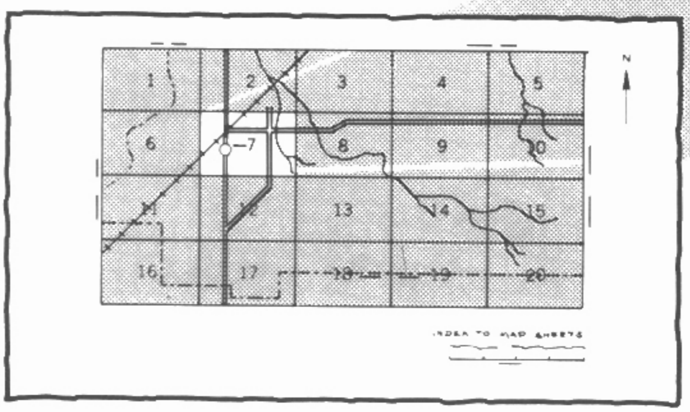
Soil survey of

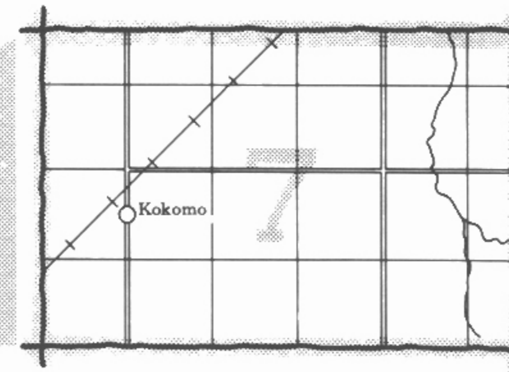
Geauga County, Ohio

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

HOW TO US

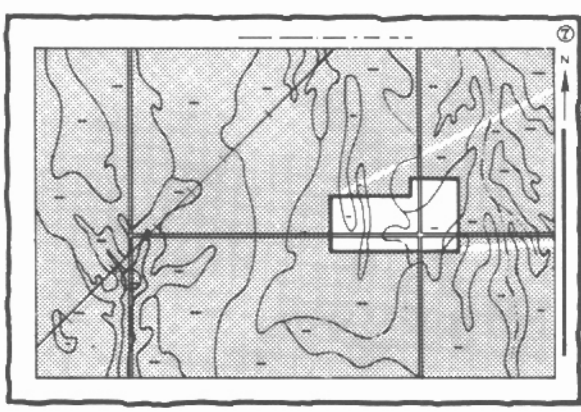
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

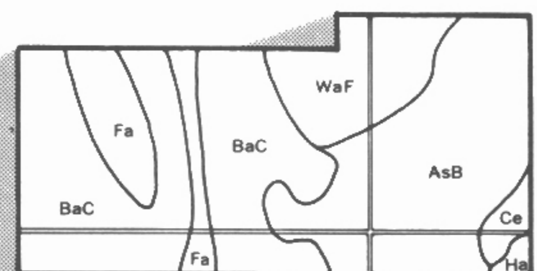




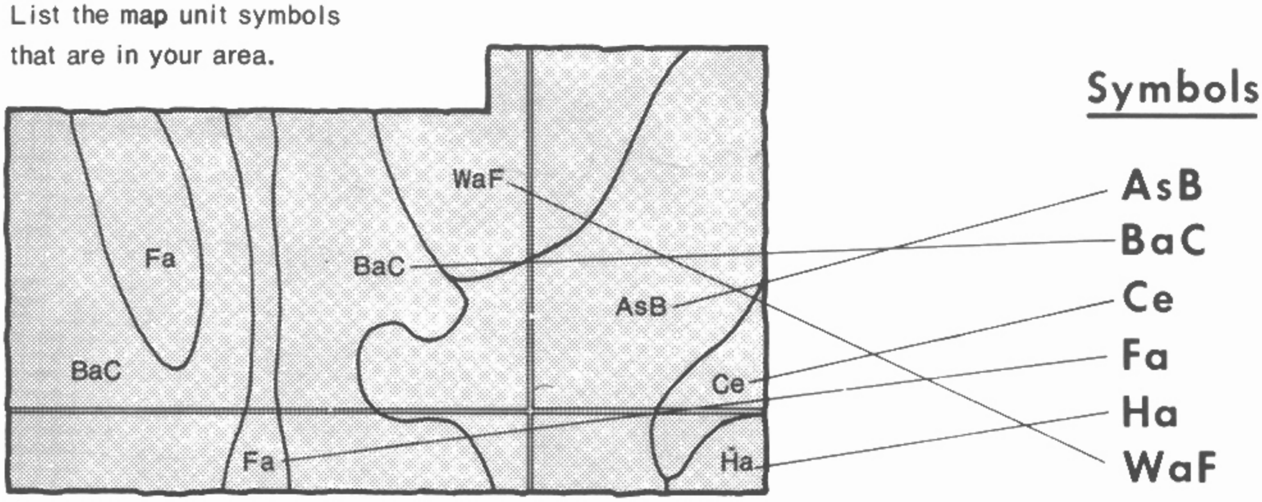
2. Note the number of the map sheet and turn to that sheet.

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



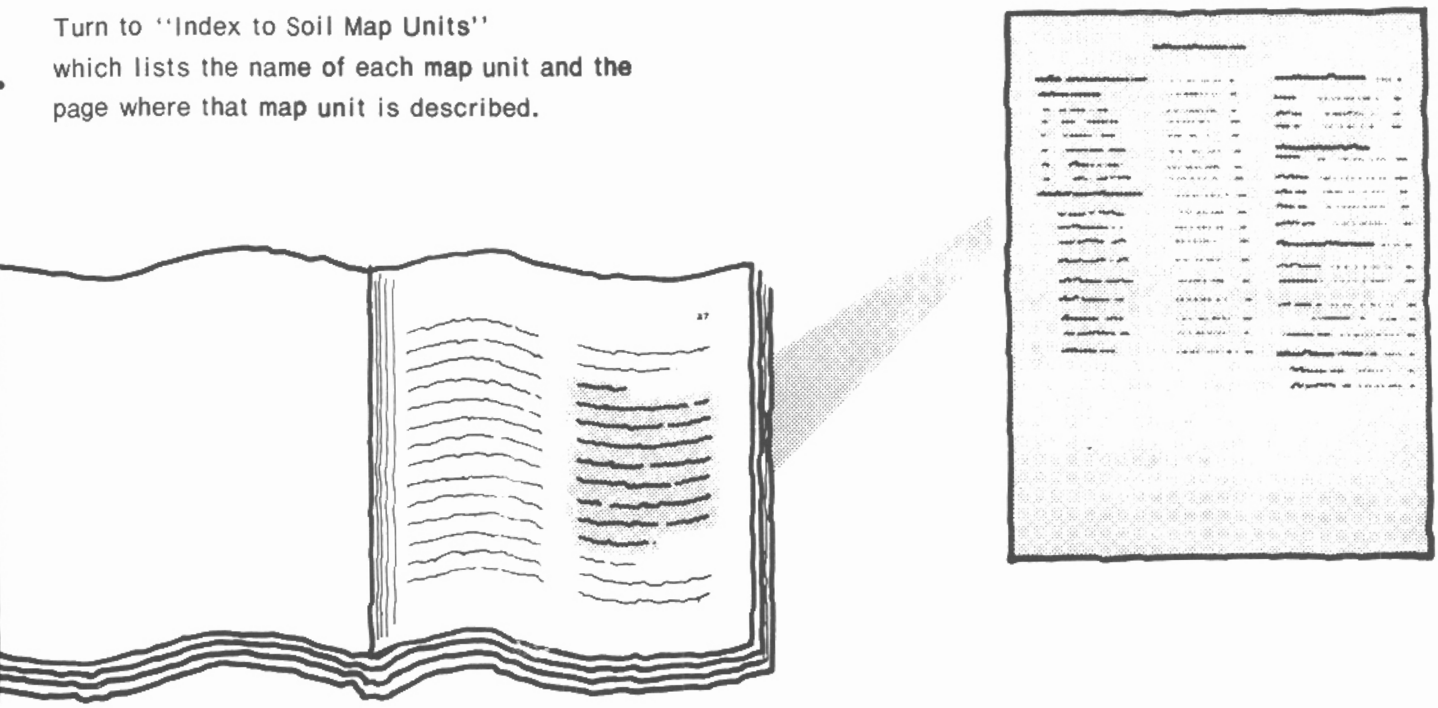


4. List the map unit symbols that are in your area.

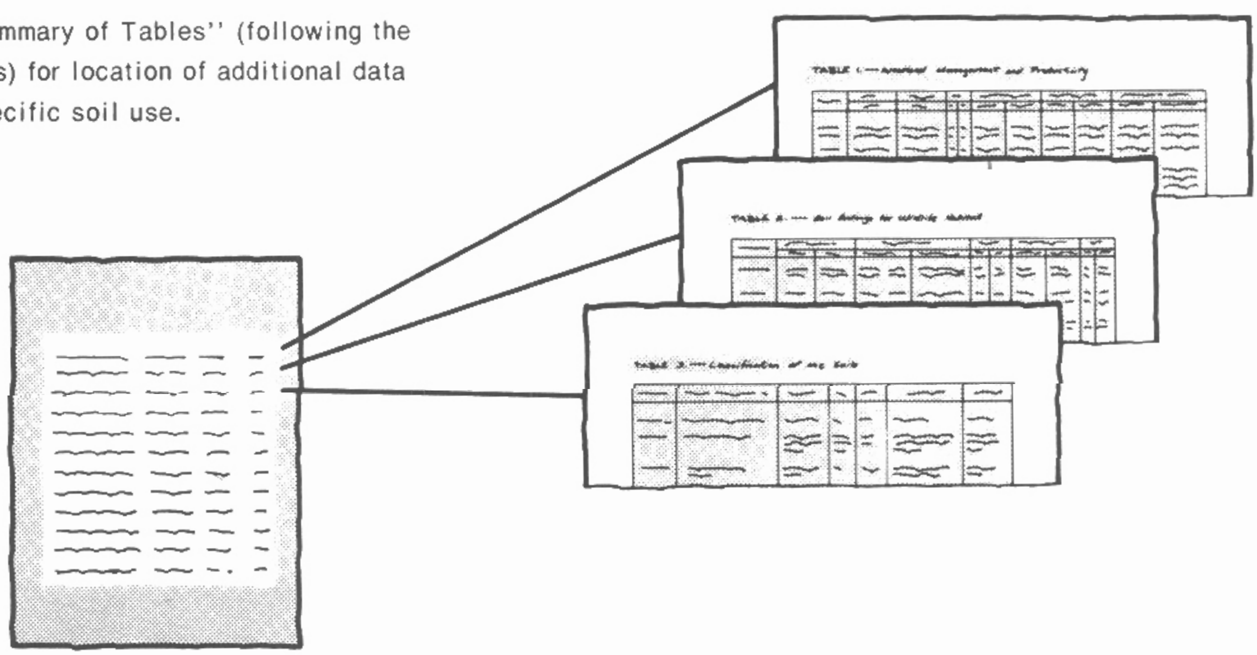


IS SOIL SURVEY

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



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



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.

This survey was made cooperatively by the Soil Conservation Service; Ohio Department of Natural Resources, Division of Lands and Soil; and the Ohio Agricultural Research and Development Center. It is part of the technical assistance furnished to the Geauga Soil and Water Conservation District. Major fieldwork was performed in the period 1965-1979. Soil names and descriptions were approved in 1979. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1979.

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

This soil survey supersedes a soil survey of Geauga County published in 1916.

Cover: Maple sugar house in an area of Mahoning soils.

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soil series

Issued April 1982

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foreword

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

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

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

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

Robert R. Shaw
State Conservationist
Soil Conservation Service

Location of Geauga County in Ohio.

soil survey of
Geauga County, Ohio

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general nature of the county

John A. Tkatschenko, district conservationist, Soil Conservation Service, helped prepare this section.

Geauga County is located in northeastern Ohio. It has an area of about 407 square miles, or 260,480 acres. Chardon, the county seat, is located in the north-central part of the county. In 1970, the population of the county was 62,977.

Most of Geauga County was once used for agriculture and forestry. The county now forms part of the expanding metropolitan area of northeastern Ohio. Housing developments, highways, and other nonfarm uses compete with agriculture for use of the land, especially in the eastern part of the county where dairy and general farming are the major agricultural uses. Much of the remaining farmland in the southeastern quarter of the county is managed by the Amish community.

Erosion, wetness, and slow or very slow permeability that results from high clay content or a compact layer in the subsoil are the major soil-related limitations for agriculture, subdivision development, and road construction. Woodlots currently cover about 38 percent of the county, providing much needed protection in the undulating areas. Most areas of the county need to be artificially drained for suitable crop production and also for nonfarm uses.

climate

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

Geauga County is cold and snowy in winter and warm in summer. Areas nearest Lake Erie are markedly cooler than the rest of the area in summer. Precipitation is well distributed during the year and is adequate for most crops on most soils. From late in fall through winter, snow squalls are frequent. In some years a single prolonged storm can leave more than 2 feet of snow on the ground, and strong winds can create deep drifts.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Chardon, Ohio, in the period 1951 to 1975. 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 27 degrees F, and the average daily minimum temperature is 19 degrees. The lowest temperature on record, which occurred at Chardon on January 24, 1963, is -20 degrees. In summer the average temperature is 69 degrees, and the average daily maximum temperature is 79 degrees. The highest recorded temperature, which occurred on September 2, 1953, is 98 degrees.

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

The total annual precipitation is about 46 inches. Of this, 23 inches, or 50 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 20 inches. The heaviest 1-day rainfall during the period of record was 4 inches at Chardon on August 15, 1952. Thunderstorms occur on about 40 days each year, and most occur in summer.

Average seasonal snowfall is 113 inches. The greatest snow depth at any one time during the period of record was 34 inches. On an average of 43 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 30 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 13 miles per hour, in January.

Crop development early in the growing season is slowed by frequent cool winds off of a cold lake. This slowing is important to fruit crops, which usually blossom only after most chance of a spring freeze is past. Fall winds, which blow off of a relatively warm lake, delay the first fall freeze and prolong the growing season for all crops.

agriculture

In recent years the number of farms in the county and the acreage in farms has decreased, but farm income has markedly increased since the early 1950's. In 1954 there were 1,682 farms, the average size was 93.5 acres, and cash receipts from farm products totaled 1,143,589 dollars (*7*). In 1978, 25 percent of the county's land was in farms, and cash receipts totaled 11,440,000 dollars (*18, 5*). In that year there were 530 farms in Geauga County, and the average size was 121 acres (*18*).

Geauga County's leading agricultural products include dairy products, 54.4 million pounds; oats, 269,800 bushels; hay, 40,400 tons; and corn, 672,700 bushels (*18*).

physiography, relief, and drainage

Geauga County is part of the Appalachian Plateau of Ohio, which includes the glaciated part of northeastern Ohio. The county was covered by several glaciers; however, late Wisconsin drift covered all of the material left by the previous glaciers. The glacial drift ranges from a few feet to less than a hundred feet in thickness. This mantle of glacial drift overlies sandstone and shale bedrock.

In most of the county, the underlying sandstone is of the Pottsville Formation, Sharon-Massillon Members, and of the Berea Formation. The underlying shale that is exposed in many areas of the county, primarily in Thompson Township, is of the Cuyahoga Formation, Orangeville-Sharpsville Members. The Pottsville Formation is of Pennsylvanian age, and the Berea and Cuyahoga Formations are of Mississippian age. The two most important and most extensive sandstone bedrock deposits in the county are the Sharon and Massillon Members of the Pottsville Formation. The Sharon Conglomerate ranges up to 60 feet in thickness on the Thompson ledges in Thompson Township in the northeastern part of the county. It is quarried for a variety of commercial uses and is also an excellent aquifer. The Massillon or Connoquenessing Sandstone ranges from 15 to 100 feet in thickness (*4*). It is a source of building stone, molding sand, and glass sand.

The relief of the county is primarily gently sloping and sloping. The steeper areas are along streams. The lowest elevation is 770 feet along the Chagrin River at the Geauga-Lake County line, and the highest elevation is 1,396 feet at Sugarloaf Mountain in Troy Township in the south-central part of the county. In general, the northern part of the county has the highest elevation. That area is part of a snow belt that extends across northeastern Ohio. High elevation, the lake escarpment, proximity to Lake Erie, and other contributory factors create this snow belt.

The Defiance End Moraine (*8*) enters the county from the west, in Russell Township. It then extends toward the northeast through Chesterland, eastward through Chardon and Hambden, and into Montville; it then proceeds southward through Huntsburg, Middlefield, and Parkman Townships. On the end moraine, relief is more pronounced, and erosion is more of a hazard than on the ground moraines. The end moraine was deposited when the ice remained stagnant during the retreat of the glacier or during a series of recessions and readvances of the glacier. Mahoning and Ellsworth soils are the major soils on the Defiance End Moraine. Terraces of sandy and gravelly glacial outwash and hummocky areas radiate outward from the end moraine across the Chagrin, Cuyahoga, and Grand River Valleys. The terrace areas are dominated by Chili, Oshtemo, and Jimtown soils.

Several bedrock-controlled highs that have thin deposits of glacial material are on the till plains throughout the county. The most prominent bedrock highs are Sugarloaf Mountain in Troy Township at an elevation of 1,396 feet, the area west of Chardon at 1,350 feet, the area in the vicinity of Fowler's Mill in

Munson Township at 1,340 feet, and Burton Village at 1,330 feet. The Loudonville, Lordstown, Mitiwanga, and associated soils are the dominant soils on these bedrock-controlled highs. These soils formed in more than 40 inches of glacial till.

Most of Geauga County is drained by the Chagrin, Cuyahoga, and Grand Rivers and their tributaries. These rivers have their headwaters at the southern base of the Defiance End Moraine and flow southward through the county into adjacent Cuyahoga, Portage, and Trumbull Counties before turning northward and eventually emptying into Lake Erie. A very small area in southeastern Troy Township is drained by Silver Creek, which flows into the Ohio River.

history

Geauga County was part of the Connecticut Western Reserve, which was chartered in 1662. The Western Reserve was a colony of the "mother state" of Connecticut until the major part, 3,000,000 acres, was sold to the Connecticut Land Company in 1795. New Englanders bought land in the area and were soon calling it Geauga. The name "Geauga" was derived from the Indian word "Sheauga," meaning raccoon. The area's first settlement, Burton, was plotted in 1798.

By December 1805, the borders of Geauga County had been determined, but the area was not made a county until March 1, 1806 (*6*).

Because of rolling terrain and the high clay content and dense layer in the subsoil, the soils in Geauga County are better suited to grass than to row crops. Consequently, dairy farming became the county's principal enterprise. Cheese processing followed the establishment of dairy farms. Geauga County is the leading county in Ohio in the production of maple sirup (*19*).

Industrial enterprises did not readily develop in Geauga County because the terrain was difficult to traverse by rail. Light industry, including the manufacture of plastics and rubber, has been established in the Middlefield, Burton, Newbury, and Chardon areas. Mineral resources, for example, sand and gravel, contribute to Geauga County's industrial base.

Over 10,000 acres along the Cuyahoga River is owned by the City of Akron, the county's largest single landowner. This area includes the East Branch and LaDue Reservoirs, which provide part of Akron's water supply.

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, woodland managers, engineers, planners, developers and builders, home buyers, and others.

This soil survey supersedes the soil survey of Geauga County published in 1916 (*13*). This survey provides additional information and contains larger maps that show the soils in greater detail.

general soil map units

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

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

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

The associations in Geauga County have been placed in three major groups. The groups and the associations in each group are described in the pages that follow.

soils on uplands

These soils make up about 78 percent of the county. The poorly drained to well drained soils formed in glacial till and in glacial till and residuum of sandstone bedrock. The landscape ranges from broad flats and undulating areas to dissected areas along drainageways. The soils are used mainly as cropland, pasture, and woodland and for urban uses. Moderately steep to very steep slopes, very slow permeability, seasonal wetness, moderate depth to bedrock, high shrink-swell potential, and a hazard of erosion are the major land use limitations.

1. Mahoning-Ellsworth association

Deep, nearly level to very steep, somewhat poorly drained and moderately well drained soils that formed in moderately fine textured glacial till

These soils are on undulating till plains and moraines. Slopes are dominantly 0 to 18 percent, although the range is 0 to 50 percent.

This association makes up about 33 percent of the county. It is about 50 percent Mahoning soils, 30 percent Ellsworth soils, and 20 percent soils of minor extent.

The Mahoning soils are on flats, low knolls, and side slopes parallel to drainageways. The Ellsworth soils are on knolls, hillsides, and side slopes along drainageways. The Mahoning soils are somewhat poorly drained and are nearly level to sloping. They have a seasonal high water table between depths of 12 to 30 inches. The Ellsworth soils are moderately well drained and are gently sloping to very steep. They have a seasonal high water table between depths of 24 and 36 inches. Both soils have a medium textured surface layer, moderate available water capacity, and slow or very slow permeability.

Some of the minor soils in this association are the well drained Loudonville and Lordstown soils that have bedrock at a depth of 20 to 40 inches. They are on side slopes along streams. Other minor soils are the poorly drained Holly soils and the somewhat poorly drained Orrville soils on flood plains along small streams and the well drained Chili and Oshtemo soils in sloping to steep hummocky areas. Also included are the somewhat poorly drained Haskins soils on flats and in slightly convex areas and the moderately well drained Rawson soils on knolls.

The soils in this association are used mainly as cropland, pasture, and woodland. In some areas they are used as sites for buildings and parks. The gently sloping and sloping Ellsworth soils are better suited to most uses than the nearly level to sloping Mahoning soils. The moderately steep to very steep Ellsworth soils are poorly suited or not suited to row crops, building site development, and sanitary facilities. They are moderately well suited to use as woodland and well suited to use as habitat for woodland wildlife.

