-1.40	0.6-2.0	0.18-0.24	4.5-6.0	Low----------	0.28	3-2	---
Brinkerton	7-28	15-35	1.20-1.50	0.6-2.0	0.14-0.18	4.5-6.0	Moderate-----	0.37		
	28-44	15-35	1.40-1.70	0.06-0.2	0.08-0.12	4.5-6.0	Moderate-----	0.32		
	44-60	15-25	1.20-1.60	0.06-0.6	0.14-0.18	5.1-6.0	Low----------	0.20		
Ca----------	0-7	20-40	1.35-1.55	0.2-2.0	0.17-0.21	5.6-6.5	Moderate-----	0.49	5	3-11
Canadice	7-40	35-60	1.40-1.75	<0.06	0.12-0.17	6.1-7.3	Moderate-----	0.28		
	40-62	35-60	1.40-1.50	<0.06	0.13-0.17	6.6-8.4	Moderate-----	0.28		
CdB, CdC, CdD----	0-8	15-27	1.20-1.40	0.6-2.0	0.18-0.22	4.5-5.5	Low----------	0.32	3-2	2-4
Cavode	8-24	35-45	1.20-1.50	0.06-0.2	0.10-0.14	4.5-5.5	Moderate-----	0.24		
	24-60	35-45	1.20-1.50	0.06-0.2	0.10-0.12	4.5-5.5	Moderate-----	0.24		
CeC----------	0-8	15-27	1.20-1.40	0.6-2.0	0.18-0.22	4.5-5.5	Low----------	0.17	3	---
Cavode	8-24	35-45	1.20-1.50	0.06-0.2	0.10-0.14	4.5-5.5	Moderate-----	0.24		
	24-60	35-45	1.20-1.50	0.06-0.2	0.10-0.12	4.5-5.5	Moderate-----	0.24		
ChA, ChB, ChC, ChD----------	0-7	6-18	1.20-1.50	0.6-6.0	0.08-0.15	4.5-5.5	Low----------	0.24	3	2-6
Chenango	7-30	6-18	1.25-1.55	0.6-6.0	0.05-0.14	4.5-5.5	Low----------	0.17		
	30-60	1-8	1.45-1.65	6.0-20.0	0.01-0.03	5.1-7.8	Low----------	0.17		
CpB----------	0-6	10-27	1.10-1.40	0.6-2.0	0.14-0.21	4.5-5.5	Low----------	0.32	3	3-10
Chippewa	6-16	18-27	1.20-1.50	0.6-2.0	0.10-0.17	4.5-5.5	Low----------	0.32		
	16-40	10-35	1.70-2.00	<0.2	0.01-0.02	5.1-6.0	Low----------	0.24		
	40-60	10-35	1.65-1.95	<0.2	0.01-0.02	5.6-6.0	Low----------	0.24		
CtA, CtB, CtC----	0-10	10-27	1.20-1.40	0.6-2.0	0.12-0.16	4.5-5.5	Low----------	0.37	3	1-4
Cookport	10-24	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.28		
	24-40	18-35	1.40-1.70	0.06-0.2	0.08-0.12	3.6-5.5	Low----------	0.28		
	40-60	10-27	1.20-1.50	0.2-0.6	0.08-0.12	3.6-5.5	Low----------	0.28		
	60	---	---	---	---	---	----------	----		

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cm³	In/hr	In/in	pH				Pct
CvC----------	0-10	10-27	1.20-1.40	0.6-2.0	0.12-0.16	4.5-5.5	Low----------	0.32	3	---
Cookport	10-24	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.28		
	24-40	18-35	1.40-1.70	0.06-0.2	0.08-0.12	3.6-5.5	Low----------	0.28		
	40-60	10-27	1.20-1.50	0.2-0.6	0.08-0.12	3.6-5.5	Low----------	0.28		
	60	---	---	---	---	---	----------	----		
EsB, EsC----------	0-8	15-20	1.20-1.40	0.6-2.0	0.14-0.20	4.5-5.5	Low----------	0.43	3	2-4
Ernest	8-29	20-35	1.30-1.50	0.6-2.0	0.12-0.16	4.5-5.5	Moderate-----	0.28		
	29-42	18-30	1.40-1.70	0.2-0.6	0.08-0.12	4.5-5.5	Low----------	0.28		
	42-60	20-35	1.30-1.60	0.2-0.6	0.08-0.12	4.5-5.5	Moderate-----	0.28		
EvD----------	0-8	15-20	1.20-1.40	0.6-2.0	0.12-0.18	4.5-5.5	Low----------	0.32	3	---