The slow or very slow permeability, erosion hazard, and seasonal wetness of both soils and the moderately steep to very steep slopes of some of the Ellsworth soils are the main land use limitations. Ditches and subsurface drains are commonly used to improve drainage on the Mahoning soils. If the Ellsworth soils are cultivated, erosion is a hazard. The Ellsworth soils are better suited than the Mahoning soils as sites for buildings. Building sites should be landscaped to provide surface drainage away from the foundation. Local roads can be improved by using artificial drainage and suitable base material. The nearly level and gently sloping soils are suited to pond reservoirs and sewage lagoons.

2. Wadsworth-Rittman association

Deep, nearly level to very steep, somewhat poorly drained and moderately well drained soils that formed in medium textured glacial till

These soils are on undulating uplands and dissected areas along drainageways. Slopes are dominantly 0 to 12 percent, although the range is 0 to 50 percent.

This association makes up about 21 percent of the county. It is about 50 percent Wadsworth soils, 40 percent Rittman soils, and 10 percent soils of minor extent.

The Wadsworth soils are on flats and low knolls. The Rittman soils are on knolls, hillsides, ridges, and side slopes along drainageways. The Wadsworth soils are somewhat poorly drained and are nearly level and gently sloping. They are medium textured and have a fragipan. Permeability is moderate or moderately slow above the fragipan and slow or very slow in the fragipan. A seasonal high water table is perched between depths of 12 and 24 inches. The Rittman soils are moderately well drained and are gently sloping to very steep. They are medium textured and have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. A seasonal high water table is perched between depths of 24 and 36 inches. Both soils have a low available water capacity.

Some of the minor soils in this association are the somewhat poorly drained Haskins soils on flats and in slightly convex areas, the moderately well drained Rawson soils on knolls, and the poorly drained Holly and somewhat poorly drained Orrville soils on flood plains along small streams. Also included are the well drained Chili and Oshtemo soils on sloping to steep hummocky areas and the well drained Loudonville soils on slope breaks and dissected areas along streams. Loudonville soils are 20 to 40 inches deep to bedrock.

The soils in this association are used mainly as cropland, pasture, and woodland. In some areas they are used as sites for buildings. The Rittman soils have higher potential for most uses than the Wadsworth soils. Both soils are suited to use as woodland. The nearly level to sloping soils are moderately well suited to use as cropland and pasture. The gently sloping and sloping Rittman soils are moderately well suited to building site development, and the Wadsworth soils are moderately well suited to poorly suited to this use. The moderately steep to very steep Rittman soils are poorly suited or are not suited to use for row crops, building site development, and sanitary facilities.

Seasonal wetness, the slow or very slow permeability of the fragipan, and the erosion hazard are the major land use limitations on both soils. The moderately steep to very steep slopes of some of the Rittman soils are also a limitation. The nearly level to sloping soils are suited to cultivated crops, hay, and pasture. Ditches and subsurface drains are used to improve drainage in the Wadsworth soils. Subsurface drains must be closely spaced for uniform drainage. If the Rittman soils are cultivated, erosion is a hazard. The soils in this association are better suited to houses without basements than to houses with basements. Building sites should be landscaped to provide surface drainage away from the foundation. Placing drains at the base of footings and coating the exterior walls of basements help prevent wet basements. Local roads can be improved by providing artificial drainage and a suitable base material to reduce damage from frost action.

3. Canfield-Ravenna association

Nearly level to sloping, moderately well drained and somewhat poorly drained soils that formed in medium and moderately coarse textured glacial till

These soils are on till plains that have low to moderate relief. The landscape consists of broad, gently sloping uplands and occasional steep-sided valleys. Slopes tend to be long and uniform and are dominantly 0 to 12 percent.

This association makes up about 8 percent of the county. It is about 65 percent Canfield soils, 20 percent Ravenna soils, and 15 percent soils of minor extent.

The Canfield soils are on knolls, ridges, and side slopes along drainageways, and the Ravenna soils are on flats and low knolls. The Canfield soils are moderately well drained and are gently sloping and sloping. They have a seasonal high water table between depths of 18 and 36 inches. The Ravenna soils are somewhat poorly drained and are nearly level and gently sloping. They have a seasonal high water table between depths of 6 and 24 inches. Both soils have a medium textured surface layer, low available water capacity, and a slowly permeable fragipan.

Some of the minor soils in this association are the well drained Wooster soils on convex hillsides and side slopes parallel to drainageways. Other minor soils are the well drained Loudonville soils that have bedrock at a depth of 20 to 40 inches and are on side slopes and ridgetops. Also included are well drained Chili and Oshtemo soils in hummocky areas, poorly drained Sebring soils in broad flat depressions, and poorly drained Holly soils on flood plains along small streams.

The soils in this association are used mainly as cropland. However, in some areas they are used as pasture, woodland, or building sites. The Canfield soils have higher potential for most uses than Ravenna soils. The Canfield soils are moderately well suited to building site development and poorly suited to sanitary facilities, and the Ravenna soils are moderately well suited to poorly suited to these uses. Both soils are suited or moderately well suited to use as cropland and well suited to use as woodland and pasture.

Seasonal wetness and the slowly permeable fragipan are the main land use limitations. The soils are suited to corn, hay, and pasture provided the Ravenna soils are artificially drained. Ditches and subsurface drains are effective in improving drainage. Because of the slowly permeable fragipan, subsurface drains should be closely spaced for uniform drainage. The soils are subject to surface crusting and compaction if tillage or harvesting is done when the soils are soft and sticky. Tillage and harvesting should be done at optimum moisture content.

The Canfield soils are better suited than the Ravenna soils to use as sites for buildings and most sanitary facilities and to recreation uses. Building sites, especially on the Ravenna soils, should be landscaped to provide surface drainage away from the foundation. Placing drains at the base of footings and coating the outside basement walls help prevent wet basements.

4. Platea-Sheffield association

Nearly level and gently sloping, somewhat poorly drained and poorly drained soils that formed in medium and moderately fine textured glacial till

These soils are on till plains and in narrow, sloping areas along drainageways. Slope ranges from 0 to 6 percent.

This association makes up about 5 percent of the county. It is about 65 percent Platea soils, 20 percent Sheffield soils, and 15 percent soils of minor extent.

The Platea soils are on broad flats, low knolls, and side slopes. The Sheffield soils are in low lying or depressional areas. The Platea soils are somewhat poorly drained and are nearly level and gently sloping. They have a fragipan. Permeability is moderately slow above the fragipan and very slow in the fragipan. A seasonal high water table is perched between depths of 6 and 24 inches. The Sheffield soils are poorly drained and are nearly level. They have a slowly permeable fragipan. A seasonal water table is perched near or above the surface. In both soils the root zone is mainly restricted to the zone above the fragipan. The available water capacity of this zone is low.

Some of the minor soils in this association are poorly drained Holly soils and somewhat poorly drained Orrville soils on flood plains. Other minor soils are somewhat poorly drained Haskins soils and moderately well drained Rawson soils in slightly convex areas. Also included are moderately well drained Ellsworth soils that do not have a fragipan and are on side slopes along drainageways.

The soils in this association are mainly in natural shrubs, trees, and pasture, although in some areas they are used for cultivated crops. The Platea soils have higher potential for most uses than the Sheffield soils. Both soils are moderately well suited to use as cropland and are well suited to pasture and hay. The Platea soils are moderately well suited to poorly suited to building site development and sanitary facilities, and the Sheffield soils are poorly suited to these uses.

The very slowly permeable fragipan, seasonal wetness, and ponding are the main land use limitations. Wetness commonly delays planting and harvesting. In drained areas the soils are suited to row crops, hay, and pasture. Surface and subsurface drains are commonly used to improve drainage. Subsurface drains must be closely spaced for uniform drainage because water moves slowly into subsurface drains. The soils are subject to surface crusting, compaction, and hard clodding if tillage or harvesting is done when the soils are wet. The Platea soils are better suited than the Sheffield soils to use as a site for buildings or sanitary facilities and for recreation uses. The Sheffield soils remain wet longer and are therefore poorly suited to these uses. Building sites should be landscaped to provide surface drainage away from the foundation. Placing drains at the base of footings and coating exterior basement walls help prevent a wet basement.

5. Darien-Mahoning association

Deep, nearly level to sloping, somewhat poorly drained soils that formed in medium and moderately fine textured glacial till

These soils are on broad flats and in undulating areas on uplands (fig. 1). Narrow, low gradient streams transect the area. Slope ranges from 0 to 12 percent.

This association makes up about 5 percent of the county. It is about 45 percent Darien soils, 35 percent Mahoning soils, and 20 percent soils of minor extent.

Darien and Mahoning soils are somewhat poorly drained and are soft and sticky when wet. Bedrock commonly is at a depth of 40 to 60 inches. These soils have a medium textured surface layer and a moderate available water capacity. The Darien soils are slowly permeable and have a seasonal high water table between depths of 6 and 18 inches. The Mahoning soils are slowly or very slowly permeable and have a seasonal high water table between depths of 12 and 30 inches.

Some of the minor soils in this association are well drained Loudonville and Lordstown soils on side slopes along waterways and Mitiwanga soils in flat to gently undulating areas. These soils have bedrock at a depth of 20 to 40 inches. Other minor soils are the poorly drained Holly and the somewhat poorly drained Orrville soils on flood plains along small streams.

The soils in this association are used mainly as cropland, woodland, and pasture. The soils are moderately well suited to use as cropland and pasture and moderately well to well suited to use as woodland. They are moderately well suited or poorly suited to building site development and poorly suited to sanitary facilities.

The slow or very slow permeability, seasonal wetness, and bedrock commonly at a depth of 40 to 60 inches are the main land use limitations. In undrained areas planting is delayed, and the choice of crops is limited. Erosion is a hazard on the sloping soils if they are used for cultivated crops. Ditches and subsurface drains are commonly used to improve drainage. Drainage by subsurface drains is slow. Subsurface drains must be closely spaced for uniform drainage. These soils are better suited to houses without basements than to houses with basements. Building sites should be landscaped to provide surface drainage away from the foundation. Footer drains and coated exterior basement walls help prevent wet basements. Sanitary facilities should be connected to central sewer and treatment facilities, if possible.

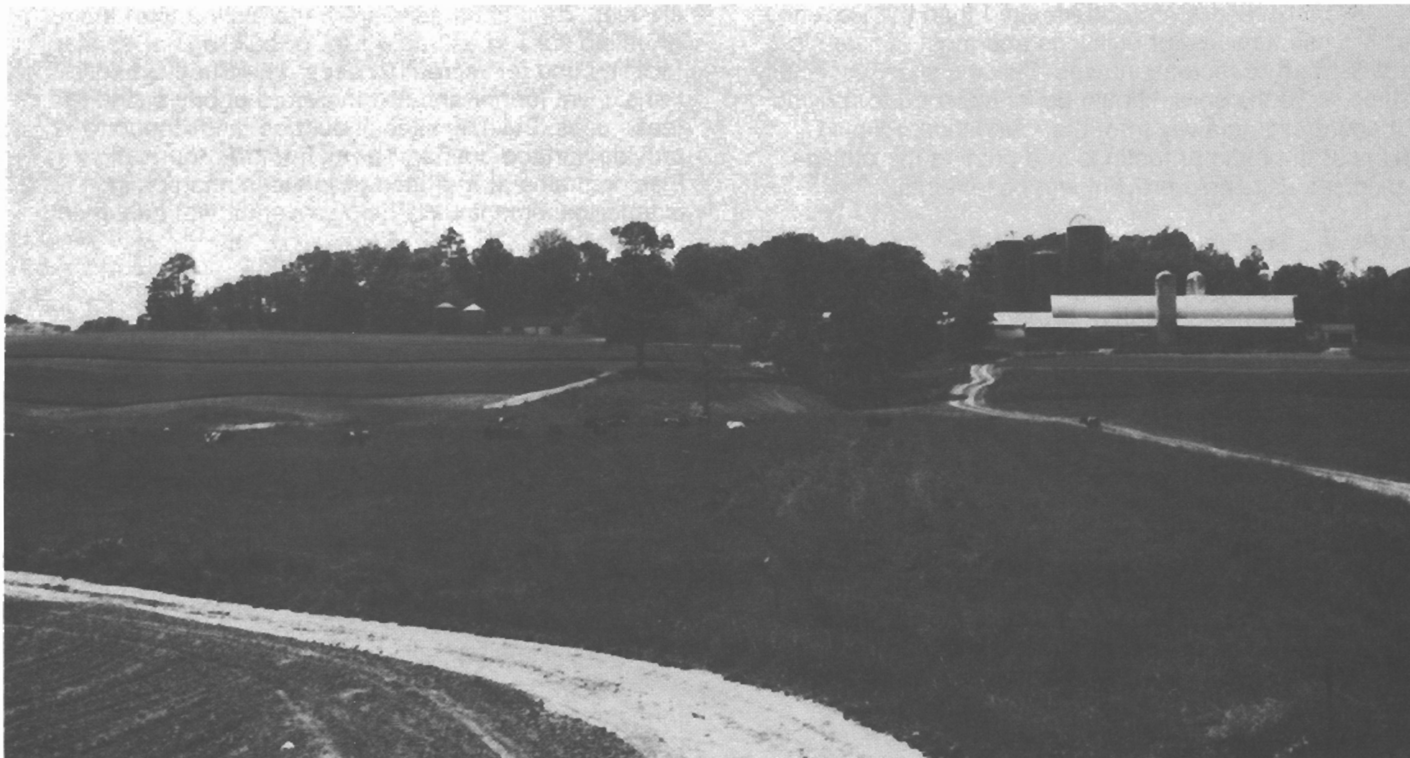

Figure 1.—The soils in the Darien-Mahoning association are moderately well suited to use as pasture. Darien soils are in the foreground, and Mahoning soils are on the low ridge in the background.

6. Loudonville-Lordstown-Mitiwanga association

Moderately deep, nearly level to very steep, well drained and somewhat poorly drained soils that formed in moderately fine to moderately coarse textured glacial till and in residuum of sandstone bedrock

These soils are in areas where the landscape is controlled by the underlying sandstone bedrock. Most areas are undulating. The areas along drainageways are dissected. Slope ranges from 0 to 70 percent.

The association makes up about 5 percent of the county. It is about 40 percent Loudonville soils, 15 percent Lordstown soils, 10 percent Mitiwanga soils, and 35 percent soils of minor extent.

The Mitiwanga soils are on the broader ridgetops. The Lordstown and Loudonville soils are on side slopes and hillsides. All of these soils have sandstone bedrock at a depth of 20 to 40 inches and a low available water capacity. The Loudonville soils are well drained, gently sloping and sloping, and moderately permeable. The Lordstown soils are well drained, gently sloping to very steep, and moderately permeable. The Mitiwanga soils are somewhat poorly drained, nearly level, and moderately permeable. They have a seasonal high water table between depths of 12 and 30 inches.

Some of the minor soils in the association are the somewhat poorly drained Mahoning and Wadsworth soils on broad flats and slight rises and the moderately well drained Canfield, Ellsworth, and Rittman soils on knolls and ridges. Other minor soils are the poorly drained Holly soils and the somewhat poorly drained Orrville soils on flood plains along small streams.

The soils in this association are used mostly as woodland. In a few areas they are used as cropland. Mitiwanga soils and the gently sloping and sloping Loudonville and Lordstown soils are moderately well suited to crops and well suited to hay. These soils are moderately well suited to well suited to woodland use, moderately well suited to poorly suited to building site development, and poorly suited to sanitary facilities. In some areas the moderately steep to very steep Lordstown soils are suited to recreation uses, for example, scenic overlooks and waterfalls.

The moderately steep to very steep slopes of the Lordstown soils, seasonal wetness of the Mitiwanga soils, and bedrock at a depth of 20 to 40 inches in the major soils are the main land use limitations. The gently sloping and sloping Loudonville and Lordstown soils are well suited to grazing early in spring; the Mitiwanga soils are poorly suited to this use. The wetness of the Mitiwanga soils delays planting and limits the choice of crops. The hard sandstone bedrock in the substratum commonly hinders the installation of subsurface drains, and outlets are not available in many areas. The major soils are suited to use as woodland and as habitat for woodland wildlife. Because the bedrock interferes with excavations for basements and utility lines, these soils are better suited to houses without basements than to houses with basements. The seasonal wetness in the Mitiwanga soils is also a limitation. Cover should be maintained on building sites as much as possible during construction to reduce soil loss by erosion. Trails in recreation areas should be protected against erosion and established across the slope if possible.

7. Geeburg association

Deep, gently sloping and sloping, moderately well drained soils that formed in fine textured glacial till

These soils are on undulating uplands and in dissected areas along drainageways. Slope ranges from 2 to 12 percent.

This association makes up less than 1 percent of the county. It is about 60 percent Geeburg soils and 40 percent soils of minor extent.

The Geeburg soils are moderately well drained and are gently sloping and sloping. They are on knolls, ridgetops, shoulder slopes, and on side slopes along well defined waterways. Permeability is very slow, and the available water capacity is moderate. A seasonal high water table is between depths of 24 and 42 inches.

Some of the minor soils in this association are poorly drained Holly soils, somewhat poorly drained Orrville soils, and well drained Tioga soils on flood plains along small streams. Other minor soils are somewhat poorly drained Haskins soils on flats and in slightly convex areas and moderately well drained Rawson soils on knolls.

The soils in this association are used mainly as cropland. In a few areas they are used as pasture or woodland. These soils are suited to crops, hay, and pasture and to use as woodland. They are moderately well suited to building site development and poorly suited to septic tank absorption fields.

The very slow permeability, seasonal wetness, and high shrink-swell potential are the main land use limitations. Random subsurface drains are needed in the lower lying areas. Erosion in areas being developed for urban uses as well as on farmland is a serious hazard, especially where the slopes are long. Hard clods and a crusty surface form if the soils are cultivated when soft and sticky. The soils are better suited to houses without basements than to houses with basements. Foundations and footings should be designed to prevent structural damage from the shrinking and swelling of the soil. Drains at the base of footings and coated exterior walls help prevent wet basements. Local roads can be improved by artificial drainage and a suitable base material. The soils are suited to pond reservoirs and sewage lagoons.

soils on stream terraces, outwash plains, kames, and uplands

These soils make up about 10 percent of the county. They are well drained to poorly drained and formed in glacial outwash and in glacial outwash over glacial till or lacustrine material. They are on broad flats, in undulating areas, and on the sides of deeply entrenched valleys and ravines. These soils are mainly used as cropland or woodland. Moderately steep to very steep slopes, seasonal wetness, ponding, slow or very slow permeability, and droughtiness are land use limitations.

8. Chili-Oshtemo association

Nearly level to very steep, well drained soils that formed in medium, moderately coarse, and coarse textured glacial outwash

These soils are in undulating, hummocky, and dissected areas on outwash plains, stream terraces, and kames. Slope ranges from 0 to 50 percent.

This association makes up a little more than 6 percent of the county. It is about 65 percent Chili soils, 15 percent Oshtemo soils, and 20 percent soils of minor extent.

The Chili and the Oshtemo soils are on outwash plains, stream terraces, and kames. The Chili soils are well drained, medium textured, and nearly level to very steep. Permeability is moderately rapid. The available water capacity is medium or low. The Oshtemo soils are gently sloping to very steep and are moderately coarse textured. Permeability is moderately rapid in the subsoil and very rapid in the substratum. The available water capacity is low to moderate.

Some of the minor soils in this association are moderately well drained Bogart soils, somewhat poorly drained Jimtown soils, and poorly drained Damascus and Sebring soils on flats and slight rises on terraces and outwash plains. Other minor soils are the poorly drained Holly soils and the somewhat poorly drained Orrville soils on flood plains along small streams.

The soils in this association are used mainly as cropland and for hay. The rolling, hilly, and very steep soils are used as woodland and pasture. The nearly level and gently sloping soils are well suited to use as cropland, pasture, and woodland and to building site development. The very steep soils are poorly suited to uses other than woodland, habitat for woodland wildlife, and some special recreation uses. If the soils are used as cropland, droughtiness is the main limitation on the nearly level and gently sloping soils. These soils are suited to irrigation. Erosion is a serious hazard on the moderately steep to very steep soils if vegetation is removed during construction. Cover should be maintained on the site as much as possible during construction to reduce the hazard of erosion. Seepage from sanitary facilities can pollute underground water supplies.

9. Haskins-Jimtown-Damascus association

Nearly level and gently sloping, somewhat poorly drained and poorly drained soils that formed in medium to coarse textured glacial outwash and in the underlying moderately fine and fine textured glacial till or lacustrine material

These soils are on broad flats on stream terraces and outwash plains. Slope ranges from 0 to 6 percent.

This association makes up about 4 percent of the county. It is about 40 percent Haskins soils, 20 percent Jimtown soils, 10 percent Damascus soils, and 30 percent soils of minor extent.

The Haskins and Jimtown soils are on flats and slight rises, and the Damascus soils are on flats and in depressions. The Haskins soils are nearly level and gently sloping, somewhat poorly drained, and medium textured. Permeability is moderate in the upper and middle parts of the subsoil and slow or very slow in the lower part of the subsoil and in the substratum. The available water capacity is moderate. These soils have a seasonal high water table between depths of 12 and 30 inches. Jimtown soils are nearly level, somewhat poorly drained, and medium textured. Permeability is moderate, and the available water capacity is moderate. These soils have a seasonal high water table at a depth between 12 and 30 inches. The Damascus soils are nearly level, poorly drained, and medium textured. Permeability is moderate in the subsoil and rapid or very rapid in the substratum. The available water capacity is moderate. These soils have a seasonal high water table near or above the surface.

Some of the minor soils in this association are somewhat poorly drained Caneadea soils, poorly drained Sebring and Canadice soils, and moderately well drained Rawson and Bogart soils on terraces and in basins of former glacial lakes. Other minor soils are poorly drained Holly soils and somewhat poorly drained Orrville soils on flood plains along small streams.

In most areas the soils in this association are used as cropland, pasture, and woodland. Haskins and Jimtown soils are suited to use as cropland, pasture, and woodland. Damascus soils are moderately well suited to use as cropland and pasture. They are poorly suited to building site development and sanitary facilities and well suited to woodland use. Haskins and Jimtown soils are moderately well suited to poorly suited to building site development and poorly suited to most sanitary facilities.

Seasonal wetness, ponding, seepage, and slow or very slow permeability are the main land use limitations. Wetness delays planting and limits the choice of crops. Surface and subsurface drains are used to improve drainage. Good drainage outlets are not available in many areas of the Damascus soils. Damascus soils are poorly suited as sites for buildings. Jimtown and Haskins soils are better suited to houses without basements than to houses with basements. Buildings should be located in the higher areas and landscaped to provide surface drainage away from the foundation. Seepage from sanitary facilities can contaminate ground water.

soils on terraces, flood plains, uplands, and in basins of former glacial lakes

These soils make up about 12 percent of the county. They are very poorly drained to well drained and are on broad flats and in long narrow areas that have very little undulation. They formed in lakebed sediments, alluvium, and organic deposits. These soils are mainly used as cropland, woodland, and habitat for wetland wildlife. Frequent flooding, wetness, ponding, low strength, seepage, and moderately slow permeability are the major land use limitations.

10. Sebring-Fitchville association

Nearly level and gently sloping, poorly drained and somewhat poorly drained soils that formed in medium and moderately fine textured lake sediments

These soils are on terraces and in basins of former glacial lakes. Low gradient sluggish streams commonly transect the areas. Slope ranges from 0 to 6 percent.

This association makes up about 5 percent of the county. It is about 30 percent Sebring soils, 20 percent Fitchville soils, and 50 percent soils of minor extent.

The Fitchville soils are on flats and slight rises, and the Sebring soils are in depressions and on flats. The Sebring soils are poorly drained and are moderately slowly permeable. They receive runoff from adjacent higher lying soils and are subject to ponding. They have a seasonal high water table near or above the surface. The Fitchville soils are somewhat poorly drained and are moderately slowly permeable. They have a seasonal high water table between depths of 12 and 30 inches. The available water capacity is high in both soils.

Some of the minor soils in this association are the poorly drained Canadice soils, somewhat poorly drained Caneadea and Haskins soils, and moderately well drained Rawson and Glenford soils on flats and in gently undulating areas. Other minor soils are the poorly drained Holly soils and the somewhat poorly drained Orrville soils on flood plains along small streams.

In most areas the soils in this association are used as cropland. In undrained areas they are used as woodland or are in brush. The Fitchville soils have higher potential for most uses than the Sebring soils. The Fitchville soils are well suited to use as cropland and pasture, and the Sebring soils are moderately well to poorly suited to these uses. Both soils are poorly suited to sanitary facilities. The Sebring soils are poorly suited to building site development, and the Fitchville soils are moderately well to poorly suited to this use.

Seasonal wetness, ponding, low strength, and the moderately slow permeability are the main land use limitations. Wetness delays planting and harvesting of farm crops. Surface drains are commonly used to remove excess surface water. Subsurface drains are used to remove excess water from the subsoil. However, establishing this type of drainage is difficult in the Sebring soils because these soils are in low positions on the landscape. The soils in this association are better suited to houses without basements than to houses with basements. Local roads can be improved by using artificial drainage and a suitable base material.

11. Holly-Orrville-Tioga association

Nearly level, poorly drained, somewhat poorly drained, and well drained soils that formed in moderately fine to moderately coarse textured alluvium

These soils are on flood plains bounded by sloping to very steep soils on slope breaks extending to the uplands. The landscape is characterized by narrow to relatively broad, flat valley floors. The soils are subject to frequent flooding. Slopes are 0 to 2 percent.

This association makes up about 6 percent of the county. It is about 35 percent Holly soils, 25 percent Orrville soils, 10 percent Tioga soils, and 30 percent soils of minor extent.

The Holly soils are in the lowest positions on flood plains, and the Tioga soils are in the highest positions. The Orrville soils are in intermediate positions between the Holly and Tioga soils. The Holly soils are nearly level and are poorly drained. Permeability is moderate or moderately slow. During extended wet periods the water table is near the surface. The Orrville soils are nearly level and are somewhat poorly drained. Permeability is moderate. During extended wet periods the water table is between depths of 12 and 30 inches. The Tioga soils are nearly level and are well drained. Permeability is moderate or moderately rapid.

The minor soils in this association are the very poorly drained Wabasha soils on broad flats and in depressions and the poorly drained Canadice and Sebring soils on terraces and in basins of former glacial lakes.

In most areas the soils in this association are used as woodland. In a few areas they are used as pasture. The soils are suited to use as woodland and as habitat for woodland wildlife. The Holly soils are moderately well suited to use as cropland. The Orrville and Tioga soils are well suited to this use. None of these soils are suited to building site development and sanitary facilities.

The wetness of the Holly and Orrville soils and frequent flooding on all three soils are the major land use limitations. Although the choice of crops is limited, these soils are suited to crops, for example, corn, which should be planted in spring after the normal period of flooding. Some crops, winter wheat, for example, can be severely damaged by flooding or wetness in winter and spring. Perennial plants should be selected on the basis of tolerance to flooding. Special measures are needed in some areas to control streambank erosion and prevent the formation of channels. The soils in this association are better suited to golf fairways and paths and trails than to most other community development uses.

12. Carlisle association

Level, very poorly drained soils that formed in organic deposits

These soils are in low areas in bogs and swales on terraces, uplands, and flood plains. The areas are swampy, and the soils support only water-tolerant reeds, sedges, and brush. The dark color of these soils is a distinguishing characteristic. Slope is 0 to 2 percent.

This association makes up less than 1 percent of the county. It is about 75 percent Carlisle soils and 25 percent soils of minor extent.

The Carlisle soils are very poorly drained and are moderately rapidly permeable. They are ponded much of the year and are subject to frequent flooding. The available water capacity is very high.

Some of the minor soils in this association are poorly drained Holly soils and very poorly drained Wabasha soils on flood plains. Other minor soils are very poorly drained Willette soils, which formed in thinner deposits of organic material over mineral material. Willette soils are in positions similar to those of Carlisle soils. Poorly drained Canadice and Sebring soils are on terraces and in basins of former glacial lakes.

In most areas the soils in this association are in their natural state and are used as habitat for wetland wildlife. These soils have low potential for use as cropland, pasture, woodland, building site development, and sanitary facilities. They have high potential for use as habitat for wetland wildlife.

Ponding, flooding, low strength, and seepage make these soils unsuited to crops, pasture, building site development, sanitary facilities, woodland use, and most recreation uses. Drainage outlets are very difficult to establish. The fluctuating water level limits the survival of most tree species. In most areas these soils provide good habitat for ducks, beaver, muskrats, and other wetland wildlife.

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, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Ellsworth silt loam, 2 to 6 percent slopes, is one of several phases in the Ellsworth series.

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

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Chili-Oshtemo complex, 6 to 18 percent slopes, is an example.

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

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

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

soil descriptions

BgB—Bogart loam, 2 to 6 percent slopes. This is a deep, gently sloping, moderately well drained soil on terraces and outwash plains. Most areas are irregular in shape and range from 2 to 85 acres in size.

Typically, the surface layer is brown, friable loam about 9 inches thick. The subsoil is yellowish brown and brown, friable and firm loam and gravelly sandy clay loam about 38 inches thick. It is mottled below a depth of about 15 inches. The substratum to a depth of about 60 inches is yellowish brown, friable gravelly sandy loam. In some areas slopes are 0 to 2 percent. In some areas the substratum is silty clay loam or silty clay. In a few areas the soils are on uplands.

Included with this soil in mapping are narrow strips of somewhat poorly drained Jimtown soils and poorly drained Damascus soils in drainageways and depressions. Also included are small areas of well drained Chili soils on knolls and Glenford soils in positions on the landscape similar to those of the Bogart soils. The included soils make up about 15 percent of most areas.

A high water table is between depths of 24 and 42 inches in winter and spring and during other extended wet periods. Runoff is medium. Permeability is moderate or moderately rapid in the subsoil and rapid in the substratum. The root zone is deep. The available water capacity is moderate. The shrink-swell potential is low. The subsoil is very strongly acid to slightly acid.

In most areas this soil is used as cropland. In some areas it is used as woodland. It is well suited to cultivated crops, specialty crops, hay, and pasture. The soil is easily farmed. However, it is susceptible to erosion. The surface layer can be worked within a fairly wide range of moisture content. At times the available water is not sufficient for crops. The soil is suited to minimum tillage, which is generally effective in controlling erosion. Using crop residue and planting cover crops reduce erosion, maintain the content of organic matter, and improve tilth. Subsurface drains are needed in areas of the included wetter soils. If the soil is used as pasture, overgrazing or grazing when the soil is soft and sticky causes surface compaction, poor tilth, and reduced growth.

This soil is well suited to use as woodland. Machine planting of tree seedlings is practical on this soil. Tree seedlings grow well if competing vegetation is controlled or removed by cutting, spraying, girdling, or mowing.

This soil is moderately well suited to use as sites for buildings and septic tank absorption fields and to some recreation uses. Because of seasonal wetness and the apparent water table it is better suited to houses without basements than to houses with basements. Building sites should be landscaped to provide surface drainage away from foundations. Sanitary facilities, especially sewage lagoons and sanitary landfills, can pollute local ground water because of the rapidly permeable substratum. Permeability is adequate for septic tank absorption fields. However, wetness occasionally interferes with absorption of effluent. Perimeter drains help lower the seasonal high water table. Local roads can be improved by providing artificial drainage and a suitable base material to reduce damage from frost action and improve soil strength. This soil is well suited to some recreation uses, especially paths and trails and golf fairways.

This soil is in capability subcass IIe and in woodland suitability subclass 1o.

BrF—Brecksville silt loam, 25 to 70 percent slopes. This is a moderately deep, very steep, well drained soil in dissected areas along drainageways on uplands. Most areas are long and narrow and range from 5 to 25 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 4 inches thick. The subsoil is about 21 inches thick. The upper part is yellowish brown, friable silt loam and firm silty clay loam; and the lower part is yellowish brown and light olive brown, mottled, firm silty clay loam and shaly silty clay loam. The substratum is light olive brown, mottled, firm shaly silty clay loam over olive, thin-bedded, weathered soft shale bedrock. Bedrock is at a depth of about 36 inches.

Included with this soil in mapping are narrow bands of Chili and Oshtemo soils on the lower part of hillsides. Narrow strips of Holly and Orrville soils are included along drainageways.

Permeability is slow, and runoff is very rapid. The root zone is moderately deep to soft shale bedrock. The available water capacity is low. The subsoil is extremely acid to strongly acid.

In most areas this soil is used as woodland. This soil is not suited to use as cropland because of the very steep slopes. It is highly susceptible to erosion and land slippage. A thick plant cover helps to control erosion.

This soil is moderately well suited to use as woodland and well suited to use as habitat for woodland wildlife. The very steep and generally uneven slope limits use of logging equipment. Logging roads and skid trails should be protected from erosion, by water bars, for example.

This soil is not suited to use as a site for buildings and septic tank absorption fields. Erosion is a severe hazard if vegetation is removed. Low strength, susceptibility to slippage, and moderate depth to bedrock are also limitations for many uses. Trails in recreation areas should be protected from erosion and established across the slope where possible.

This soil is in capability subclass VIIe and in woodland suitability subclass 3r.

Ca—Canadice silt loam. This is a deep, nearly level, poorly drained soil in basins of former glacial lakes. It receives runoff from adjacent higher lying soils and is subject to ponding. Most areas are irregular in shape and range from 5 to 200 acres in size. Slopes are 0 to 2 percent.

Typically, the surface layer is dark gray, friable silt loam about 10 inches thick. The subsoil is gray and olive brown, mottled, firm silty clay about 30 inches thick. The substratum to a depth of about 60 inches is light olive brown, firm silty clay. Some areas in depressions have a very dark gray surface layer and other areas have less clay in the subsoil and substratum.

Included with this soil in mapping and comprising about 15 percent of most areas are small areas of somewhat poorly drained Caneadea and Fitchville soils on slight rises.

The water table is perched near or above the soil surface in winter and spring and during other extended wet periods. Runoff is very slow or ponded. Permeability is very slow. The root zone is deep. The available water capacity is moderate or high. The shrink-swell potential is moderate. The subsoil is medium acid to neutral.

In most areas this soil is used as woodland or pasture. In a few areas it has been cleared and is used as cropland. Excessive wetness and very slow permeability are major limitations for farming. These limitations commonly delay tillage. Undrained areas can be used for hay and pasture, but maintaining tilth and desirable forage stands is difficult. Drained areas are suited to crops, hay, and pasture. The very slow internal water movement reduces the effectiveness of subsurface drains. Outlets for subsurface drains are not available in many areas. Surface drains can be used to remove surface water. This soil is subject to crusting, compaction, and hard clodding if tillage or harvesting is done when the soil is wet. Using crop residue and planting cover crops increase water infiltration and improve the content of organic matter and tilth.

This soil is poorly suited to use as woodland. However, water-tolerant trees grow well. Use of harvesting and planting equipment is limited during wet seasons. Reforestation with desirable species is difficult because plant competition is severe.

This soil is poorly suited to use as a site for buildings, to recreation uses, and to use for most sanitary facilities because of prolonged wetness, the very slow permeability, and the amount of clay in the subsoil and substratum. Drainage can be improved with surface drains, storm sewers, and open ditches. Building sites should be landscaped for good surface drainage away from foundations. Local roads and streets can be improved by providing artificial drainage and a suitable base material to increase soil strength. Play areas and walkways usually need special surfacing.

This soil is in capability subclass IVw and in woodland suitability subclass 5w.

CcA—Caneadea silt loam, 0 to 2 percent slopes. This is a deep, nearly level, somewhat poorly drained soil on slight rises on lake plains. Most areas are irregular in shape and range from 10 to 150 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 4 inches thick. The subsurface layer is brown, mottled, firm silt loam about 2 inches thick. The subsoil is yellowish brown and brown, mottled, firm silty clay loam and silty clay about 38 inches thick. The substratum to a depth of about 60 inches is brown, mottled, firm silty clay.

Included in mapping and making up about 15 percent of most areas are small areas of poorly drained Sebring and Canadice soils in shallow depressions and drainageways.

A water table is perched between depths of 12 and 30 inches in winter and spring and during other extended wet periods. Permeability and runoff are slow. The root zone is deep, and the available water capacity is moderate. The shrink-swell potential is high in the subsoil and substratum. Reaction is very strongly acid or strongly acid in the upper part of the subsoil and slightly acid to mildly alkaline in the lower part.

In most areas this soil is used as woodland or is in brush. If the soil is drained, it is suited to use as cropland and pasture. Planting is delayed in undrained areas. The slow internal water movement reduces the effectiveness of subsurface drains, and a combination of surface and subsurface drainage is needed. This soil dries out slowly in spring even if drained. It has a narrow range of optimum moisture for tillage. The soil puddles and clods if worked when wet. Tilling or grazing should be controlled to prevent excessive compaction.

In undrained areas this soil is suited to use as woodland. Species selected for planting should be tolerant of the high clay content in the subsoil and some wetness.

This soil is poorly suited to septic tank absorption fields. Unless artificial drainage is provided, it is also poorly suited to use as a site for buildings. Because of the seasonal wetness and high shrink-swell potential it is better suited to houses without basements than to houses with basements. Ditches, storm sewers, and subsurface drains improve drainage. Building sites should be landscaped for good surface drainage away from foundations. Foundations and footings should be designed to prevent structural damage caused by the shrinking and swelling of the soil. Local roads and intensive recreation facilities can be improved by providing artificial drainage and a suitable base material to reduce the damage from frost action and increase soil strength. Most play areas and walkways need special surfacing.

This soil is in capability subclass IIIw and in woodland suitability group 3c.

CcB—Caneadea silt loam, 2 to 6 percent slopes. This is a deep, gently sloping, somewhat poorly drained soil on slightly convex knolls and on convex slopes along drainageways in basins of former glacial lakes. Most areas are irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is brown and yellowish brown, mottled, firm silty clay and clay about 36 inches thick. The substratum to a depth of about 60 inches is brown and olive brown, mottled, firm silty clay. In some areas the soil is eroded, and the surface layer has more clay and is stickier. Runoff is rapid from these areas.

Included with this soil in mapping and making up about 15 percent of most areas are small areas of poorly drained Canadice soils in shallow depressions and drainageways.

A water table is perched between depths of 12 and 30 inches in winter and spring and during other extended wet periods. Permeability is slow. Runoff is medium. The root zone is deep, and the available water capacity is moderate. The shrink-swell potential is high in the subsoil and substratum. Reaction is very strongly acid or strongly acid in the upper part of the subsoil and slightly acid to mildly alkaline in the lower part.

In most areas this soil is used as woodland or is in brush. If the soil is drained, it is suited to use as cropland and pasture. Planting is delayed in undrained areas. The slow internal movement of water reduces the effectiveness of subsurface drains, and a combination of surface and subsurface drainage is needed. Erosion is a hazard if this soil is used for cultivated crops. Using crop residue and planting cover crops increase water infiltration and improve the content of organic matter and tilth. This soil puddles and clods if worked when wet. Tilling or grazing should be controlled to prevent excessive compaction.

In undrained areas this soil is suited to use as woodland. Species selected for planting should be tolerant of some wetness. Plant competition can be reduced by spraying, disking, or mowing.

Because of the seasonal wetness, this soil is better suited to houses without basements than to houses with basements. It is poorly suited to septic tank absorption fields because of the seasonal high water table and slow permeability. Ditches, storm sewers, and subsurface drains are used to improve drainage. Building sites should be landscaped to provide surface drainage away from foundations. Foundations and footings should be designed to prevent structural damage caused by the shrinking and swelling of the soil. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Local roads and intensive recreation facilities can be improved by providing artificial drainage and a suitable base material to reduce the damage from frost action and increase soil strength. Most play areas and walkways need special surfacing.

This soil is in capability subclass IIIw and in woodland suitability subclass 3c.

CdB—Canfield silt loam, 2 to 6 percent slopes. This is a deep, gently sloping, moderately well drained soil on knolls, convex ridgetops, and side slopes at the heads of drainageways on uplands. Most areas are irregular in shape and range from 3 to 65 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer is yellowish brown, friable silt loam about 2 inches thick. The subsoil is about 51 inches thick. The upper part is yellowish brown and dark yellowish brown, firm loam that has mottles below a depth of about 19 inches; the middle part is a dark yellowish brown and dark brown, very firm and firm, dense loam and gravelly sandy loam fragipan that has mottles in the upper 7 inches; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 78 inches is brown, firm sandy loam. In some areas the soil is moderately eroded, and the surface layer is brown and has more coarse fragments.

Included with this soil in mapping and making up about 15 percent of most areas are small areas of somewhat poorly drained Ravenna soils on foot slopes and along drainageways and small areas of Rittman soils that have more clay in the subsoil.

A water table is perched between depths of 18 and 36 inches in winter and spring and during other extended wet periods. Permeability is moderate above the fragipan and slow in the fragipan. Runoff is medium. The root zone is mainly restricted to the zone above the fragipan and consequently the available water capacity is low. The zone above the fragipan is very strongly acid or strongly acid, except where lime has been added.

This soil is used mainly for cultivated crops and as pasture and woodland. The soil is well suited to corn, hay, and pasture. Seasonal wetness sometimes delays planting. Row crops can be grown year after year if management is intensive. Tillage and harvesting should be done at optimum moisture content. This soil is subject to surface crusting and compaction if tillage and harvesting are done when the soil is soft and sticky. Using crop residue and planting cover crops improve the content of organic matter and tilth, help to control erosion, and increase water infiltration. Artificial drainage may be needed in seep areas and in areas of the included wetter soils.

This soil is suited to use as woodland. Machine planting of tree seedlings is practical on this soil. Plant competition can be reduced by spraying, mowing, or disking. Species tolerant of the root-restricting layer in the lower part of the subsoil should be selected for planting.

This soil is moderately well suited to use as a site for buildings. However, it is poorly suited to septic tank absorption fields because of seasonal wetness and the slowly permeable fragipan. It is better suited to houses without basements than to houses with basements. Buildings should be landscaped for surface drainage away from the foundation. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Increasing the size of filter fields and perimeter drains improves the effectiveness of septic tank absorption fields. Local roads and streets can be improved by providing artificial drainage and suitable base material to reduce damage from frost action.

This soil is in capability subclass IIe and in woodland suitability subclass 1d.

CdC—Canfield silt loam, 6 to 12 percent slopes. This is a deep, sloping, moderately well drained soil on ridgetops and on side slopes along well defined waterways. Most areas are long and narrow or irregular in shape and range from 3 to 50 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 50 inches thick. The upper part is yellowish brown and dark yellowish brown, firm loam and silt loam that has mottles below a depth of about 17 inches; the middle part is a dark yellowish brown, mottled, very firm, dense loam fragipan; and the lower part is yellowish brown, mottled, firm loam. The substratum to a depth of about 78 inches is brown, firm sandy loam and loam. In some areas the soil is moderately eroded. In these areas the surface layer is brown and has more coarse fragments.

Included with this soil in mapping and making up about 15 percent of most areas are small areas of somewhat poorly drained Ravenna soils on foot slopes and along drainageways and small areas of well drained Wooster soils on narrow ridges and the upper part of slopes.