Ernest	8-29	20-35	1.30-1.50	0.6-2.0	0.12-0.16	4.5-5.5	Moderate-----	0.28		
	29-42	18-30	1.40-1.70	0.2-0.6	0.08-0.12	4.5-5.5	Low----------	0.28		
	42-60	20-35	1.30-1.60	0.2-0.6	0.08-0.12	4.5-5.5	Moderate-----	0.28		
GnB, GnC, GnD, GpF*----------	0-7	15-27	1.20-1.40	0.6-2.0	0.10-0.18	3.6-5.5	Low----------	0.28	3	1-4
Gilpin	7-27	18-35	1.20-1.50	0.6-2.0	0.10-0.16	3.6-5.5	Low----------	0.24		
	27-30	15-35	1.20-1.50	0.6-2.0	0.06-0.10	3.6-5.5	Low----------	0.24		
	30	---	---	---	---	---	----------	----		
GsC----------	0-7	15-27	1.20-1.40	0.6-2.0	0.10-0.18	3.6-5.5	Low----------	0.17	3	---
Gilpin	7-27	18-35	1.20-1.50	0.6-2.0	0.10-0.16	3.6-5.5	Low----------	0.24		
	27-30	15-35	1.20-1.50	0.6-2.0	0.06-0.10	3.6-5.5	Low----------	0.24		
	30	---	---	---	---	---	----------	----		
HnB, HnC, HnD, HoF*----------	0-10	13-25	1.30-1.50	0.6-2.0	0.17-0.23	4.5-5.5	Low----------	0.37	4	1-3
Hanover	10-27	18-30	1.40-1.70	0.6-2.0	0.10-0.18	4.5-5.5	Low----------	0.37		
	27-60	20-30	1.60-1.90	0.2-0.6	0.06-0.10	4.5-5.5	Low----------	0.37		
HsD----------	0-10	13-25	1.30-1.50	0.6-2.0	0.15-0.22	4.5-5.5	Low----------	0.28	4	---
Hanover	10-27	18-30	1.40-1.70	0.6-2.0	0.10-0.18	4.5-5.5	Low----------	0.37		
	27-60	20-30	1.60-1.90	0.2-0.6	0.06-0.10	4.5-5.5	Low----------	0.37		
HtA, HtB, HtC, HtD----------	0-6	7-18	1.20-1.40	2.0-6.0	0.10-0.14	3.6-5.5	Low----------	0.17	4	2-4
	6-32	7-18	1.20-1.40	2.0-20	0.08-0.12	3.6-5.5	Low----------	0.17		
Hazleton	32-56	5-15	1.20-1.40	2.0-20	0.04-0.10	3.6-5.5	Low----------	0.17		
	56	---	---	---	---	---	----------	----		
HvB, HvD, HvF----	0-6	7-18	1.20-1.40	2.0-6.0	0.10-0.16	3.6-5.5	Low----------	0.17	4	2-4
Hazleton	6-32	7-18	1.20-1.40	2.0-20	0.08-0.12	3.6-5.5	Low----------	0.17		
	32-56	5-15	1.20-1.40	2.0-20	0.04-0.10	3.6-5.5	Low----------	0.17		
	56	---	---	---	---	---	----------	----		
LdB, LdC, LdD, LtF*----------	0-7	8-18	1.10-1.40	0.6-2.0	0.11-0.17	4.5-5.5	Low----------	0.20	3	2-6
Lordstown	7-38	8-18	1.20-1.50	0.06-2.0	0.10-0.16	4.5-5.5	Low----------	0.28		
	38	---	---	---	---	---	----------	----		
MaA, MaB, MaC, MaD----------	0-8	10-18	1.10-1.40	0.6-2.0	0.09-0.14	4.5-5.5	Low----------	0.24	3	3-7
Mardin	8-21	10-18	1.20-1.50	0.6-2.0	0.09-0.16	4.5-5.5	Low----------	0.24		
	21-64	10-18	1.70-2.00	<0.2	0.04-0.06	4.5-5.5	Low----------	0.24		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cm^3	In/hr	In/in	pH				Pct
MdD----------	0-8	10-18	1.10-1.40	0.6-2.0	0.11-0.17	4.5-5.5	Low----------	0.24	3	3-7
Mardin	8-21	10-18	1.20-1.50	0.6-2.0	0.09-0.16	4.5-5.5	Low----------	0.24		
	21-64	10-18	1.70-2.00	<0.2	0.04-0.06	4.5-5.5	Low----------	0.24		
Mm*:										
Medihemists.										
Medisaprists.										
Ph----------	0-7	10-18	1.20-1.40	0.6-2.0	0.14-0.20	4.5-6.0	Low----------	0.37	5	2-4
Philo	7-36	10-18	1.20-1.40	0.2-2.0	0.10-0.20	4.5-6.0	Low----------	0.28		
	36-60	5-18	1.20-1.40	2.0-6.0	0.06-0.10	4.5-6.0	Low----------	0.24		
Pn*.										
Pits										
Po----------	0-7	5-15	1.20-1.40	0.6-2.0	0.14-0.23	3.6-5.5	Low----------	0.28	5	1-4
Pope	7-49	5-18	1.30-1.60	0.6-6.0	0.10-0.18	3.6-5.5	Low----------	0.28		
	49-60	5-20	1.30-1.60	0.6-6.0	0.10-0.18	3.6-5.5	Low----------	0.28		
ReA----------	0-24	10-20	1.20-1.40	0.6-2.0	0.14-0.18	4.5-6.0	Low----------	0.24	3	1-3
Rexford	24-36	10-18	1.20-1.50	0.06-0.2	0.04-0.08	5.1-6.5	Low----------	0.28		
	36-60	10-18	1.30-1.60	0.2-2.0	0.04-0.08	5.1-6.5	Low----------	0.28		
Sc----------	0-11	2-15	1.20-1.50	0.6-2.0	0.18-0.21	4.5-6.0	Low----------	0.49	3	2-8
Scio	11-44	2-15	1.20-1.50	0.6-2.0	0.17-0.20	4.5-6.0	Low----------	0.64		
	44-60	0-5	1.45-1.65	2.0-20.0	0.02-0.19	5.1-7.8	Low----------	0.17		
ShC----------	0-5	10-17	1.20-1.50	0.6-2.0	0.14-0.18	3.6-5.5	Low----------	0.32	3-2	1-3
Shelmadine	5-26	22-35	1.50-1.70	0.6-2.0	0.10-0.14	3.6-5.5	Low----------	0.28		
	26-42	22-35	1.60-1.80	0.06-0.2	0.08-0.12	3.6-5.5	Low----------	0.28		
	42-60	10-27	1.40-1.60	0.06-0.6	0.10-0.14	3.6-5.5	Low----------	0.28		
SvC----------	0-5	10-17	1.20-1.50	0.6-2.0	0.12-0.18	3.6-5.5	Low----------	0.17	3-2	1-3
Shelmadine	5-26	22-35	1.50-1.70	0.6-2.0	0.10-0.14	3.6-5.5	Low----------	0.28		
	26-42	22-35	1.60-1.80	0.06-0.2	0.08-0.12	3.6-5.5	Low----------	0.28		
	42-60	10-27	1.40-1.60	0.06-0.6	0.10-0.14	3.6-5.5	Low----------	0.28		
Ud*.										