A water table is perched between depths of 18 and 36 inches in winter and spring and during other extended wet periods. Permeability is moderate above the fragipan and slow in the fragipan. Runoff is rapid. The root zone is generally restricted by the fragipan, and consequently the available water capacity is low. The zone above the fragipan is very strongly acid or strongly acid, except where lime has been added.

This soil is used mainly for cultivated crops and as pasture and woodland. It is well suited to hay and pasture. It can be cropped successfully, but cropping systems should include long-term hay and pasture. Erosion is a concern, especially where slopes are long. The surface layer is susceptible to crusting, especially in the more eroded areas. Using minimum tillage and planting cover crops improve the content of organic matter and tilth, help reduce soil loss by erosion, and increase water infiltration. Using grassed waterways is a good practice. Some areas with long slopes can be farmed on the contour. Random subsurface drainage may be needed in the included wetter soils.

This soil is suited to use as woodland. Laying out logging roads and skid trails on the contour facilitates the use of equipment and helps to prevent excessive erosion. Plant competition can be reduced by spraying, mowing, or disking.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. Because of the seasonal wetness, it is better suited to houses without basements than to houses with basements. Buildings should be designed to conform to the natural shape of the land. Land shaping is needed in some areas. Drains at the base of footings and exterior basement wall coatings are commonly used to help prevent wet basements. Local roads can be improved by strengthening or replacing the base material and providing artificial drainage to reduce damage from frost action. The distribution lines in septic tank absorption fields should be across the slope to prevent seepage to the soil surface. Increased runoff and erosion during construction can be reduced by maintaining plant cover wherever possible. This soil is well suited to paths and trails.

This soil is in capability subclass IIIe and in woodland suitability subclass 1d.

Cf—Carlisle muck, ponded. This is a deep, level, very poorly drained soil in low areas in bogs and swales on terraces, uplands, and flood plains. It is ponded much of the year and is subject to frequent flooding. Slopes are 0 to 2 percent. Most areas are oval and range from 3 to 75 acres in size.

Typically, the surface layer is black, very friable muck about 4 inches thick. Below that to a depth of about 60 inches the soil is black, dark reddish brown, and dark brown, friable muck. Some areas have mineral material at a depth of 16 to 51 inches.

Included with this soil in mapping are narrow strips of Wallkill soils that are commonly on the periphery of the mapped areas.

Water is near the surface and ponds for long periods. Permeability is moderately rapid. Runoff is very slow. The rooting depth of most plants is related to the depth to the water table. The available water capacity and the content of organic matter are very high. The root zone is strongly acid to mildly alkaline.

In most areas this soil is in its natural state and is used as habitat for wetland wildlife (fig. 2). In a few areas it is used as woodland or for cultivated crops. The ponding, flooding, low strength, and seepage make this soil poorly suited to use as cropland and pasture and not suited to building site development, sanitary facilities, woodland, and most recreation uses. Drainage outlets are difficult to establish. The fluctuating water level limits the survival of most tree species. This soil is best suited to use as habitat for ducks, beaver, muskrats, and other wetland wildlife.

This soil is in capability subclass Vw. It is not assigned to a woodland suitability subclass.

CnA—Chili loam, 0 to 2 percent slopes. This is a deep, nearly level, well drained soil on outwash plains and stream terraces. The areas are narrow to broad, irregular in shape, and range from 2 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 10 inches thick. The subsoil is about 45 inches thick. The upper part is dark yellowish brown, firm loam; the middle part is yellowish red, reddish brown, and brown, firm gravelly sandy clay loam; and the lower part is reddish brown and brown, very friable gravelly sandy loam and loose very gravelly loamy sand. The substratum to a depth of about 60 inches is yellowish brown, loose gravelly sand. In some areas the surface layer is silt loam. In a few areas the soil is slightly wetter and has gray mottles in the lower part of the subsoil.

Included with this soil in mapping and comprising about 15 percent of most areas are small areas of somewhat poorly drained Jimtown soils in shallow depressions and along drainageways.

Permeability is moderately rapid. Runoff is slow. The root zone is deep, and the available water capacity is moderate or low. The shrink-swell potential is low. The subsoil is strongly acid to slightly acid.

In most areas this soil is used as cropland. It is suited to corn, wheat, oats, hay, and pasture. It is especially well suited to crops planted early in spring and to grazing early in spring. Growth of pasture is slow in summer because the soil tends to be droughty. This soil is well suited to no-till or minimum tillage practices. Leaving crop residue, planting cover crops, and using other management practices help conserve moisture, improve tilth, and maintain the content of organic matter. Because nutrients are moderately rapidly leached, this soil generally responds better to smaller, more frequent applications of fertilizer than to one large application.

This soil is suited to use as woodland. Machine planting of tree seedlings is practical on this soil. Plant competition can be reduced by spraying, mowing, or disking.

This soil is well suited as a site for buildings, local roads and streets, septic tank absorption fields, and to most recreation uses. Nearby ground water supplies can be contaminated if this soil is used for sanitary facilities.

Figure 2.—Carlisle muck, ponded, has a water table near the surface and ponds for long periods. It is well suited to use as habitat for wetland wildlife.

Although the soil is well suited to local roads and streets, it can be improved by replacing the subsoil with a more suitable base material. Sloughing is a hazard in excavations. This soil is a probable source of gravel.

This soil is in capability subclass IIs and in woodland suitability subclass 2o.

CnB—Chili loam, 2 to 6 percent slopes. This is a deep, gently sloping, well drained soil on stream terraces, outwash plains, and kames. Areas of this soil generally range from 10 to 85 acres in size, although some are 150 acres or more.

Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is about 53 inches thick. The upper part is dark yellowish brown and brown, firm loam; the middle part is yellowish red, reddish brown, and brown, firm gravelly clay loam and gravelly sandy clay loam; and the lower part is reddish brown and brown, very friable and loose, gravelly sandy loam and very gravelly loamy sand. The substratum to a depth of about 64 inches is yellowish brown, loose gravelly sand. In some areas the surface layer is silt loam, gravelly loam, or sandy loam. A few areas are on uplands. In other areas the soils are slightly wetter.

Permeability is moderately rapid. Runoff is slow or medium, and much of the rainfall infiltrates into the soil. The root zone is deep, and the available water capacity is moderate or low. The reaction in the root zone ranges from very strongly acid to medium acid, except where lime has been added.

In most areas this soil is used as cropland. It is well suited to oats, wheat, hay, and potatoes. Erosion is a moderate hazard if the soil is cultivated. This soil is well suited to no-till or minimum tillage. These practices generally are adequate in controlling erosion. This soil is well suited to deep-rooted hay crops, alfalfa, for example. Planting cover crops and using grassed waterways help prevent excessive soil loss. Returning crop residue or regularly adding other organic material helps improve fertility, reduce crusting, and increase water infiltration. Plants often show moisture stress during the drier summer months. Because nutrients are moderately rapidly leached, this soil generally responds better to smaller, more frequent applications of fertilizer than to one large application. This soil is well suited to grazing early in spring.

This soil is well suited to woodland. Machine planting of tree seedlings is practical on this soil. Plant competition can be controlled by spraying, mowing, or disking.

This soil is well suited as a site for buildings, local roads and streets, septic tank absorption fields, and to most recreation uses. Nearby ground water supplies can be contaminated if this soil is used for sanitary facilities. Although the soil is well suited for local roads and streets, it can be improved by replacing the subsoil with a more suitable base material. Sloughing is a hazard in excavations. This soil is a probable source of gravel. Cover should be maintained on the site as much as possible during construction to reduce the hazard of erosion.

This soil is in capability subclass IIe and in woodland suitability subclass 2o.

CnC—Chili loam, 6 to 12 percent slopes. This is a deep, sloping, well drained soil on stream terraces, outwash plains, and kames. Most areas are long and narrow or irregular in shape and range from 3 to 35 acres in size.

Typically, the surface layer is dark brown, friable loam about 7 inches thick. The subsoil is about 35 inches thick. The upper part is brown and reddish brown, firm loam, and the lower part is dark brown, firm gravelly sandy clay loam and gravelly sandy loam. The substratum to a depth of about 60 inches is brown and yellowish brown, friable or loose gravelly sand. In some areas the surface layer is gravelly loam or gravelly sandy loam. In other areas the subsoil has less gravel and clay. These areas tend to be more droughty.

Permeability is moderately rapid. Runoff is medium. The root zone is mainly deep, and the available water capacity is moderate or low. The shrink-swell potential is low. The subsoil is strongly acid to slightly acid.

In most areas this soil is used as cropland. It is suited to cultivated crops, hay, and pasture. Erosion and droughtiness are the main hazards for cultivated crops. It is well suited to no-till or minimum tillage. During dry periods the soil is droughty. Because of the limited available water capacity, it is better suited to crops that mature early than to crops that mature late in summer. Leaving crop residue, planting cover crops, and using other management practices help conserve moisture, increase the content of organic matter, and reduce erosion. This soil is well suited to grazing early in spring.

This soil is well suited to use as woodland. Tree seedlings are difficult to establish during dry periods. Plant competition can be reduced by spraying, mowing, and disking.

This soil is suited as a site for buildings, local roads and streets, septic tank absorption fields, and to recreation uses. Ground water can become polluted from sanitary facilities. Downslope seepage of effluent from septic tank absorption fields is a hazard because the soil material is porous. Buildings should be designed to conform to the natural slope of the land. Land shaping is needed in some areas. Local roads can be improved by replacing the subsoil with a suitable base material. This soil is droughty for lawns during dry periods. Sloughing is a hazard in excavations. Cover should be maintained on the site as much as possible during construction to reduce soil loss by erosion. Trails in recreation areas should be protected against erosion and established across the slope if possible. This soil is a probable source of gravel.

This soil is in capability subclass IIIe and in woodland suitability subclass 2o.

CoD2—Chili gravelly loam, 12 to 18 percent slopes, eroded. This is a deep, moderately steep, well drained soil on outwash plains, stream terraces, and kames. Most areas are long and narrow or round and range from 5 to 25 acres in size.

Typically, the surface layer is brown, friable, gravelly loam about 6 inches thick. The subsoil is about 34 inches thick. The upper part is dark brown, firm loam; and the lower part is reddish brown, firm, gravelly sandy clay loam and gravelly sandy loam. The substratum to a depth of about 60 inches is brown and yellowish brown, loose, gravelly loamy sand and gravelly sand. In some areas the surface layer is loam or sandy loam. In other areas, the soil formed in glacial till and has a fragipan. In a few areas the subsoil has less gravel and clay.

Permeability is moderately rapid. Runoff is rapid. The root zone is deep, and the available water capacity is low or moderate. The shrink-swell potential is low. The surface layer and subsoil are very strongly acid to slightly acid.

In most areas this soil is used as cropland. The moderately steep slopes, the hazard of erosion, and the low or moderate available water capacity severely limit the use of this soil for cultivated crops. Maintaining perennial vegetation is the best way to control erosion. Alfalfa grows well. A row crop can be grown occasionally if care is taken to prevent erosion. The soil is better suited to early season crops, oats, for example, than to crops that mature late in summer. Seeding pasture using the trash mulch or no-till method reduces the risk of erosion and conserves moisture. Returning crop residue or regularly adding other organic material helps to improve fertility and increase water infiltration.

This soil is suited to use as woodland and as habitat for woodland wildlife. The use of logging and planting equipment is limited by slope. Logging roads and skid trails should be protected against erosion and established across the slope if possible. Species adapted to dry sites should be selected for planting.

The soil is moderately well suited to buildings that are specially designed to fit the slope. Development should be on the contour if possible. Cover should be maintained on the site as much as possible during construction to reduce the hazard of erosion. The permeability is adequate for septic tank absorption fields; however, the effluent is likely to seep downslope and pollute nearby ground water. Most local roads require considerable excavation. Sloughing is a hazard in excavations. Trails in recreation areas should be protected against erosion and established across the slope if possible. The soil is a probable source of gravel.

This soil is in capability subclass IVe and in woodland suitability subclass 2r.

CyD—Chili-Oshtemo complex, 6 to 18 percent slopes. This complex consists of deep, well drained, rolling and hilly Chili and Oshtemo soils on kames. These kames typically have short complex slopes. Individual areas are irregular in shape and range from 6 to over 100 acres in size. About 55 percent of the complex is Chili gravelly loam, 30 percent is Oshtemo sandy loam, and 15 percent is included soils. The areas are so intricately mixed or so small in size that it was not practical to map them separately.

Typically, the surface layer of the Chili soil is dark grayish brown, friable gravelly loam about 6 inches thick. The subsoil is about 42 inches thick. The upper part is dark yellowish brown, friable loam and clay loam; and the lower part is dark brown, friable gravelly loam, gravelly clay loam, and gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, very friable and loose, gravelly loamy sand and gravelly sand.

Typically, the surface layer of the Oshtemo soil is dark grayish brown, friable sandy loam about 6 inches thick. The subsoil is about 44 inches thick. The upper part is dark brown, friable sandy loam; and the lower part is brown, loose loamy sand. The substratum to a depth of about 66 inches is brown, loose loamy sand and sand. In some areas thin strata of loamy sand are in the upper part of the subsoil.

Included with these soils in mapping are small areas of more droughty soils that are 50 to 70 percent gravel in the subsoil and substratum and are near the crest of hills. Small included spots of poorly drained Sebring and Canadice soils are in depressions that receive runoff and sediment from the adjacent slopes. The included soils make up about 15 percent of most areas.

Permeability is moderately rapid in the Chili soil. It is moderately rapid in the upper part of the subsoil of the Oshtemo soil and very rapid in the substratum. Runoff is rapid. Both soils have a deep root zone that has a low or moderate available water capacity. In both soils the subsoil is commonly strongly acid to slightly acid.

These soils are used mainly as pasture and woodland. In a few areas they are used for cultivated crops. However, they are poorly suited to cultivated crops. The moderately steep slope, erosion hazard, and low or moderate available water capacity severely limit the use of these soils as cropland. The major crops grown are oats, wheat, and mixed hay. The soils are better suited to early season crops, for example, oats, than to crops that mature late in the summer. Erosion is a severe hazard if the soils are cultivated, especially in the steeper areas. Cultivated crops can be grown occasionally if care is taken to prevent erosion. Using grassed waterways helps prevent excessive soil loss. Because of the complex slopes, it is difficult to use contour tillage and stripcropping. Returning crop residue or regularly adding other organic material helps improve fertility and increase water infiltration. Plants often show moisture stress during the summer. These soils are well suited to grazing early in spring. Reseeding by the trash mulch or no-till seeding method reduces the risk of erosion.

These soils are suited to use as woodland and as habitat for woodland wildlife. Species selected for planting should be tolerant of dry sites. Tree seedlings are difficult to establish during the drier part of the year. Seedlings should be planted early in spring. Logging roads and skid trails should be protected against erosion by water bars or other practices and established across the slope where possible. Woodland growth can be increased by removing competing vegetation by cutting, spraying, or mowing.

These soils are moderately well suited to building sites. The complex slope and the steepness of some areas are the major limitations. Land shaping is needed in many areas. Buildings should be designed to conform to the natural slope of the land. The permeability is adequate for septic tank absorption fields; however, the effluent is likely to seep downslope and pollute nearby ground water. Sloughing is a hazard in excavations. These soils provide good foundation material for streets and roads. Cover should be maintained on construction sites as much as possible to reduce soil loss by erosion.

These soils are in capability subclass IVe. The Chili soil is in woodland suitability subclass 2o, and the Oshtemo soil is in subclass 3o.

CyF—Chili-Oshtemo complex, 25 to 50 percent slopes. This complex consists of deep, very steep, well drained Chili and Oshtemo soils in dissected areas of terraces. Individual areas are long and narrow and range from 2 to 25 acres in size. About 60 percent of the complex is Chili gravelly loam, 30 percent is Oshtemo sandy loam, and 10 percent is other soils that were included in mapping. These areas are so intricately mixed or so small in size that it was not practical to map them separately.

Typically, the surface layer of the Chili soil is dark grayish brown, friable gravelly loam about 4 inches thick. The subsoil is about 36 inches thick. In the upper part it is dark yellowish brown, friable loam and clay loam, and in the lower part it is dark brown, friable gravelly loam and gravelly clay loam. The substratum to a depth of about 60 inches is yellowish brown, loose gravelly loamy sand and gravelly sand.

Typically, the surface layer of the Oshtemo soil is dark grayish brown, friable sandy loam about 6 inches thick. The subsoil is dark brown, friable sandy loam about 34 inches thick. The substratum to a depth of about 60 inches is brown, loose loamy sand and sand. In some areas the subsoil has thin strata of loamy sand.

Included with these soils in mapping are small areas of soils that are more droughty and are 50 to 70 percent gravel in the subsoil and substratum. The included soils make up about 10 percent of most areas.

Permeability of the Chili soil is moderately rapid. Permeability of the Oshtemo soil is moderately rapid in the upper part of the subsoil and very rapid in the substratum. Runoff is rapid. Both soils have a deep root zone. The available water capacity of the Oshtemo soil is low, and that of the Chili soil is low or moderate. The subsoil of both soils is commonly strongly acid to slightly acid.

In most areas these soils are used as woodland. In some areas they are used as pasture. These soils are poorly suited to farming because of droughtiness and very steep slopes. The use of tillage equipment is severely limited. Erosion is a very severe hazard if plant cover is removed.

These soils are suited to use as woodland and as habitat for woodland wildlife. Planting trees on narrow strips helps control erosion. Seedlings are difficult to establish during dry periods. Steep slopes severely limit the use of equipment.

These soils are not suited to use as sites for buildings and sanitary facilities. Construction is difficult, and erosion is a very severe hazard if vegetation is removed. Sloughing is a hazard in excavations. Trails in recreation areas should be protected from erosion and established across the slope where possible.

These soils are in capability subclass VIIe. The Chili soil is in woodland suitability subclass 2r, and the Oshtemo soil is in subclass 3r.

Da—Damascus silt loam. This is a deep, nearly level, poorly drained soil on stream terraces and outwash plains. It receives runoff from adjacent higher lying soils and is subject to ponding. Slopes are 0 to 2 percent. Most areas are irregular in shape and range from 2 to 250 acres in size.

Typically, the surface layer is dark gray, friable silt loam about 10 inches thick. The subsoil is about 22 inches thick. The upper part is gray and dark gray, friable loam and firm clay loam that has mottles below a depth of about 14 inches; and the lower part is gray, mottled, firm gravelly loam and sandy loam. The substratum to a depth of about 60 inches is stratified layers of light olive brown and gray, loose and friable loam, gravelly loamy sand, and gravelly sandy loam that has mottles in the upper 4 inches. In some areas the surface layer is loam or sandy loam. A few areas are on uplands.

Included with this soil in mapping are small areas of somewhat poorly drained Jimtown soils on slight rises. Also included are small areas of somewhat poorly drained Orrville soils along drainageways. The included soils make up about 15 percent of most areas.

The water table is near or above the surface in winter and spring and during other extended wet periods. Permeability is moderate in the upper part of the subsoil and rapid or very rapid in the substratum. Runoff is very slow or ponded. The root zone is deep, and the available water capacity is moderate. The surface layer and subsoil are very strongly acid to slightly acid. The shrink-swell potential is low.

In most areas this soil is used as woodland or pasture. In a few areas it is used as cropland. The major limitation for farming is seasonal wetness. In undrained areas the soil is too wet for crops. In drained areas it is suited to corn, hay, and pasture. This soil is poorly suited to grazing early in spring. Surface drains can be used to remove surface water. Subsurface drains can be used to remove excess water from the root zone if outlets are available. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to use as woodland. Use of planting and harvesting equipment is limited during wet seasons. Species selected for planting should be tolerant of wetness. Reforestation with desirable species is difficult because seedling mortality is moderate and plant competition is severe. Plant competition can be reduced by spraying, mowing, or disking.

This soil is poorly suited as a site for buildings and septic tank absorption fields because of ponding and possible contamination of ground water supplies. Drainage can be improved by subsurface drains, storm sewers, and open ditches. Local roads can be improved by providing artificial drainage and suitable base material to eliminate ponding and reduce damage from frost action. Excavations are limited during winter and spring because of wetness and sloughing of banks.

This soil is in capability subclass IIIw and in woodland suitability subclass 2w.

DrA—Darien silt loam, bedrock substratum, 0 to 2 percent slopes. This is a deep, nearly level, somewhat poorly drained soil in broad areas on uplands. Most areas are irregular in shape and range from 20 to over 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsurface layer is light yellowish brown, friable silt loam about 4 inches thick. The subsoil is about 28 inches thick. The upper part is grayish brown, mottled, friable loam; and the middle and lower parts are dark yellowish brown, mottled, firm clay loam. The substratum is brown, mottled, firm clay loam over weathered, rippable siltstone and shale bedrock to a depth of about 55 inches.

Included with this soil in mapping are small areas of poorly drained soils that are similar to the Darien soil, except for being grayer in the subsoil. These included soils are in depressions and are subject to ponding.

A water table is perched between depths of 6 and 18 inches in winter and spring and during other extended wet periods. Permeability and runoff are slow. The root zone is mainly moderately deep to compact glacial till. The available water capacity is moderate. Reaction is strongly acid or medium acid in the subsoil. The shrink-swell potential is moderate in the subsoil.

In most areas this soil is used as cropland. In some areas it is used as woodland or pasture. Seasonal wetness severely limits the use of this soil for cultivated crops. In drained areas the soil is suited to some cultivated crops and to water-tolerant grasses and legumes for hay and pasture. Tillage operations are commonly delayed in spring. A combination of surface and subsurface drainage can be used to overcome the wetness. Drainage by subsurface drains is slow. Tillage and grazing when the soil is wet causes compaction. Minimum tillage, using crop residue and cover crops, and tilling and harvesting at the proper moisture content are effective management practices.