Udorthents										
UnA----------	0-10	5-18	1.20-1.50	0.6-2.0	0.18-0.21	4.5-6.0	Low----------	0.49	3	2-7
Unadilla	10-42	1-18	1.20-1.50	0.6-2.0	0.17-0.20	4.5-6.0	Low----------	0.64		
	42-60	1-10	1.45-1.65	2.0-20.0	0.01-0.07	5.1-7.8	Low----------	0.17		
VeA, VeB, VeC----	0-11	13-23	1.30-1.50	0.6-2.0	0.18-0.22	3.6-6.0	Low----------	0.37	4	2-4
Venango	11-19	18-30	1.45-1.70	0.6-2.0	0.15-0.18	3.6-6.0	Low----------	0.37		
	19-46	18-27	1.60-1.88	0.06-0.2	0.06-0.09	4.5-7.3	Low----------	0.37		
	46-62	12-27	1.55-1.88	0.06-0.6	0.08-0.12	6.6-8.4	Low----------	0.37		
VsC----------	0-11	13-23	1.30-1.50	0.6-2.0	0.17-0.20	4.5-5.5	Low----------	0.28	4	---
Venango	11-19	18-30	1.45-1.70	0.6-2.0	0.16-0.18	4.5-5.5	Low----------	0.37		
	19-46	18-27	1.60-1.88	0.06-0.2	0.06-0.09	4.5-7.3	Low----------	0.37		
	46-62	12-27	1.55-1.88	0.06-0.6	0.08-0.12	6.6-8.4	Low----------	0.37		
Wa----------	0-7	15-35	1.05-1.40	0.2-2.0	0.17-0.22	5.1-7.8	Low----------	0.43	5	4-8
Wayland	7-36	18-35	1.10-1.60	0.06-0.2	0.16-0.20	5.1-8.4	Low----------	0.43		
	36-64	15-30	1.25-1.55	0.06-0.2	0.08-0.19	5.6-8.4	Low----------	0.43		
WhB, WhC, WhD----	0-7	15-25	1.10-1.30	0.6-2.0	0.16-0.20	4.5-5.5	Low----------	0.32	3	1-4
Wharton	7-47	15-35	1.20-1.50	0.06-0.2	0.12-0.16	4.5-5.5	Moderate-----	0.24		
	47-60	20-45	1.20-1.60	0.06-0.2	0.08-0.12	3.6-5.5	Moderate-----	0.17		
WoB, WoC, WoD----	0-10	11-19	1.30-1.50	0.6-2.0	0.15-0.20	4.5-6.0	Low----------	0.28	4	1-3
Wooster	10-27	18-30	1.35-1.65	0.6-2.0	0.14-0.18	4.5-6.0	Low----------	0.37		
	27-42	18-30	1.55-1.75	0.2-0.6	0.08-0.12	4.5-6.0	Low----------	0.37		
	42-60	12-22	1.40-1.65	0.2-2.0	0.08-0.14	4.5-7.3	Low----------	0.37		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched," are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated.]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
AaA, AaB, AaC, AbC---- Alvira	C	None	---	---	0.5-1.5	Perched	Oct-May	>48	Soft	High	High	High.
AgB, AhB---- Armagh	D	None	---	---	0-0.5	Apparent	Oct-Jun	48-72	Soft	High	High	High.
At---- Atkins	D	Common	Very brief	Sep-Jul	0	Apparent	Nov-Jun	>60	---	High	High	Moderate.
BcB---- Braceville	C	None	---	---	1.5-3.0	Perched	Nov-Mar	>60	---	Moderate	Moderate	Moderate.
BkB, BnB---- Brinkerton	D	None	---	---	0-0.5	Perched	Oct-May	>60	---	High	High	High.
Ca---- Canadice	D	None	---	---	0-0.5	Apparent	Dec-May	>60	---	Moderate	High	Low.
CdB, CdC, CdD, CeC---- Cavode	C	None	---	---	0.5-1.5	Perched	Oct-May	40-72	Soft	High	High	High.
ChA, ChB, ChC, ChD---- Chenango	A	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Moderate.
CpB---- Chippewa	D	None	---	---	0-0.5	Apparent	Sep-May	>60	---	High	High	Moderate.
CtA, CtB, CtC, CvC---- Cookport	C	None	---	---	1.5-3.0	Perched	Dec-Apr	40-72	Hard	Moderate	Moderate	Moderate.
EsB, EsC, EvD---- Ernest	C	None	---	---	1.5-3.0	Perched	Dec-Apr	>60	---	Moderate	Moderate	Moderate.
GnB, GnC, GnD, GpF*, GsC---- Gilpin	C	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Low	High.
HnB, HnC, HnD, HoF*, HsD---- Hanover	C	None	---	---	1.5-3.0	Perched	Nov-Apr	>60	---	Moderate	Moderate	Moderate.
HtA, HtB, HtC, HtD, HvB, HvD, HvF---- Hazleton	B	None	---	---	>6.0	---	---	>40	Hard	Moderate	Low	High.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
LdB, LdC, LdD, LtF*---------- Lordstown	C	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Low------	High.
MaA, MaB, MaC, MaD, MdD---------- Mardin	C	None--------	---	---	1.5-3.0	Perched	Nov-Apr	>60	---	Moderate	Moderate	Low.
Mm*: Medihemists.												
Medisaprists.												
Ph---------- Philo	B	Occasional	Very brief	Dec-May	1.5-3.0	Apparent	Dec-Apr	>40	Hard	Moderate	Low------	High.
Pn*. Pits												
Po---------- Pope	B	Occasional	Very brief to brief.	Nov-Apr	>6.0	---	---	>60	---	Moderate	Low------	High.
ReA---------- Rexford	C	None--------	---	---	0-1.5	Perched	Oct-May	>60	---	High-----	High-----	High.
Sc---------- Scio	B	None--------	---	---	1.5-3.0	Apparent	Dec-Apr	>60	---	High-----	Moderate	Moderate.
ShC, SvC---------- Shelmadine	D	None--------	---	---	0-0.5	Perched	Sep-Jun	>60	---	High-----	High-----	High.
Ud*. Udorthents												
UnA---------- Unadilla	B	Rare--------	Very brief	Nov-Apr	>6.0	---	---	>60	---	High-----	Low------	Moderate.
VeA, VeB, VeC, VsC---------- Venango	C	None--------	---	---	0.5-1.5	Perched	Dec-Apr	>60	---	High-----	High-----	High.
Wa---------- Wayland	D	Frequent----	Brief to long.	Nov-Jun	0	Apparent	Nov-Jun	>60	---	High-----	High-----	Low.
WhB, WhC, WhD----- Wharton	C	None--------	---	---	1.5-3.0	Perched	Nov-Mar	>40	Soft	High-----	High-----	High.
WoB, WoC, WoD----- Wooster	C	None--------	---	---	>4.0	Perched	Dec-Apr	>60	---	Moderate	Low------	High.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Alvira	Fine-loamy, mixed, mesic Aeric Fragiaquults
Armagh	Clayey, mixed, mesic Typic Ochraquults
Atkins	Fine-loamy, mixed, acid, mesic Typic Fluvaquents
Braceville	Coarse-loamy, mixed, mesic Typic Fragiochrepts
Brinkerton	Fine-silty, mixed, mesic Typic Fragiaqualfs
Canadice	Fine, illitic, mesic Typic Ochraqualfs
Cavode	Clayey, mixed, mesic Aeric Ochraquults
Chenango	Loamy-skeletal, mixed, mesic Typic Dystrochrepts
Chippewa	Fine-loamy, mixed, mesic Typic Fragiaquepts
Cookport	Fine-loamy, mixed, mesic Aquic Fragiudults
Ernest	Fine-loamy, mixed, mesic Aquic Fragiudults
Gilpin	Fine-loamy, mixed, mesic Typic Hapludults
Hanover	Fine-loamy, mixed, mesic Typic Fragiudults
Hazleton	Loamy-skeletal, mixed, mesic Typic Dystrochrepts
Lordstown	Coarse-loamy, mixed, mesic Typic Dystrochrepts
Mardin	Coarse-loamy, mixed, mesic Typic Fragiochrepts
Medihemists	Medihemists
Medisaprists	Medisaprists
Philo	Coarse-loamy, mixed, mesic Fluvaquentic Dystrochrepts
Pope	Coarse-loamy, mixed, mesic Fluventic Dystrochrepts
Rexford	Coarse-loamy, mixed, mesic Aeric Fragiaquepts
Scio	Coarse-silty, mixed, mesic Aquic Dystrochrepts
Shelmadine	Fine-loamy, mixed, mesic Typic Fragiaquults
Udorthents	Udorthents
Unadilla	Coarse-silty, mixed, mesic Typic Dystrochrepts
Venango	Fine-loamy, mixed, mesic Aeric Fragiaqualfs
Wayland	Fine-silty, mixed, nonacid, mesic Mollic Fluvaquents
Wharton	Fine-loamy, mixed, mesic Aquic Hapludults
*Wooster	Fine-loamy, mixed, mesic Typic Fragiudalfs

* The soil is a taxadjunct to the series. See text for description of those characteristics of the soil that are outside the range of the series.

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