The soil is moderately well suited to use as woodland. Species selected for planting should be tolerant of some wetness. Plant competition can be reduced by spraying, mowing, or disking.

This soil is poorly suited to septic tank absorption fields, and unless artificial drainage is provided it is poorly suited as a site for buildings. Because of seasonal wetness and shale or siltstone bedrock at a depth of 40 to 60 inches, it is better suited to houses without basements than to houses with basements. Ditches and subsurface drains are used to improve drainage. Building sites should be landscaped for good surface drainage away from foundations. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Local roads and streets can be improved by using artificial drainage and suitable base material to reduce damage from wetness and frost action. Extensive drainage is needed for intensive recreation uses, ball diamonds and tennis courts, for example.

This soil is in capability subclass IIIw and in woodland suitability subclass 3o.

DrB—Darien silt loam, bedrock substratum, 2 to 6 percent slopes. This is a deep, gently sloping, somewhat poorly drained soil on broad convex slopes on uplands. Most areas are irregular in shape and range from 20 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 33 inches thick. The upper part is light olive brown, mottled, firm loam and silt loam; and the middle and lower parts are gray, mottled, firm clay loam. The substratum to a depth of about 50 inches is brown, firm clay loam over weathered, rippable shale bedrock. In some areas the subsoil has more clay.

A water table is perched between depths of 6 and 18 inches in winter and spring and during other extended wet periods. Permeability is slow, and runoff is slow or medium. The root zone is mainly moderately deep to compact glacial till. The available water capacity is moderate. The subsoil is strongly acid or medium acid. The shrink-swell potential is moderate in the subsoil.

In most areas this soil is used as cropland. In some areas it is used as woodland or pasture. Seasonal wetness limits the use of this soil for cultivated crops. If drained, this soil is suited to row crops and forage crops. The slow internal water movement reduces the effectiveness of subsurface drains, and a combination of surface and subsurface drainage is needed. Tilling or grazing when the soil is soft and sticky causes compaction. Erosion is a hazard if the soil is cultivated. Using crop residue and cover crops and tilling and harvesting at the proper moisture content are effective management practices. A thick plant cover helps to control erosion in pasture and meadow.

The soil is moderately well suited to use as woodland. Species selected for planting should be tolerant of some wetness. Plant competition can be reduced by spraying, mowing, or disking.

Because of seasonal wetness, this soil is better suited to houses without basements than to houses with basements. It is poorly suited to septic tank absorption fields because of the seasonal high water table and slow permeability. The underlying bedrock is mostly rippable. Buildings should be located on the higher parts of the landscape for good surface drainage away from the foundation. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Damage to local roads and streets from frost action and wetness can be reduced by using artificial drainage and suitable base material. Extensive drainage is needed for intensive recreation uses, baseball diamonds and tennis courts, for example. The soil is suitable for hiking trails during the drier part of the year.

This soil is in capability subclass IIIw and in woodland suitability subclass 3o.

EhB—Ellsworth silt loam, 2 to 6 percent slopes. This is a deep, gently sloping, moderately well drained soil on knolls and side slopes at the heads of drainageways on uplands. Most areas are irregular in shape and range from 5 to 40 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 29 inches thick. The upper part is brown, mottled, firm silty clay loam; the middle part is brown, mottled, firm clay; and the lower part is dark brown, mottled, firm silty clay loam. The substratum to a depth of about 60 inches is dark brown and yellowish brown, firm silty clay loam. In a few eroded areas the surface layer is brown silty clay loam.

Included with this soil in mapping and comprising about 15 percent of most areas are small areas of somewhat poorly drained Mahoning soils.

A water table is perched between depths of 24 and 36 inches in winter and spring and during other extended wet periods. Permeability is slow or very slow. Runoff is medium. The root zone is mainly moderately deep to compact glacial till. The available water capacity is moderate. Reaction is very strongly acid or strongly acid in the upper part of the subsoil and medium acid to mildly alkaline in the lower part. The shrink-swell potential is moderate.

In most areas this soil is used as cropland and pasture, for hay, and for orchards (fig. 3). It is suited to cultivated crops, hay, pasture, and orchards. This soil is commonly wet in spring and dry in midsummer. Subsurface drainage is needed in areas of the included wetter soils and in wet-weather seeps. Hard clods and a crusty surface form if the soil is cultivated when it is soft and sticky. Grazing when the soil is soft and sticky causes compaction and reduced growth. Contour cultivation, using minimum tillage, planting cover crops, incorporating crop residue in the soil, and tilling, pasturing, and harvesting at the optimum moisture content reduce soil loss by erosion, improve tilth, and maintain the content of organic matter.

This soil is moderately well suited to use as woodland. Machine planting of tree seedlings is practical on this

Figure 3.—An apple orchard on Ellsworth silt loam, 2 to 6 percent slopes.

soil. Plant competition can be reduced by spraying, mowing, or disking.

This soil is moderately well suited as a site for buildings. Because of the seasonal wetness, it is better suited to houses without basements than to houses with basements. Foundations and footings should be designed to prevent structural damage from frost action and from the shrinking and swelling of the soil. Building sites should be landscaped to keep surface water away from the foundations. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Local roads can be improved by providing artificial drainage and suitable base material.

This soil is poorly suited to septic tank absorption fields. It is suited to recreation uses, picnic areas and hiking trails, for example. It is also suitable for pond embankments.

This soil is in capability subclass IIIe and in woodland suitability subclass 3o.

EhB2—Ellsworth silt loam, 2 to 6 percent slopes, eroded. This is a deep, gently sloping, moderately well drained soil on knolls and side slopes parallel to drainageways on uplands. Erosion has removed part of the original surface layer, and tillage has mixed subsoil material into the present surface layer. Most areas are irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 25 inches thick. The upper part is dark yellowish brown and dark brown, firm silty clay loam; and the lower part is dark brown and dark yellowish brown, mottled, firm clay and silty clay loam. The substratum to a depth of about 60 inches is brown, firm silty clay loam. In many areas the surface layer is silty clay loam. In some uneroded areas the surface layer is very dark grayish brown.

Included with this soil in mapping are narrow strips of somewhat poorly drained Mahoning soils in slight depressions and on foot slopes. The included soils make up about 10 percent of most areas.

A water table is perched between depths of 24 and 36 inches in winter and spring and during other extended wet periods. The content of organic matter is moderately low. Permeability is slow or very slow. Runoff is medium. The root zone is mainly moderately deep to compact glacial till. The available water capacity is moderate. Reaction is very strongly acid or strongly acid in the upper part of the subsoil and medium acid to mildly alkaline in the lower part. The shrink-swell potential is moderate.

In most areas this soil has been cleared and cultivated, but in some areas it is reverting to natural vegetation. It is suited to cultivated crops, hay, and pasture. This soil is commonly wet in spring and dry in midsummer. Subsurface drainage is needed in areas of the included wetter soils and in wet-weather seeps. Hard clods and a crusty surface form if the soil is cultivated when it is soft and sticky. Grazing when this soil is soft and sticky causes compaction and reduced growth. Contour cultivation, using minimum tillage, planting cover crops, incorporating crop residue in the soil, and tilling, pasturing, and harvesting at optimum moisture content reduce soil loss by erosion, improve tilth, and maintain the content of organic matter.

This soil is moderately well suited to use as woodland. Machine planting of tree seedlings is practical on this soil. Plant competition can be reduced by spraying, mowing, or disking.

This soil is moderately well suited as a site for buildings. Because of the seasonal wetness, it is better suited to houses without basements than to houses with basements. Foundations and footings should be designed to prevent structural damage from frost action and from the shrinking and swelling of the soil. Building sites should be landscaped to keep surface water away from the foundations. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Local roads can be improved by providing artificial drainage and suitable base material. This soil is poorly suited to septic tank absorption fields. It is suited to recreation uses, picnic areas and hiking trails, for example. It is also suitable for pond embankments.

This soil is in capability subclass IIIe and in woodland suitability subclass 3o.

EhC—Ellsworth silt loam, 6 to 12 percent slopes. This is a deep, sloping, moderately well drained soil on ridgetops and uneven shoulder slopes and along well defined waterways. Most areas are irregular in shape and range from 5 to 25 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 26 inches thick. The upper part is dark yellowish brown and dark brown, firm silty clay loam; and the lower part is dark brown and dark yellowish brown, mottled, firm clay. The substratum to a depth of about 60 inches is brown, firm silty clay loam. In some areas the surface layer is silty clay loam less than 7 inches thick.

Included with this soil in mapping and making up about 10 percent of most areas are small areas of somewhat poorly drained Mahoning soils along drainageways.

A water table is perched between depths of 24 and 36 inches in winter and spring. Permeability is slow or very slow. Runoff is rapid. The root zone is mainly moderately deep to compact glacial till. The available water capacity is moderate. The soil is droughty during extended dry periods because of water loss as runoff. Reaction is very strongly acid or strongly acid in the upper part of the subsoil and medium acid to mildly alkaline in the lower part. The shrink-swell potential is moderate.

In most areas this soil is used as woodland. In many formerly cultivated areas the soil is reverting to natural vegetation. This soil is suited to hay and pasture. It can be cropped successfully, but cropping systems should include a high proportion of long-term hay or pasture. Erosion is a serious hazard, especially where the slopes are long. Subsurface drainage may be needed in areas of the included wetter soils. Hard clods and a crusty surface form if the soil is cultivated when it is soft or sticky. Minimum tillage, planting cover crops, tilling at optimum moisture content, and other management practices reduce soil loss by erosion, improve tilth, and maintain the content of organic matter.

The soil is moderately well suited to use as woodland. Seedling mortality generally is not a problem. Laying out logging roads and skid trails on the contour facilitates the use of equipment and helps to prevent excessive erosion. Plant competition can be reduced by spraying, mowing, or disking.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. Because of seasonal wetness, it is better suited to houses without basements than to houses with basements. Buildings should be designed to conform to the natural shape of the land. Land shaping is needed in some areas. Foundations and footings should be designed to prevent structural damage from frost action and from the shrinking and swelling of the soil. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Local roads can be improved by strengthening or replacing the base material and providing artificial drainage to prevent damage from frost action and low soil strength. Increased runoff and erosion are hazards during construction. These hazards can be reduced by maintaining plant cover wherever possible. Trails in recreation areas should be protected from erosion and established across the slope where possible. Some areas are suitable sites for ponds and lakes.

This soil is in capability subclass IVe and in woodland suitability subclass 3o.

EhC2—Ellsworth silt loam, 6 to 12 percent slopes, eroded. This is a deep, sloping, moderately well drained soil on ridgetops and uneven shoulder slopes and along well defined waterways in uplands. Erosion has removed part of the original surface layer, and tillage has mixed subsoil material that has more clay into the present surface layer. Most areas are long and narrow or irregular in shape and range from 5 to 25 acres in size.

Typically, the surface layer is brown, friable silt loam about 5 inches thick. The subsoil is about 26 inches thick. The upper part is dark yellowish brown and dark brown, firm silty clay loam; and the lower part is dark brown and dark yellowish brown, mottled, firm clay. The substratum to a depth of about 60 inches is brown, firm silty clay loam. In many areas the surface layer is silty clay loam. In some uneroded areas the surface layer is very dark grayish brown.

Included with this soil in mapping and making up about 10 percent of most areas are small areas of somewhat poorly drained Mahoning soil along drainageways.

A water table is perched between depths of 24 and 36 inches in winter and spring. Permeability is slow or very slow. Runoff is rapid. The root zone is mainly moderately deep to compact glacial till. The available water capacity is moderate, and the soil is droughty during extended dry periods because of water loss through runoff. Reaction is very strongly acid or strongly acid in the upper part of the subsoil and medium acid to mildly alkaline in the lower part. The shrink-swell potential is moderate.

In most areas this soil is cultivated (fig. 4). In some formerly cultivated areas the soil is reverting to its natural vegetation. This soil is suited to hay and pasture. It can be cropped successfully, but cropping systems should include a high proportion of long-term hay or pasture. Erosion is a serious hazard, especially where the slopes are long. Subsurface drainage may be needed in areas of the included wetter soils. Hard clods and a crusty surface form if the soil is cultivated when it is soft and sticky. Minimum tillage, planting cover crops, tilling at optimum moisture content, and other management practices reduce soil loss by erosion, improve tilth, and maintain the content of organic matter. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is moderately well suited to use as woodland. Seedling mortality generally is not a problem. Laying out logging roads and skid trails on the contour facilitates the use of equipment and helps prevent excessive erosion. Plant competition can be reduced by spraying, mowing, or disking.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. Because of seasonal wetness, it is better suited to houses without basements than to houses with basements. Buildings should be designed to conform to the natural shape of the land. Land shaping is needed in some areas. Foundations and footings should be designed to prevent structural damage from frost action and from the shrinking and swelling of the soil. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Local roads can be improved by strengthening or replacing the base material and providing artificial drainage to prevent damage from frost action and low soil strength. Increased runoff and erosion are hazards during construction. These hazards can be reduced by maintaining plant cover where possible. Trails in recreation areas should be protected from erosion and established across the slope where possible. Some areas are suitable sites for ponds.

This soil is in capability subclass IVe and in woodland suitability subclass 3o.

EhD—Ellsworth silt loam, 12 to 18 percent slopes. This is a deep, moderately steep, moderately well drained soil on convex hillsides and on side slopes parallel to drainageways. Most areas are long and narrow and range from 5 to 30 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 26 inches thick. The upper part is dark yellowish brown and dark brown, firm silty clay loam; and the lower part is dark brown and dark yellowish brown, mottled, firm clay. The substratum to a depth of about 60 inches is brown, firm silty clay loam. In some small areas the soil is eroded, and the surface layer is brown silty clay loam.

Included with this soil in mapping are small areas of

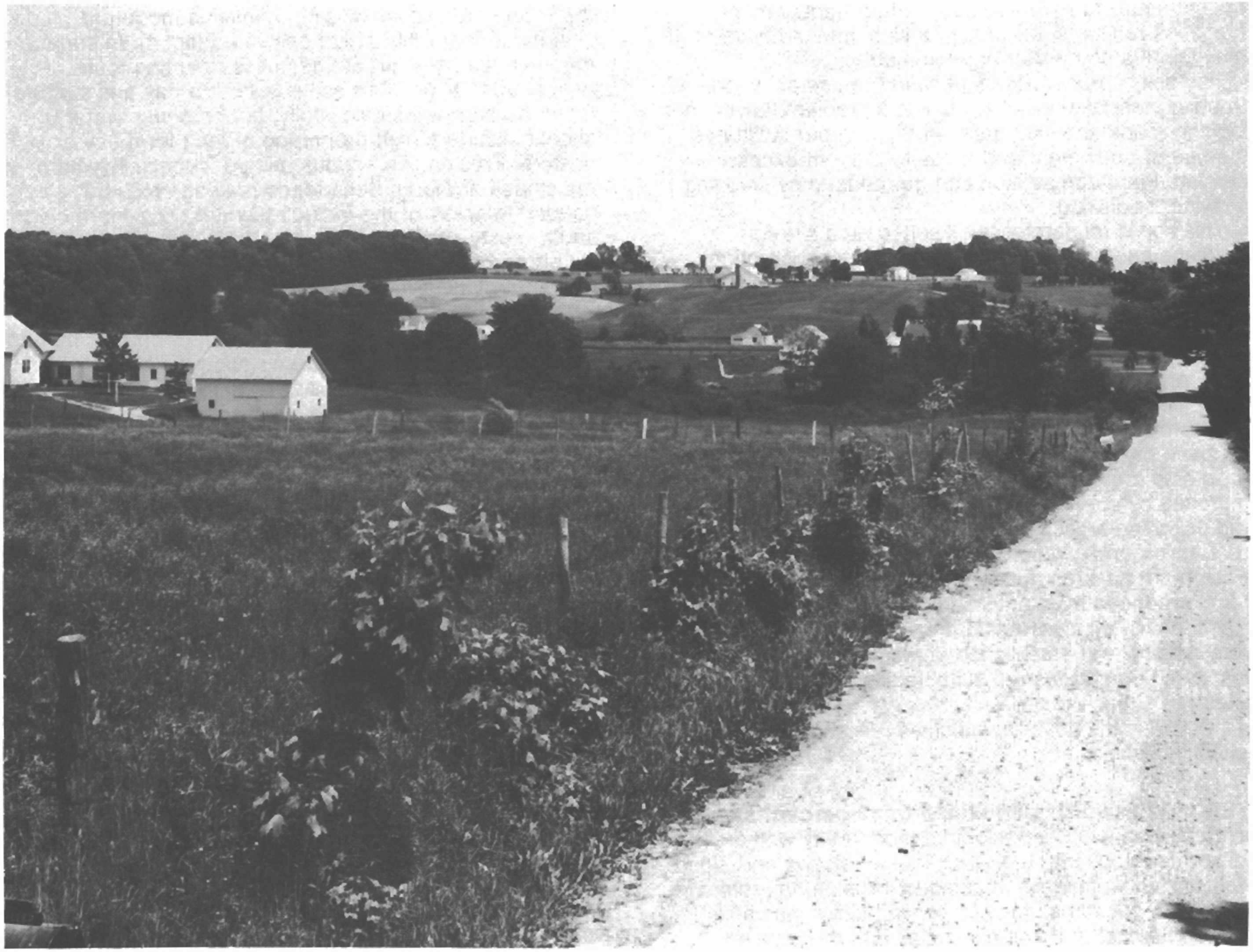

Figure 4.—Haskins, Ellsworth, and Mahoning soils are used as cropland, pasture, and woodland. Haskins soils are in the foreground, and Ellsworth and Mahoning soils are in the background.

somewhat poorly drained Mahoning soils on foot slopes, along drainageways, and in seep spots. The included soils make up about 10 percent of most areas.

A water table is perched between depths of 24 and 36 inches in winter and spring. Permeability is slow or very slow. Runoff is very rapid. The root zone is mainly moderately deep to compact glacial till. The available water capacity is moderate. Reaction is very strongly acid or strongly acid in the upper part of the subsoil and medium acid to neutral in the lower part. The shrink-swell potential is moderate.

In most areas this soil is used as woodland. In some areas it is in natural shrubs. This soil is suited to grasses and legumes for pasture. It tends to be droughty in summer. Slope and the hazard of erosion severely limit the use of this soil for cultivated crops. Use of tillage equipment, especially large machines, is very difficult. Erosion is difficult to control in new seedings unless reseeding is done with cover crops or companion crops or by the trash mulch or no-till seeding method. Minimum tillage, good fertilization, and controlled grazing are important.

This soil is moderately well suited to woodland. Slope limits the use of planting and logging equipment. Logging roads and skid trails should be protected against erosion by water bars and established across the slope if possible.

This soil is moderately well suited to use as building sites if the buildings are specially designed. The slow or very slow permeability, seasonal wetness, and slope limit the use of this soil for building sites and sanitary facilities. Erosion is a serious hazard during construction. Housing developments and construction sites should be developed on the contour where possible. Most local roads require considerable excavation. Foundations and footings should be designed to prevent structural damage from frost action and from the shrinking and swelling of the soil. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Trench absorption fields are difficult to lay out and construct. Controlling the downhill flow of effluent is a serious concern. Trails in recreation areas should be protected against erosion and laid out on the contour where possible.

This soil is in capability subclass VIe and in woodland suitability subclass 3r.

EhD2—Ellsworth silt loam, 12 to 18 percent slopes, eroded. This is a deep, moderately steep, moderately well drained soil on convex slopes along well defined waterways. Erosion has removed part of the original surface layer, and tillage has mixed subsoil material that has more clay into the present surface layer. Most areas are long and narrow and range from 5 to 30 acres in size.

Typically, the surface layer is brown, friable silt loam about 5 inches thick. The subsoil is about 26 inches thick. The upper part is dark yellowish brown and dark brown, firm silty clay loam; and the lower part is dark brown and dark yellowish brown, mottled, firm clay. The substratum to a depth of about 60 inches is brown, firm silty clay loam. In many areas the surface layer is silty clay loam. In some uneroded areas the surface layer is very dark grayish brown.

Included with this soil in mapping are small areas of the somewhat poorly drained Mahoning soils on foot slopes, along drainageways, and in seep spots. These included soils make up about 10 percent of most areas.

A water table is perched between depths of 24 and 36 inches in winter and spring. Permeability is slow or very slow. Runoff is very rapid. The root zone is mainly moderately deep to compact glacial till. The available water capacity is moderate. The soil is droughty during extended dry periods because of water loss through runoff. Reaction is very strongly acid or strongly acid in the upper part of the subsoil and medium acid to mildly alkaline in the lower part. The shrink-swell potential is moderate.

In most areas this soil is used for pasture or is reverting to its natural vegetation. This soil is suited to grasses and legumes for pasture. Slope and the hazard of erosion severely limit the use of this soil for cultivated crops. Use of tillage equipment, especially large machines, is very difficult. This soil tends to be droughty in summer. Erosion is difficult to control in new seedings. Reseeding with cover crops or companion crops or by the trash mulch or no-till seeding method reduces the risk of erosion. Minimum tillage, good fertilization, and controlled grazing are important in helping to control erosion, improve tilth, and maintain the content of organic matter.

This soil is moderately well suited to use as woodland. Slope limits the use of planting and logging equipment. Logging roads and skid trails should be protected against erosion by water bars and established across the slope where possible.

This soil is poorly suited to use as a site for buildings, unless the buildings are specially designed. The slope, slow or very slow permeability, and seasonal wetness severely limit the use of this soil as a site for buildings and sanitary facilities. If proper design and installation procedures are used, the slope limitation can be partially overcome. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Foundations and footings should be designed to prevent structural damage from frost action and the shrinking and swelling of the soil. Most local roads require considerable excavation. Cover should be maintained on the site as much as possible during construction to reduce the hazard of erosion. Trench absorption fields are difficult to lay out and construct. Controlling the downhill flow of effluent is a serious concern. Trails in recreation areas should be protected against erosion and laid out on the contour where possible.

This soil is in capability subclass VIe and in woodland suitability subclass 3r.

EhE—Ellsworth silt loam, 18 to 25 percent slopes. This is a deep, steep, moderately well drained soil on side slopes along drainageways. Most areas are long and narrow and range from 5 to 200 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 5 inches thick. The subsoil is about 24 inches thick. The upper part is dark yellowish brown and dark brown, firm silty clay loam; and the lower part is dark yellowish brown, mottled, firm clay. The substratum to a depth of about 60 inches is brown, firm silty clay loam. In some areas the soil is eroded, and the surface layer is brown silty clay loam.

Included with this soil in mapping are narrow strips of the moderately deep Lordstown soils on the lower part of slopes. Also included are narrow bands of the somewhat poorly drained Orrville soils along drainageways. The included soils make up about 10 percent of most areas.

A water table is perched between depths of 24 and 36 inches during wet periods. Permeability is slow or very slow. Runoff is very rapid. The root zone is mainly moderately deep to compact glacial till. The available water capacity is moderate. Reaction is very strongly acid or strongly acid in the upper part of the subsoil and medium acid to mildly alkaline in the lower part. The shrink-swell potential is moderate.

In most areas this soil is used as woodland. In some areas it is in natural shrubs. This soil is too steep for cultivated crops but can be used for grasses and legumes for permanent pasture. Erosion is a serious hazard when adequate vegetative cover is not maintained and when pastures are reseeded. Reseeding by the trash mulch or no-till seeding method reduces the risk of erosion. Pasture rotation and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is moderately well suited to use as woodland and well suited to use as habitat for woodland wildlife. The slope limits the use of equipment. Competing vegetation can be controlled by spraying, mowing, or disking. Logging roads and skid trails should be constructed on the contour and protected against erosion by water bars or other management practices.

This soil is poorly suited as a site for most buildings and sanitary facilities. The steep slope causes difficulty in construction for urban development. The hazard of erosion is high if vegetation is removed. Cover should be maintained on the site as much as possible during construction. Trails in recreation areas should be protected against erosion and laid out on the contour where possible.

This soil is in capability subclass VIe and in woodland suitability subclass 3r.

EhF—Ellsworth silt loam, 25 to 50 percent slopes. This is a deep, very steep, moderately well drained soil on side slopes along drainageways. Most areas are long and narrow and range from 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 4 inches thick. The subsoil is about 24 inches thick. The upper part is dark yellowish brown and dark brown, firm silty clay loam; and the lower part is dark brown and dark yellowish brown, mottled, firm clay. The substratum to a depth of about 60 inches is brown, firm silty clay loam. In some areas the soil is eroded, and the surface layer is brown silty clay loam.

Included with this soil in mapping are narrow strips of the moderately deep Lordstown soils on the lower part of slopes. Also included are narrow bands of the somewhat poorly drained Orrville soils along drainageways. The included soils make up about 10 percent of most areas.

A water table is perched between depths of 24 and 36 inches during wet periods. Permeability is slow or very slow. Runoff is very rapid. The root zone is mainly moderately deep to compact glacial till. The available water capacity is moderate. Reaction is very strongly acid or strongly acid in the upper part of the subsoil and slightly acid to mildly alkaline in the lower part.

In most areas this soil is used as woodland. Because of the very steep slopes this soil is very poorly suited to crops and pasture. It is moderately well suited to trees and well suited to use as habitat for woodland wildlife. Erosion is a serious hazard if adequate vegetative cover is not maintained. The slope severely limits the use of planting and harvesting equipment. Logging roads and skid trails need to be well designed and protected from erosion by water bars.

This soil is unsuited as a site for buildings and septic tank absorption fields. Construction for recreation and urban uses is very difficult, and the hazard of erosion is very high if vegetation is removed. Most slopes are unstable and subject to slippage. Slope stability needs to be considered prior to cutting or filling. Trails in recreation areas should be protected against erosion and established across the slope where possible.

This soil is in capability subclass VIIe and in woodland suitability subclass 3r.

EmC—Ellsworth silt loam, shale substratum, 6 to 12 percent slopes. This is a deep, sloping, moderately well drained soil on ridgetops and along well defined waterways. Most areas are irregular in shape and range from 5 to 35 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is about 34 inches thick. The upper part is yellowish brown, firm silty clay loam; and the lower part is yellowish brown, mottled, firm silty clay. Rippable shale bedrock is at a depth of about 42 inches. In some areas the surface layer is silty clay loam less than 8 inches thick. In other areas shale bedrock is at a depth of more than 60 inches.

Included with this soil in mapping and making up about 10 percent of most areas are small areas of somewhat poorly drained Mahoning shale substratum soils along drainageways.

A water table is perched between depths of 24 and 36 inches in winter and spring. Permeability is slow. Runoff is rapid. The root zone is mainly moderately deep to compact glacial till. The available water capacity is moderate, and the soil is droughty during extended dry periods because of water loss through runoff. The subsoil is very strongly acid or strongly acid in the upper part and medium acid to mildly alkaline in the lower part. The shrink-swell potential is moderate. Rippable shale bedrock is at a depth of 40 to 60 inches.

In most areas this soil is used as cropland. This soil is suited to hay and pasture. It can be cropped successfully, but cropping systems should include a high proportion of long term hay or pasture. Erosion is a serious hazard, especially where the slopes are long. Subsurface drainage may be needed in areas of the included wetter soils. Hard clods and a crusty surface form if the soil is cultivated when it is soft and sticky. Minimum tillage, planting cover crops, tillage at optimum moisture content, and other management practices help reduce soil loss by erosion, improve tilth, and maintain the content of organic matter.

The soil is moderately well suited to use as woodland. Seedling mortality generally is not a problem. Laying out logging roads and skid trails on the contour facilitates the use of equipment and helps to prevent excessive erosion.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. Because of seasonal wetness it is better suited to houses without basements than to houses with basements. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements.

Buildings should be designed to conform to the natural shape of the land. Foundations and footings should be designed to prevent structural damage caused by the shrinking and swelling of the soil. The shale bedrock at a depth of 40 to 60 inches is rippable with heavy earthmoving equipment. Local roads and streets can be improved by strengthening or replacing the base material and providing artificial drainage to prevent damage from frost action and low strength. Cover should be maintained on the site as much as possible during construction to reduce soil loss by erosion. Trails in recreation areas should be protected against erosion and established across the slope where possible.

This soil is in capability subclass IVe and in woodland suitability subclass 3o.

EmD—Ellsworth silt loam, shale substratum, 12 to 18 percent slopes. This is a deep, moderately steep, moderately well drained soil on side slopes parallel to drainageways and on convex hillsides. Most areas are long and narrow and range from 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is brown, friable silt loam about 4 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown, firm silty clay loam; and the lower part is olive brown, mottled, firm silty clay and silty clay loam. Rippable shale bedrock is at a depth of about 42 inches. In some areas the surface layer is silty clay loam. In other areas shale bedrock is at a depth of more than 60 inches.

Included with this soil in mapping and making up about 10 percent of most areas are small areas of somewhat poorly drained Mahoning shale substratum soils along drainageways.

A water table is perched between depths of 24 and 36 inches in winter and spring. Permeability is slow. Runoff is very rapid. The root zone is mainly moderately deep to compact glacial till. The available water capacity is moderate. The soil is droughty during extended dry periods because of water loss through runoff. The subsoil is very strongly acid or strongly acid in the upper part and medium acid to mildly alkaline in the lower part. The shrink-swell potential is moderate. Rippable shale bedrock is at a depth of 40 to 60 inches.

In most areas this soil is used as pasture or woodland. In a few areas it is used as cropland. This soil is suited to grasses and legumes for pasture. Slope and the hazard of erosion severely limit the use of this soil for cultivated crops. Use of tillage equipment, especially large machines, is very difficult. This soil tends to be droughty in summer. Erosion is difficult to control in new seedings. Reseeding with cover crops or companion crops or by the trash mulch or no-till seeding method reduces the risk of erosion. Minimum tillage, good fertilization, and controlled grazing are important in helping to reduce soil loss by erosion, improve tilth, and maintain the content of organic matter.

This soil is moderately well suited to use as woodland. Slope limits the use of planting and logging equipment. Logging roads and skid trails should be protected against erosion by water bars and established across the slopes where possible.

The slope, seasonal wetness, and slow permeability limit the use of the soil as a site for buildings and septic tank absorption fields. The soil is moderately well suited to buildings that are specially designed. The shale bedrock, at a depth of 40 to 60 inches, is rippable with heavy earthmoving equipment. Housing developments and construction sites should be developed on the contour where possible. Foundations and footings should be designed to prevent structural damage caused by the shrinking and swelling of the soil. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Cover should be maintained on the site as much as possible during construction to reduce soil loss by erosion. Trench absorption fields are difficult to lay out and construct. Controlling the downhill flow of effluent is a serious concern. Most local roads require considerable excavation. Trails in recreation areas should be protected against erosion and laid out on the contour where possible.

This soil is in capability subclass VIe and in woodland suitability subclass 3r.

FcA—Fitchville silt loam, 0 to 2 percent slopes. This is a deep, nearly level, somewhat poorly drained soil on terraces and in basins of former glacial lakes. Most areas are oblong, broad, or irregular in shape and range from 10 to 200 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is yellowish brown and dark yellowish brown mottled, friable and firm silt loam and silty clay loam about 52 inches thick. The substratum to a depth of about 69 inches is yellowish brown, friable silt loam.

Included with this soil in mapping are small areas of moderately well drained Glenford soils on slight rises and poorly drained Sebring soils in shallow depressions and along drainageways. The included soils make up about 15 percent of most areas.

A water table is perched between depths of 12 and 30 inches in winter and spring and during other extended wet periods. Permeability is moderately slow. Runoff is slow. The root zone is deep, and the available water capacity is high. The subsoil ranges from very strongly acid to medium acid in the upper part and strongly acid to neutral in the lower part.

In most areas this soil is used as cropland. In drained areas it is well suited to cultivated crops, hay, and pasture. Row crops can be grown year after year. Planting is delayed in undrained areas. In undrained areas this soil can be used for water-tolerant grasses and legumes for hay and pasture. Surface drains help remove excess surface water, and subsurface drains help lower the water table. This soil is subject to crusting, compaction, and hard clodding if tillage or harvesting is done when the soil is wet. Using crop residue and planting cover crops improve the content of organic matter and tilth and increase water infiltration. Because of compaction, grazing should be limited to periods when the surface is not soft and sticky.

This soil is well suited to use as woodland. Species selected for planting should be tolerant of some wetness. Logging and planting can usually be done during the drier part of the year. Plant competition can be reduced by spraying, disking, or mowing.

This soil is not well suited as a site for buildings, recreation uses, and most sanitary facilities because of the seasonal high water table, moderately slow permeability, and low strength. It is better suited to houses without basements than to houses with basements. Storm sewers and ditches help lower the water table. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Local roads can be improved by using artificial drainage and suitable base material to reduce the damage from frost action and improve soil strength. Play areas and walkways need drainage and in some cases special surfacing.

This soil is in capability subclass IIw and in woodland suitability subclass 2o.

FcB—Fitchville silt loam, 2 to 6 percent slopes. This is a deep, gently sloping, somewhat poorly drained soil on slight convex knolls in basins of former glacial lakes and on terraces. Most areas are irregular in shape and range from 5 to 80 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is yellowish brown and strong brown, mottled, firm silt loam and silty clay loam about 36 inches thick. The substratum to a depth of about 60 inches is yellowish brown and brown, mottled, friable silt loam and silty clay loam. In a few areas silty clay layers are in the subsoil and substratum.

Included with this soil in mapping are small areas of moderately well drained Glenford soils on slight rises and poorly drained Sebring soils in shallow depressions and along drainageways. The included soils make up about 15 percent of most areas.

A water table is perched between depths of 12 and 30 inches in winter and spring and during other extended wet periods. Permeability is moderately slow. Runoff is slow to medium. The root zone is deep, and the available water capacity is high. The surface layer crusts after heavy rains. Reaction ranges from very strongly acid to medium acid in the upper part of the subsoil and from strongly acid to neutral in the lower part.

In most areas this soil is used as cropland. If it is artificially drained, this soil is suited to cultivated crops, hay, and pasture. Planting is delayed in undrained areas. Grasses and legumes for hay and pasture should be tolerant of wetness. Erosion is a hazard if the soil is cultivated. Minimum tillage and using crop residue and cover crops reduce erosion, maintain the content of organic matter, and improve tilth. Because of the hazard of compaction, grazing should be limited to periods when the surface is not soft and sticky.

In undrained areas this soil is well suited to use as woodland. However, the use of planting and harvesting equipment is limited during wet periods. Species selected for planting should be tolerant of some wetness. Logging and planting can usually be done during the drier part of the year.

This soil is not well suited as a site for buildings, recreation uses, and most sanitary facilities because of seasonal wetness, moderately slow permeability, and low strength. Drainage can be improved by subsurface drains, storm sewers, and open ditches. Although the slope provides some surface drainage, building sites should be landscaped for good surface drainage away from foundations. This soil is better suited to houses without basements than to houses with basements. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Local roads can be improved by providing artificial drainage and suitable base material to reduce the damage from frost action and improve soil strength. Excavations are limited during winter and spring because of wetness. Play areas and walkways need drainage and in some cases special surfacing. Cover should be maintained on the site as much as possible during construction to reduce soil loss by erosion.

This soil is in capability subclass IIe and in woodland suitability subclass 2o.

GbB—Geeburg silt loam, 2 to 6 percent slopes. This is a deep, gently sloping, moderately well drained soil on the top and side slopes of rises on broad undulating uplands. Most areas are irregular in shape and range from 5 to 120 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 23 inches thick. The upper part is yellowish brown, mottled, firm silty clay loam; and the middle and lower parts are dark yellowish brown, mottled, firm silty clay. The substratum to a depth of about 60 inches is dark yellowish brown and yellowish brown, firm silty clay that has mottles in the lower part.

Included with this soil in mapping are small areas of somewhat poorly drained soils that are similar to Geeburg soils except for being grayer in the subsoil. The included soils are in less sloping areas and make up about 15 percent of most areas.

A water table is perched between depths of 24 and 42 inches in winter and spring and during other extended wet periods. Permeability is very slow. Runoff is medium. The root zone is mainly moderately deep to compact glacial till. The available water capacity is moderate. Reaction is very strongly acid or strongly acid in the upper part of the subsoil and medium acid to mildly alkaline in the lower part. The shrink-swell potential is high.

In most areas this soil is used as cropland. It is suited to corn, wheat, oats, hay, and pasture. Under optimum management, this soil can be used for row crops year after year. Contour cultivation, minimum tillage, use of cover crops, and incorporating crop residue into the soil control erosion, improve tilth, and maintain the content of organic matter. Subsurface drainage is needed in areas of the included wetter soils and in wet-weather seeps. Hard clods and a crusty surface form if the soil is cultivated when it is soft and sticky. Grazing when the soil is wet destroys soil structure, reduces the quality of vegetation cover for erosion control, and lowers forage production.

This soil is suited to use as woodland. Machine planting of tree seedlings is practical on this soil. Species selected for planting should be tolerant of the high clay content in the subsoil.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. Because of seasonal wetness and the high shrink-swell potential, it is better suited to houses without basements than to houses with basements. Foundations and footings should be designed to prevent structural damage from the shrinking and swelling of the soil. Excavations around basements and foundations should be backfilled with soil that has a low shrink-swell potential. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Using artificial drainage and a suitable base material under local roads and streets reduces damage from low strength and from the shrinking and swelling of the soil. During the drier part of the year this soil is suited to recreation uses, picnic areas and paths and trails, for example.

This soil is in capability subclass IIIe and in woodland suitability subclass 2c.

GbC—Geeburg silt loam, 6 to 12 percent slopes. This is a deep, sloping, moderately well drained soil on ridgetops and uneven shoulder slopes and on side slopes along well defined waterways. Most areas range from 10 to 75 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 20 inches thick. The upper part is yellowish brown, firm silty clay; and the lower part is dark yellowish brown, mottled, firm silty clay. The substratum to a depth of about 60 inches is brown and yellowish brown, mottled, firm silty clay.

Included with this soil in mapping are small areas of Ellsworth soils, which have less clay in the subsoil, and small areas of somewhat poorly drained soils that, except for being grayer in the subsoil, are similar to Geeburg soils. These included soils comprise about 15 percent of most areas.

A water table is perched between depths of 24 and 42 inches in winter and spring and during other extended wet periods. Permeability is very slow. Runoff is rapid. The available water capacity is moderate. Reaction is very strongly acid or strongly acid in the upper part of the subsoil and medium acid to mildly alkaline in the lower part. The shrink-swell potential is high.

In most areas, this soil is used as cropland. It is suited to hay and pasture. It can be cropped successfully, but cropping systems should include a high proportion of long-term hay or pasture. Erosion is a serious hazard, especially where the slopes are long. Subsurface drainage may be needed in areas of the included wetter soils. Hard clods and a crusty surface form if the soil is cultivated when it is soft and sticky. Standard management practices, such as minimum tillage, use of cover crops, and tilling at proper moisture content, reduce erosion, improve tilth, and maintain the content of organic matter.

This soil is suited to use as woodland. Species selected for planting should be tolerant of the high clay content in the subsoil. Laying out logging roads and skid trails on the contour facilitates the use of equipment and helps to prevent excessive erosion. Using water bars in logging roads and skid trails will also reduce erosion.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. Because of the seasonal wetness and the high shrink-swell potential it is better suited to houses without basements than to houses with basements. Foundations and footings should be designed to prevent structural damage from the shrinking and swelling of the soil. Excavations around basements and foundations should be backfilled with soil having low shrink-swell potential. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Erosion is a serious hazard during construction, and cover should be maintained on the building site as much as possible. Local roads and streets can be improved by providing artificial drainage and replacing the surface layer and subsoil with a suitable base material. Trails in recreation areas should be protected from erosion and established across the slope wherever possible. Some areas are suitable sites for ponds.

This soil is in capability subclass IVe and in woodland suitability subclass 2c.

GfB—Glenford silt loam, 2 to 6 percent slopes. This is a deep, gently sloping, moderately well drained soil on convex parts of knolls on lake plains and stream terraces. Most areas are long and narrow or irregular in shape and range from 10 to 60 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 31 inches thick. It is yellowish brown, friable silt loam and firm silty clay loam that has mottles below a depth of about 12 inches. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam. In some areas thin strata of fine sandy loam, loam, silty clay loam, or fine sand are in the subsoil.

Included with this soil in mapping are small areas of somewhat poorly drained Fitchville soils in shallow depressions and along drainageways. Also included are small areas of moderately well drained Rawson soils that have more sand in the upper part of the subsoil. The included soils make up about 15 percent of most areas.

A water table is perched at a depth between 24 and 42 inches in winter and spring and during other extended wet periods. Permeability is moderately slow. Runoff is medium. The root zone is mainly deep, and the available water capacity is high. The surface layer is easily tilled within a fairly wide range of moisture content. The subsoil is very strongly acid to medium acid in the upper part and medium acid to neutral in the lower part.

In most areas this soil is used for farming. It is well suited to cultivated crops, hay, and pasture. It is easily farmed, although it is susceptible to surface crusting and erosion. Erosion is difficult to control in cultivated areas where the slopes are 4 to 6 percent. Minimum tillage, using crop residue, and growing cover crops reduce erosion, maintain the content of organic matter, and improve tilth. Subsurface drains are needed in areas of the included wetter soils.

This soil is suited to a wide variety of trees and shrubs. Machine planting of tree seedlings is practical on this soil. Plant competition can be reduced by spraying, mowing, or disking.

This soil is moderately well suited as a site for buildings and septic tank absorption fields. Because of the seasonal wetness, it is better suited to houses without basements than to houses with basements. Drains at the base of footings and a protective coating on exterior walls help prevent wet basements. Local roads can be improved by providing artificial drainage and suitable base material to reduce the risk of damage from frost action and low soil strength. The moderately slow permeability limits the effectiveness of septic tank absorption fields. This limitation can be partly overcome by increasing the size of the absorption area. The soil is well suited to paths and trails.

This soil is in capability subclass IIe and in woodland suitability subclass 1o.

GfC—Glenford silt loam, 6 to 12 percent slopes. This is a deep, sloping, moderately well drained soil on side slopes along drainageways. Most areas are long and narrow and range from 5 to 40 acres is size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 28 inches thick. The upper part is yellowish brown, firm silt loam and silty clay loam; and the middle and lower parts are yellowish brown and brown, mottled, firm silt loam and silty clay loam. The substratum to a depth of about 60 inches is light olive brown and yellowish brown, friable silt loam and silty clay loam. In some areas thin strata of fine sandy loam, loam, and fine sand are in the subsoil.

Included with this soil in mapping are small areas of somewhat poorly drained Fitchville soils in shallow depressions and along drainageways. Also included are small areas of moderately well drained Rawson soils that have more sand in the upper part of the subsoil. The included soils make up about 15 percent of most areas.

A water table is perched between depths of 24 and 42 inches in winter and spring and during other extended wet periods. Permeability is moderately slow. Runoff is rapid. The root zone is mainly deep, and the available water capacity is high. The surface layer is easily tilled within a fairly wide range of moisture content. The subsoil is very strongly acid to medium acid in the upper part and medium acid to neutral in the lower part.

This soil is well suited to hay and pasture. It can be cropped successfully, but cropping systems should include long-term hay and pasture. Erosion is a concern, especially where slopes are long. Using minimum tillage and growing cover crops improves the content of organic matter and tilth, reduces erosion, and increases water infiltration. Surface compaction, poor tilth, and increased runoff result from overgrazing or grazing when the soil is soft and sticky. Subsurface drains are needed in areas of the included wetter soils.

This soil is well suited to use as woodland. Laying out logging roads and skid trails on the contour facilitates the use of equipment and helps to prevent excessive erosion. Plant competition can be reduced by spraying, mowing, or disking.

This soil is moderately well suited as a site for buildings and septic tank absorption fields. Because of seasonal wetness, it is better suited to houses without basements than to houses with basements. Buildings should be designed to conform to the natural shape of the land. Land shaping is needed in some areas. Drains at the base of foundations and protective coatings on exterior walls help prevent wet basements. The moderately slow permeability limits the effectiveness of septic tank absorption fields. However, this limitation can be overcome by increasing the size of the absorption area. The distribution lines in absorption fields should be across the slope to reduce seepage of unfiltered effluent to the soil surface. Local roads and streets can be improved by providing artificial drainage and suitable base material to reduce the risk of damage caused by frost action and low strength. Cover should be maintained on the site as much as possible during construction to reduce soil loss by erosion.

This soil is in capability subclass IIIe and in woodland suitability subclass 1o.

HsA—Haskins loam, 0 to 2 percent slopes. This is a deep, nearly level, somewhat poorly drained soil on uplands and outwash plains. Most areas are irregular in shape and range from 10 to 40 acres in size.

Typically, the surface layer is dark brown, friable loam about 9 inches thick. The subsoil is about 37 inches thick. The upper and middle parts are yellowish brown and dark brown, mottled, firm loam, clay loam, sandy clay loam, and gravelly sandy clay loam; and the lower part is dark brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is brown, mottled, firm clay loam. In some areas the surface layer is sandy loam or silt loam. In some areas, the layers in the lower part of the subsoil and in the substratum are sandy loam or gravelly loam.

Included with this soil in mapping and making up about 15 percent of most areas are small areas of moderately well drained Rawson soil in higher convex areas on the landscape.

A water table is perched between depths of 12 and 30 inches in winter and spring and during other extended wet periods. Permeability is moderate in the upper and middle parts of the subsoil and slow or very slow in the lower part of the subsoil and in the substratum. Runoff is slow. The root zone is mainly moderately deep to compact glacial till or lacustrine material. The available water capacity is moderate. Reaction is strongly acid to slightly acid in the upper and middle parts of the subsoil and slightly acid to mildly alkaline in the lower part.

In most areas this soil is used for farming or as woodland. Seasonal wetness and slow or very slow permeability are the major limitations for farming. Wetness delays planting and limits the choice of crops. Drained areas are suited to corn, hay, and pasture. Undrained areas can be used for hay and pasture. However, maintaining desirable forage stands and minimizing soil compaction are difficult, especially in permanent pasture. Surface drains are needed; subsurface drains are commonly used to lower the perched water table. These drains are more effective if placed on or above the slowly or very slowly permeable glacial till or lacustrine material. Tilling at proper moisture content, using crop residue, growing cover crops, and other management practices improve tilth and increase the content of organic matter.

This soil is well suited to use as woodland. Species selected for planting should be tolerant of some wetness. Plant competition can be reduced by spraying, mowing, or disking.

This soil is poorly suited to septic tank absorption fields, and unless artificial drainage is provided it is poorly suited as a site for buildings. Because of seasonal wetness and lateral movement of water above the slowly or very slowly permeable glacial till or lacustrine material in the lower part of the soil, it is better suited to houses without basements than to houses with basements. Ditches and subsurface drains are used to improve drainage. Building sites should be landscaped for good surface drainage away from the foundation. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Local roads and parking lots can be improved by providing artificial drainage and suitable base material to reduce the damage from frost action.

This soil is in capability subclass IIw and in woodland suitability subclass 2o.

HsB—Haskins loam, 2 to 6 percent slopes. This is a deep, gently sloping, somewhat poorly drained soil on uplands and outwash plains. Most areas are irregular in shape and range from 2 to 85 acres in size.

Typically, the surface layer is dark brown, friable loam about 7 inches thick. The subsurface layer is brown, friable loam about 3 inches thick. The subsoil is about 33 inches thick. The upper and middle parts are yellowish brown and dark brown, mottled, friable loam and firm sandy clay loam and gravelly sandy clay loam; and the lower part is dark brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is brown, mottled, firm clay loam. In some areas the surface layer is silt loam or sandy loam. In some areas the lower part of the subsoil and the substratum are sandy loam or gravelly loam, and in other areas the entire subsoil and substratum are clay loam or silty clay loam.

Included with this soil in mapping and making up about 15 percent of most areas are small areas of moderately well drained Rawson soils in higher convex areas.

A water table is perched between depths of 12 and 30 inches in winter and spring and during other extended wet periods. Permeability is moderate in the upper and middle parts of the subsoil and slow or very slow in the lower part of the subsoil and in the substratum. Runoff is medium. The root zone is mainly moderately deep to compact glacial till or lacustrine material. The available moisture capacity is moderate. The surface layer is easily tilled within a fairly wide range of moisture content. Reaction is strongly acid to slightly acid in the upper and middle parts of the subsoil and slightly acid to mildly alkaline in the lower part.

In most areas this soil is used for farming or as woodland. In drained areas it is suited to cultivated crops, corn for example, and to small grains and hay. Planting is delayed in undrained areas. Soil loss by erosion is a hazard on long slopes that are cultivated. Subsurface drains are commonly used to lower the perched water table. These drains are more effective if placed on or above the slowly or very slowly permeable glacial till or lacustrine material. Minimum tillage, using crop residue, and planting cover crops reduce erosion, maintain the content of organic matter, and improve tilth. Grazing should be controlled, especially when the soil is soft and sticky, to prevent excessive compaction.

In undrained areas this soil is suited to use as woodland. Species selected for planting should be tolerant of some wetness. Plant competition can be reduced by spraying, mowing, or disking.

Because of seasonal wetness and lateral movement of water above the slowly or very slowly permeable glacial till or lacustrine material in the lower part of the soil, this soil is better suited to houses without basements than to houses with basements. It is poorly suited to septic tank absorption fields. Drainage ditches, storm sewers, and subsurface drains improve drainage. Drains at the base of footings and protective coatings on exterior walls help prevent wet basements. Local roads and streets can be improved by providing artificial drainage and suitable base material.

This soil is in capability subclass IIe and in woodland suitability subclass 2o.

Ho—Holly silt loam, frequently flooded. This is a deep, nearly level, poorly drained soil on flood plains. It is frequently flooded for long periods in fall, winter, and spring. Slopes are 0 to 2 percent. Most areas are long and narrow and range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 12 inches thick. It is dark gray, firm silt loam and clay loam that has mottles below a depth of about 12 inches. The substratum to a depth of about 60 inches is very dark gray and gray, mottled, friable and very friable clay loam, gravelly loam, sandy loam, and gravelly sandy loam. In some areas the surface layer is loam or sandy loam. In a few areas the subsoil and substratum have more clay.

Included with this soil in mapping and making up about 15 percent of most areas are narrow strips of somewhat poorly drained Orrville soils on slight rises.

The water table is near the soil surface in winter and spring and during other extended wet periods. Permeability is moderate or moderately slow. Runoff is very slow, and some areas are ponded. The root zone is deep. The available water capacity is high. The subsoil is neutral to strongly acid. The shrink-swell potential is low.

In most areas this soil is in wetland vegetation and woodland. Flooding and wetness limit the use of this soil for cultivated crops, hay, and pasture. Surface drains commonly remove ponded water. Subsurface drains are used in areas where outlets are available. If drainage and protection from flooding are provided, this soil is suited to row crops. Perennial plants selected for planting should be tolerant of wetness. This soil is poorly suited to grazing early in spring. Overgrazing or grazing when the soil is soft and sticky causes compaction and poor tilth.

This soil is suited to trees adapted to wet sites and is well suited to use as habitat for wetland wildlife. Planting should be done in the drier part of the year.

This soil is unsuited as a site for buildings, septic tank absorption fields, and most recreation uses because of frequent flooding, prolonged wetness, and moderate or moderately slow permeability. Diking to control flooding is difficult. Local roads can be improved by adding fill to raise the road above the flooding level and using a suitable base material to reduce damage from frost action and wetness.

This soil is in capability subclass IIIw and in woodland suitability subclass 2w.

JtA—Jimtown silt loam, 0 to 3 percent slopes. This is a deep, nearly level, somewhat poorly drained soil on stream terraces and outwash plains. Most areas are irregular in shape and range from 2 to 250 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 31 inches thick. The upper part is yellowish brown, mottled, friable and firm loam and sandy clay loam; and the lower part is yellowish brown, mottled, friable fine sandy loam and firm gravelly loam. The substratum to a depth of about 60 inches is dark grayish brown and dark gray, loose, gravelly loamy sand. In some areas the surface layer is loam or sandy loam. In some areas the substratum is silty clay loam or clay loam.

Included with this soil in mapping and making up about 15 percent of most areas are small areas of poorly drained Damascus soils in slight depressions.

The water table is between depths of 12 and 30 inches in winter and spring and during other extended wet periods. Permeability is moderate. Runoff is slow. The root zone is deep, and the available water capacity is moderate. The subsoil is very strongly acid to slightly acid. The shrink-swell potential is low.

In most areas this soil is used for farming. In some areas it is used as woodland. The major limitation for farming is seasonal wetness. Wetness delays planting and limits the choice of crops. Undrained areas can be used for hay and pasture; however, maintaining tilth and desirable forage stands is difficult. Drained areas are suited to corn, hay, and pasture. Subsurface drains can be used to lower the water table. Minimum tillage, growing cover crops, incorporating crop residue, and other management practices improve tilth and increase the content of organic matter. Grazing early in spring when the soil is soft can damage pasture plants. Pastures grow well during the dry part of summer.

In undrained areas this soil is suited to use as woodland and as habitat for openland and woodland wildlife. Species selected for planting should be tolerant of some wetness. Plant competition can be reduced by spraying, mowing, or disking.

Because of seasonal wetness, this soil is better suited to houses without basements than to houses with basements. Buildings should be located in the higher areas and landscaped for good surface drainage away from foundations. Drainage can be improved with subsurface drains, storm sewers, and open ditches. Unless artificial drainage is provided, the soil is poorly suited to septic tank absorption fields. Seepage from sanitary facilities can contaminate nearby ground water supplies. Local roads can be improved by providing artificial drainage and suitable base material to reduce the damage from frost action. Excavations are limited during winter and spring because of wetness and sloughing of banks. Wetness also limits use of this soil for recreation uses. It is better suited to picnic areas and golf fairways than to other recreation uses.

This soil is in capability subclass IIw and in woodland suitability subclass 2o.

LrB—Lordstown loam, 2 to 6 percent slopes. This is a moderately deep, gently sloping, well drained soil on side slopes and ridgetops. Most areas are long and narrow or irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is very dark grayish brown friable loam about 5 inches thick. The subsoil is dark yellowish brown and yellowish brown, friable channery loam and channery fine sandy loam about 30 inches thick. Thin-bedded sandstone bedrock is at a depth of about 35 inches. In some areas the surface layer is channery loam or silt loam.

Included with this soil in mapping and making up about 15 percent of most areas are small areas of soils that have bedrock at a depth of less than 20 inches.

Permeability is moderate. Runoff is medium. The root zone is mainly moderately deep to sandstone bedrock. The available water capacity is low. The surface layer is very strongly acid to slightly acid, and the subsoil is strongly acid or very strongly acid.

In most areas this soil is used as pasture or woodland. It is suited to corn, small grains, hay, and pasture and is well suited to grazing early in spring. This soil is not naturally highly productive, but it responds to good management. Erosion is a moderate hazard if this soil is cultivated. It is suited to the no-till or minimum tillage method of crop production. There are occasional periods of drought. Using crop residue, planting cover crops, and other management practices conserve moisture, control erosion, and improve tilth.

This soil is moderately well suited to use as woodland. Machine planting of tree seedlings is practical on this soil.

The good natural drainage and gentle slope of this soil are favorable for homesites. However, the soil is only moderately well suited to this use. The bedrock at a depth of 20 to 40 inches interferes with excavation for basements and utility lines. Because of the bedrock, this soil is better suited to houses without basements than to houses with basements.

The moderate depth to bedrock makes this soil poorly suited to septic tank absorption fields. The volume of soil over the bedrock is not enough to filter the effluent adequately. This soil is well suited to recreation uses, for example, camping and hiking trails.

This soil is in capability subclass IIe and in woodland suitability subclass 3o.

LrC—Lordstown loam, 6 to 12 percent slopes. This is a moderately deep, sloping, well drained soil on the upper part of hillsides on bedrock-controlled uplands. Most areas are long and narrow and range from 15 to 35 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 5 inches thick. The subsoil is dark yellowish brown and yellowish brown, friable channery loam and channery fine sandy loam about 25 inches thick. Thin-bedded sandstone bedrock is at a depth of about 30 inches. In some areas the surface layer is channery loam or silt loam.

Included with this soil in mapping are small areas of soils than have bedrock at a depth of less than 20 inches and a few areas that have bedrock at a depth of more than 40 inches. Bedrock outcroppings are in some areas. The included soils and rock outcroppings make up about 15 percent of most areas.

This soil warms and dries early in spring and is droughty during dry periods. Permeability is moderate. The root zone is mainly moderately deep to sandstone bedrock. The available water capacity is low. Runoff is rapid. The surface layer is very strongly acid to slightly acid, and the subsoil is strongly acid or very strongly acid.

In most areas this soil is used as woodland or pasture. It is suited to small grains, hay, and pasture and is especially well suited to grazing early in spring. If the soil is used for cultivated crops, erosion is a hazard, especially where the slopes are long. Erosion reduces the depth to the underlying bedrock and reduces the volume of soil from which plants can extract water and nutrients. In most areas this soil is suited to the no-till or minimum tillage method of crop production. Using crop residue, planting cover crops, and other management practices reduce erosion, conserve moisture, and maintain the content of organic matter.

This soil is moderately well suited to use as woodland. Water bars protect logging roads and skid trails from erosion. The slope permits all the common practices for woodland improvement and harvesting. Plant competition can be reduced by spraying, mowing, or disking.

Although the good natural drainage of this soil is favorable for homesites, it is only moderately well suited to this use. The underlying bedrock at a depth of 20 to 40 inches interferes with excavation for basements and utility lines. This soil is better suited to houses without basements than to houses with basements. Buildings should be designed to conform to the natural shape of the land. Because of droughtiness, lawns are difficult to establish during much of the year. Erosion is a hazard during construction. This hazard can be reduced by maintaining plant cover wherever possible.

This soil is poorly suited to use as a septic tank absorption field because of the moderate depth to bedrock. Inadequate filtration and downslope seepage of the effluent are likely to occur. Trails in recreation areas should be protected against erosion and established across the slope if possible.

This soil is in capability subclass IIIe and in woodland suitability subclass 3o.

LxD—Lordstown-Rock outcrop complex, 12 to 18 percent slopes. This complex consists of moderately deep, well drained, moderately steep Lordstown channery loam and areas of exposed bedrock on hillsides. The Lordstown soil is mainly on the lower part of side slopes, and the Rock outcrop is on the upper part. Areas are mostly long and narrow and range from 5 to 30 acres in size. About 65 percent of this complex is

Lordstown soil, about 20 percent is Rock outcrop, and the remaining 15 percent is other soils. The areas form such an intricate pattern that it was not practical to map them separately.

Typically, the surface layer of the Lordstown soil is very dark grayish brown, friable channery loam about 4 inches thick. The subsoil is dark yellowish brown and yellowish brown, friable channery loam and channery fine sandy loam about 24 inches thick. Sandstone bedrock is at a depth of about 28 inches.

Included with the Lordstown soil and Rock outcrop in mapping are small areas of shallow, somewhat excessively drained soils in which bedrock is at a depth of 10 to 20 inches. Some areas of stony or very stony soils and a few seep areas are also included. These inclusions make up about 15 percent of the mapped areas.

The Lordstown soil warms and dries early in spring and is droughty. Permeability is moderate. The root zone is mainly the 20 to 40 inches of soil over sandstone bedrock. The available water capacity is low. Runoff is very rapid. The surface layer is very strongly acid to slightly acid, and the subsoil is strongly acid or very strongly acid.

In most areas this complex is used as woodland and pasture. It is suited to hay or improved pasture. Pasture can be grazed early in spring, but pasture plants do not grow well during the dry part of summer. The Rock outcrop seriously interferes with cultivation. Reseeding can be done by the trash mulch or no-till seeding method.

The Lordstown soil is moderately well suited to use as woodland. The slope and rock outcrops moderately limit the use of equipment. Seedling growth is improved if competing vegetation is controlled or removed by cutting, spraying, girdling, or mowing. Logging roads and skid trails should be protected from erosion by water bars or other practices.

This complex is poorly suited as a site for buildings, sanitary facilities, and most recreation uses. The bedrock interferes with excavation for basements and utility lines. Cover should be maintained on the site as much as possible during construction to reduce the hazard of erosion. Trails in recreation areas should be protected against erosion and established across the slope if possible.

This complex is in capability subclass VIe. The Lordstown soil is in woodland suitability subclass 3r. The Rock outcrop was not assigned a woodland suitability subclass.

LxF—Lordstown-Rock outcrop complex, 18 to 70 percent slopes. This complex consists of moderately deep, well drained, steep and very steep Lordstown channery loam and areas of exposed bedrock on hillsides. The Lordstown soil is mainly on the lower parts of side slopes, and the Rock outcrop is on the upper parts. Areas are mostly long and narrow and range from 3 to 25 acres in size. About 50 percent of this complex is Lordstown soil, 30 percent is Rock outcrop, and the remaining 20 percent is other soils. The areas form such an intricate pattern that it was not practical to map them separately.

Typically, the surface layer of the Lordstown soil is very dark grayish brown, very friable channery loam about 4 inches thick. The subsurface layer is brown, very friable channery loam about 2 inches thick. The subsoil is dark yellowish brown and yellowish brown, friable channery fine sandy loam and channery loam about 15 inches thick. The substratum is yellowish brown, friable very channery fine sandy loam. Thin-bedded sandstone bedrock is at a depth of about 28 inches.

Included with the Lordstown soil and Rock outcrop in mapping and making up about 10 percent of most areas are small areas of shallow, somewhat excessively drained soils in which bedrock is at a depth of 10 to 20 inches.

The Lordstown soil warms and dries early in spring and is droughty. Permeability is moderate. The root zone is mainly 20 to 40 inches of soil over sandstone bedrock. The available water capacity is low. Runoff is very rapid. The subsoil is strongly acid or very strongly acid.

In most areas this complex is used as woodland. The Lordstown soil is moderately well suited to this use. The Lordstown soil is well suited to habitat for woodland wildlife. Logging and establishing new plantations are very difficult. Logging roads and skid trails can be protected from erosion by water bars.

Construction for urban uses and recreation is difficult, and erosion is a very severe hazard if vegetation is removed. Trails in recreation areas should be protected from erosion and established across the slope where possible.

This complex is in capability subclass VIIe. The Lordstown soil is in woodland suitability subclass 3r. The Rock outcrop is not assigned to a woodland suitability subclass.

LyB—Loudonville silt loam, 2 to 6 percent slopes. This is a moderately deep, gently sloping, well drained soil on side slopes and ridgetops on uplands. Most areas are long and narrow or irregular in shape and range from 3 to 10 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 26 inches thick. The upper part is yellowish brown and dark yellowish brown, friable loam and firm clay loam; and the lower part is yellowish brown, firm loam and friable sandy loam. Sandstone bedrock is at a depth of about 34 inches. In some areas the surface layer is channery silt loam. In other areas bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of somewhat poorly drained Mitiwanga soils on flatter areas. Also included are small areas of deep moderately well drained Ellsworth and Rittman soils. The included soils make up about 15 percent of most areas.

Permeability is moderate. Runoff is medium. The root zone is moderately deep to sandstone bedrock. The available water capacity is low. The surface layer and subsoil are very strongly acid to medium acid, except where lime has been added.

In most areas this soil is in permanent pasture or woodland. In a few areas it is used for cultivated crops. This soil is suited to corn, small grains, hay, and pasture. Erosion is a moderate hazard if the soil is cultivated. This soil is well suited to grazing early in spring. This soil is not naturally highly productive, but it responds to good management. It is suited to the no-till or minimum tillage method of crop production. Using crop residue, planting cover crops, and other management practices conserve moisture, control erosion, and improve tilth. Pasture rotation and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is well suited to use as woodland. The slope permits all common practices for woodland improvement and for harvesting.

Although the good natural drainage is favorable for homesites, this soil is only moderately well suited to this use. The bedrock at a depth of 20 to 40 inches interferes with excavations for basements and utility lines. Because of the bedrock this soil is better suited to houses without basements than to houses with basements.

The moderate depth to bedrock makes this soil poorly suited for septic tank absorption fields. The volume of soil over the bedrock is not enough to filter the effluent adequately. This soil is well suited to recreation uses, for example, camping and paths and trails.

This soil is in capability subclass IIe and in woodland suitability subclass 2o.

LyC—Loudonville silt loam, 6 to 12 percent slopes. This is a moderately deep, sloping, well drained soil on side slopes and ridgetops on uplands. Most areas are irregular in shape and range from 5 to 45 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 23 inches thick. The upper part is brown and yellowish brown, firm loam and clay loam; and the lower part is yellowish brown, firm loam and friable sandy loam. Sandstone bedrock is at a depth of about 30 inches. In some areas the surface layer is channery silt loam. In a few areas bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping and comprising about 15 percent of most areas are small areas of deep, moderately well drained Ellsworth and Rittman soils.

Permeability is moderate. Runoff is rapid. The root zone is mainly moderately deep to sandstone bedrock. The available water capacity is low. The surface layer and subsoil are very strongly acid to medium acid, except where lime has been added.

In most areas this soil is in permanent pasture or woodland. In a few areas it is used for cultivated crops and hay. This soil is suited to corn, small grains, hay, and pasture. It is especially well suited to grazing early in spring. The hazard of erosion limits the use of this soil for cultivated crops. Crops commonly do not get enough water for good growth during long dry periods, especially in areas where bedrock is at a depth of less than 20 inches. Erosion reduces the depth to the underlying bedrock and reduces the volume of soil from which plants can extract water and nutrients. In most areas this soil is suited to the no-till or minimum tillage method of crop production. Contour tillage, using crop residue, planting cover crops, and other management practices help reduce erosion, conserve moisture, and maintain the content of organic matter.

This soil is suited to use as woodland. Logging roads and skid trails can be protected from erosion by water bars or other practices. Plant competition can be reduced by spraying, mowing, or disking. The slope permits all the common practices for woodland improvement and harvesting.

Although the good natural drainage is favorable for homesites, this soil is only moderately well suited to this use. The underlying bedrock at a depth of 20 to 40 inches interferes with excavations for basements and utility lines. This soil is better suited to houses without basements than to houses with basements. Buildings should be designed to conform to the natural shape of the land. Erosion is a hazard during construction. This hazard can be reduced by maintaining plant cover wherever possible.

This soil is poorly suited to use as a septic tank absorption field because of the moderate depth to bedrock. Inadequate filtration and downslope seepage of the effluent is likely to occur. Trails in recreation areas should be protected against erosion and established across the slope if possible.

This soil is in capability subclass IIIe and in woodland suitability subclass 2o.

MgA—Mahoning silt loam, 0 to 2 percent slopes. This is a deep, nearly level, somewhat poorly drained soil on uplands. It is in broad areas on flats and in small areas at the head of waterways. Most areas are irregular in shape and range from 10 to 150 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is dark yellowish brown and brown, mottled, firm silty clay loam and clay about 30 inches thick. The substratum to a depth of about 60 inches is brown and dark yellowish brown, firm silty clay loam and clay loam.

Included with this soil in mapping are small areas of moderately well drained Ellsworth soils on slight rises. Also included are small areas of poorly drained Canadice and Sebring soils in depressions. These included soils make up about 15 percent of most areas.

A water table is perched between depths of 12 to 30 inches in winter and spring and during other extended wet periods. Permeability is slow or very slow. Runoff is slow. This soil warms and dries slowly in spring, even if it is artificially drained. The root zone is mainly restricted to the moderately deep zone above the compact glacial till. The available water capacity is moderate. Except where lime has been added, reaction is strongly acid or very strongly acid in the surface layer and upper part of the subsoil and medium acid to mildly alkaline in the lower part of the subsoil. The shrink-swell potential is moderate.

In most areas this soil is used for cultivated crops, hay, and pasture. In some areas it is reverting to natural vegetation. The major limitations to the use of this soil for cultivated crops are wetness and slow or very slow permeability. In drained areas the soil is suited to corn and to grasses and legumes for hay and pasture. Planting is delayed and the choice of crops is limited in undrained areas. Both surface and subsurface drains are used to improve drainage. Subsurface drains must be closely spaced to give uniform drainage. This soil needs to be cultivated at a suitable moisture content because it is sticky and soft when wet. Hard clods and a crusty surface form if it is cultivated when wet. Grazing should be controlled to prevent compaction. Returning crop residue and planting cover crops increase water infiltration and help improve the content of organic matter and tilth.

This soil is suited to use as woodland. Plant competition can be reduced by spraying, mowing, or disking. Species tolerant of some wetness and the fairly high clay content in the subsoil should be selected for planting.

This soil is poorly suited to septic tank absorption fields, and unless artificial drainage is provided it is poorly suited as a site for buildings. Because of seasonal wetness, it is better suited to houses without basements than to houses with basements. Building sites should be landscaped for good surface drainage away from the foundation. Foundations and footings should be designed to prevent structural damage caused by the shrinking and swelling of the soil. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Local roads and streets can be improved by using artifical drainage and suitable base material to reduce damage from frost action and low strength. Drainage is needed for intensive recreation uses, for example, ballfields and tennis courts.

This soil is in capability subclass IIIw and in woodland suitability subclass 2c.

MgB—Mahoning silt loam, 2 to 6 percent slopes. This is a deep, gently sloping, somewhat poorly drained soil in broad areas on uplands. The areas range from 20 to 250 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is dark yellowish brown, yellowish brown, and grayish brown, mottled, firm silty clay loam about 28 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, firm silty clay loam.

Included with this soil in mapping are small areas of moderately well drained Ellsworth soils on slight rises. Also included are small areas of poorly drained Canadice and Sebring soils in depressions. These included soils make up about 15 percent of most areas.

This soil has a water table perched between depths of 12 and 30 inches in winter and spring and during other extended wet periods. Permeability is slow or very slow. Runoff is medium. This soil warms and dries slowly in spring, even if it is artificially drained. The root zone is mainly restricted to the moderately deep zone above the compact glacial till. The available water capacity is moderate. Except where lime has been added, reaction is strongly acid or very strongly acid in the surface layer and upper part of the subsoil and medium acid to mildly alkaline in the lower part of the subsoil. The shrink-swell potential is moderate.

In most areas this soil is used for cultivated crops, hay, and pasture. In some areas it is used as woodland or is reverting to natural vegetation. In drained areas this soil is suited to cultivated crops, hay, and pasture. Wetness and slow or very slow permeability limit the suitability of this soil for crops that are planted early in spring. In undrained areas this soil can be used for hay and pasture. However, minimizing soil compaction and maintaining desirable forage stands are difficult. Both surface and subsurface drains help improve drainage. Subsurface drains must be closely spaced to provide uniform drainage. Hard clods and a crusty surface form if the soil is cultivated when soft and sticky. Maintaining good tilth and controlling erosion are difficult in intensively cultivated areas. Tilling and harvesting at the proper moisture level, planting cover crops, incorporating crop residue, and other management practices help improve tilth, increase the content of organic matter, and control erosion.

This soil is suited to trees, and in some areas it is in native hardwoods. Plant competition can be reduced by spraying, mowing, or disking. Species tolerant of some wetness and the fairly high content of clay in the subsoil should be selected for planting.

Because of seasonal wetness, this soil is better suited to houses without basements than to houses with basements. It is poorly suited to septic tank absorption fields because of the seasonal high water table and slow or very slow permeability. Building sites should be landscaped for good surface drainage away from the foundation. Foundations and footings should be designed to prevent structural damage caused by the shrinking and swelling of the soil. Ditches and subsurface drainage are used to improve drainage. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Excavations are limited by wetness in winter and spring. Providing artificial drainage and suitable base material under local roads helps reduce damage from frost action and low strength. Drainage is needed for intensive recreation uses, for example, ballfields and tennis courts. In some areas this soil is suited to use as pond sites.

This soil is in capability subclass IIIe and in woodland suitability subclass 2c.

MgC—Mahoning silt loam, 6 to 12 percent slopes. This is a deep, sloping, somewhat poorly drained soil on hillsides and on side slopes parallel to drainageways. Most areas are irregular in shape and range from 15 to 40 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is dark yellowish brown and yellowish brown, mottled, firm silty clay loam and clay about 24 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown and brown, firm silty clay loam and clay loam. In some eroded areas the surface layer is brown or yellowish brown silty clay loam.

Included with this soil in mapping and making up about 15 percent of most areas are small areas of moderately well drained Ellsworth soils on the steeper part of the unit.

A water table is perched between depths of 12 to 30 inches in winter and spring and during other extended wet periods. Permeability is slow or very slow. Runoff is rapid. This soil warms and dries slowly in spring, even if it is artificially drained. The root zone is mainly restricted to the moderately deep zone above the compact glacial till. The available water capacity is moderate. Except where lime has been added reaction is strongly acid or very strongly acid in the surface layer and upper part of the subsoil and medium acid to mildly alkaline in the lower part of the subsoil. The shrink-swell potential is moderate.

In most areas this soil is used for cultivated crops, hay, and pasture. In some areas it is used as woodland or is reverting to natural vegetation. This soil is suited to use for hay and pasture. It can be cropped successfully; however, the system should include a high proportion of long-term hay or pasture. Erosion is a serious hazard, especially where the slopes are long. Subsurface drainage is needed for optimum yields. Hard clods and a crusty surface form if the soil is cultivated when it is soft and sticky. Minimum tillage, cover crops, contour tillage, tilling at optimum moisture content, and other management practices reduce soil loss by erosion, improve tilth, and maintain the content of organic matter.

This soil is suited to use as woodland. Species selected for planting should be tolerant of some wetness and of the fairly high clay content in the subsoil. Laying out logging roads and skid trails on the contour facilitates the use of equipment and helps to prevent excessive erosion.

Because of seasonal wetness, this soil is better suited to houses without basements than to houses with basements. It is poorly suited to septic tank absorption fields because of the seasonal high water table and slow or very slow permeability. Surface water should be diverted away from foundations. Drains at the base of footings and a coating on exterior basement walls help prevent wet basements. Foundations and footings should be designed to prevent structural damage caused by the shrinking and swelling of the soil. Cover should be maintained on the site as much as possible during construction to reduce the severe hazard of erosion. Local roads can be improved by providing artificial drainage and a suitable base material. Trails in recreation areas should be protected from erosion and established across the slope wherever possible. Some areas are suitable sites for ponds.

This soil is in capability subclass IVe and in woodland suitability subclass 2c.

MsA—Mahoning silt loam, shale substratum, 0 to 2 percent slopes. This is a deep, nearly level, somewhat poorly drained soil on flats on uplands. The areas are irregular in shape and commonly range from 2 to 90 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 42 inches thick. The upper part is yellowish brown, mottled, firm silty clay loam; and the lower part is dark yellowish brown and brown, mottled, firm silty clay loam and silty clay. The substratum is yellowish brown, firm silty clay. Weathered shale bedrock is at a depth of about 58 inches. In a few areas the depth to weathered shale bedrock is more than 60 inches.

Included with this soil in mapping and making up about 15 percent of most areas are some small areas of poorly drained soils that have gray mottles in the subsoil.

A water table is perched at a depth of 12 to 30 inches in winter and spring and during other extended wet periods. Permeability and runoff are slow. Rippable shale bedrock is at a depth of 40 to 60 inches. This soil warms and dries slowly in spring, even if it is artificially drained. The root zone is mainly restricted to the moderately deep zone above the compact glacial till. The available water capacity is moderate. Reaction is strongly acid or very strongly acid in the surface layer and upper part of the subsoil, except where lime has been added.

This soil is used mainly for cultivated crops, hay, and pasture and as woodland. Seasonal wetness and slow permeability limit the use of this soil for farming. Planting is delayed and the choice of crops is limited in undrained areas. These areas can be used for hay and pasture, but maintaining desirable forage stands and tilth is difficult. In drained areas this soil is suited to corn, hay, and pasture. Both surface and subsurface drains are used to improve drainage in most areas. This soil needs to be cultivated at suitable moisture content because it is sticky when wet. Hard clods and a crusty surface form if this soil is cultivated when wet. Grazing should be controlled to reduce compaction. Returning crop residue, using cover crops, and tilling and harvesting at proper moisture content help to increase water infiltration and maintain the content of organic matter and tilth.

This soil is suited to use as woodland. Plant competition can be reduced by spraying, mowing, or disking. Species selected for planting should be tolerant of some wetness and a fairly high clay content in the subsoil.

This soil is poorly suited to septic tank absorption fields and unless artificial drainage is provided, it is poorly suited as a site for buildings. Because of seasonal wetness, it is better suited to houses without basements than to houses with basements. Building sites should be landscaped to provide good surface drainage away from the foundation. Ditches and subsurface drains are also used to improve drainage. Foundations and footings should be designed to prevent structural damage caused by the shrinking and swelling of the soil. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. The shale bedrock at a depth of 40 to 60 inches is rippable with heavy excavation equipment. Artificial drainage and suitable base material help reduce damage to local roads and streets from frost action and low strength.

This soil is in capability subclass IIIw and in woodland suitability subclass 2c.

MsB—Mahoning silt loam, shale substratum, 2 to 6 percent slopes. This is a deep, gently sloping, somewhat poorly drained soil in slightly convex areas between drainageways. The areas are irregular in shape and range from 3 to 50 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 9 inches thick. The subsoil is about 39 inches thick. The upper part is yellowish brown, mottled, firm silty clay loam; and the lower part is dark yellowish brown and brown, mottled, firm silty clay loam and silty clay. The substratum is yellowish brown, firm silty clay. Weathered shale bedrock is at a depth of about 58 inches. In a few areas the depth to weathered shale bedrock is more than 60 inches.

Included with this soil in mapping and making up about 10 percent of most areas are small areas in depressions of poorly drained soils whose subsoil has gray mottles.

A water table is perched at a depth of 12 to 30 inches in winter and spring and during other extended wet periods. Permeability is slow. Runoff is medium. Rippable shale bedrock is at a depth of 40 to 60 inches. This soil warms and dries slowly in spring, even if it is artificially drained. The root zone is mainly restricted to the moderately deep zone above the compact glacial till. The available water capacity is moderate. The surface layer and subsoil are very strongly acid to strongly acid, except where lime has been added.

This soil is used about equally for cultivated crops, hay, and pasture and as woodland. Seasonal wetness and slow permeability limit farming. In undrained areas, planting is delayed, and the choice of crops is limited. These areas can be used for hay and pasture, but maintaining desirable forage stands and tilth is difficult. Drained areas are suited to corn, hay, and pasture. Both surface and subsurface drains are used to improve drainage in most areas. This soil needs to be cultivated at a suitable moisture content because it is sticky when wet. Hard clods and a crusty surface form if the soil is cultivated when wet. Grazing should be controlled to reduce compaction. Erosion is a hazard when cultivated crops are grown. Returning crop residue, planting cover crops, and tilling and harvesting at proper moisture content help reduce soil loss by erosion, increase water infiltration, and maintain the content of organic matter and tilth.

The soil is suited to woodland. Plant competition can be reduced by spraying, mowing, or disking. Species selected for planting should be tolerant of some wetness and the fairly high clay content in the subsoil.

Because of seasonal wetness, this soil is better suited to houses without basements than to houses with basements. It is poorly suited to septic tank absorption fields because of the seasonal high water table and slow permeability. Foundations and footings should be designed to prevent structural damage caused by the shrinking and swelling of the soil. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. The shale bedrock at a depth of 40 to 60 inches is rippable with heavy excavation equipment. Providing artificial drainage and suitable base material under local roads helps reduce damage from frost action and low strength. Drainage is needed for intensive recreation areas, for example, ballfields and tennis courts.

This soil is in capability subclass IIIe and in woodland suitability subclass 2c.

MtA—Mitiwanga silt loam, 0 to 3 percent slopes. This is a moderately deep, nearly level, somewhat poorly drained soil on bedrock-controlled landforms on uplands. Most areas are irregular in shape and range from 5 to 120 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 22 inches thick. The upper part is yellowish brown and grayish brown, mottled, firm silt loam and silty clay loam; and the lower part is dark yellowish brown, motttled, firm clay loam. Sandstone bedrock is at a depth of about 31 inches. In some areas the surface layer is loam.

Included with this soil and making up about 15 percent of most areas are small, low-lying areas of poorly drained soils that have a gray subsoil.

A water table is perched between depths of 12 and 30 inches in winter and spring and during other extended wet periods. This soil warms and dries slowly in spring, even if it is artificially drained. Permeability is moderate. Runoff is slow. The root zone is mainly moderately deep to sandstone bedrock. The available water capacity is low. The shrink-swell potential is moderate in the subsoil. Reaction is very strongly acid to medium acid in the surface layer and subsoil, except where lime has been added.

In most areas this soil is used as pasture and woodland. In a few areas it is used for cultivated crops and hay. Seasonal wetness and moderate depth to bedrock limit the use of this soil for farming. Unless artificially drained, this soil is poorly suited to cultivation. Wetness delays planting and limits the choice of crops. In undrained areas the soil can be used for hay and pasture, but maintaining soil tilth and desirable forage stands is difficult. Surface and subsurface drains can be used; however, the hard sandstone bedrock commonly hinders the installation of drains, and outlets are not available in many areas. This soil is subject to surface crusting, compaction, and hard clodding if tillage or harvesting is done when the soil is soft and sticky. Tillage and harvesting should be done at optimum moisture content using equipment that minimizes soil compaction. Using crop residue and cover crops improves the content of organic matter and tilth.

This soil is suited to use as woodland. Species that tolerate some wetness should be selected for reforestation. Plant competition can be reduced by spraying, mowing, or disking.

This soil is poorly suited as a site for building and sanitary facilities because of the seasonal wetness and hard bedrock at a depth of 20 to 40 inches. Surface drains and storm sewers can be used to remove surface water. Buildings should be landscaped for surface drainage away from the foundations. This soil is better suited to houses without basements than houses with basements. The underlying bedrock interferes with excavations for basements and utility lines. Local roads can be improved by providing artificial drainage and suitable base material to reduce damage from frost action and wetness. The soil is better suited to picnic areas and paths and trails than to most other recreation uses.

This soil in in capability subclass IIw and in woodland suitability subclass 3o.

Or—Orrville silt loam, frequently flooded. This is a deep, nearly level, somewhat poorly drained soil on flood plains. It is frequently flooded for very brief to brief periods in fall, winter, and spring. Slopes are 0 to 2 percent. Most areas are long and narrow and range from 5 to 120 acres.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 25 inches thick. It is yellowish brown and grayish brown, friable silt loam and loam that has mottles in the upper part. The substratum to a depth of about 60 inches is gray, friable and loose fine sandy loam, loamy fine sand, and gravelly loamy sand that has mottles in the upper part.

Included with this soil in mapping and making up about 15 percent of most areas are narrow strips of poorly drained Holly and very poorly drained Wabasha soils in slight depressions and old meander channels and well drained Tioga soils on slight rises.

The water table is between depths of 12 and 30 inches in winter and spring and during other extended wet periods. Permeability is moderate. Runoff is slow. The root zone is deep, and the available water capacity is high. Reaction is strongly acid to slightly acid in the surface layer and subsoil, except where lime has been added. The shrink-swell potential is low.

In most areas this soil is used as pasture or woodland. Flooding and seasonal wetness limit farming. Wetness delays planting and limits the choice of crops. Undrained areas can be used for pasture, but maintaining tilth and desirable forage stands is difficult. Drained areas are suited to row crops, corn, for example. Surface drainage can be used to remove excess surface water. Subsurface drainage is also needed, but suitable outlets are difficult to establish in some areas. Growing cover crops helps maintain the content of organic matter and protect the surface during flooding.

This soil is well suited to use as woodland. Species selected for planting should be able to withstand flooding and be tolerant of some wetness. Seedlings grow well if competing vegetation is controlled or removed by such practices as spraying, mowing, or disking.

This soil is unsuited as a site for buildings, septic tank absorption fields, and most recreation uses because of the flooding hazard and seasonal wetness. During the drier part of the year this soil is suited to some recreation uses, hiking, for example. The use of dikes to control flooding is difficult. Local roads and streets can be improved by using fill to raise the road above the flooding level and a suitable base material to reduce the damage from frost action. Sloughing is a hazard in excavations.

This soil is in capability subclass IIw and in woodland suitability subclass 2o.

OsB—Oshtemo sandy loam, 2 to 6 percent slopes. This is a deep, gently sloping, well drained soil on outwash terraces and kames. Most areas are irregular in shape and range from 3 to 25 acres in size.

Typically, the surface layer is dark grayish brown, friable sandy loam about 9 inches thick. The subsoil is about 43 inches thick. The upper part is dark brown, friable sandy loam; and the lower part is dark brown, firm sandy clay loam and loose loamy sand. The substratum to a depth of about 66 inches is brown, loose loamy sand and gravelly loamy sand. In some areas the surface layer is loam. In a few areas the subsoil has more gravel and clay.

Permeability is moderately rapid in the upper part of the subsoil and very rapid in the substratum. Runoff is slow. The root zone is deep, and the available water capacity is moderate or low. The surface layer and subsoil are commonly strongly acid to slightly acid. The shrink-swell potential is low.

In most areas this soil is used for cultivated crops. It is well suited to small grains, hay, and early spring pasture. If the soil is irrigated, it is well suited to cultivated and specialty crops. No-till or minimum tillage is a suitable practice. Growth of pasture is slow in summer because the soil is droughty. Deep-rooted plants, for example, alfalfa, make the best growth during dry periods. Using crop residue, growing cover crops, and other management practices conserve moisture, improve tilth, reduce erosion, and maintain the content of organic matter. Because nutrients are moderately rapidly leached, this soil generally responds better to smaller but more frequent, timely applications of fertilizer than to one large application.

This soil is moderately well suited to use as woodland. Machine planting of tree seedlings is practical on this soil. Plant competition can be reduced by spraying, mowing, or disking. Species adapted to dry sites should be selected for planting.

This soil is well suited as a site for buildings, local roads and streets, and most recreation uses. It is poorly suited to some sanitary facilities, especially sewage lagoons and sanitary landfills, because of the possible contamination of ground water. Sloughing is a hazard in excavations. There may be some difficulty establishing a lawn because of the moderate or low available water capacity. This soil is a probable source of sand.

This soil is in capability subclass IIIs and in woodland suitability subclass 3o.

OsC—Oshtemo sandy loam, 6 to 12 percent slopes. This is a deep, sloping, well drained soil on outwash terraces. Most areas are irregular in shape and range from 5 to 25 acres in size.

Typically, the surface layer is dark grayish brown, friable sandy loam about 6 inches thick. The subsoil is about 30 inches thick. The upper part is dark brown, friable sandy loam; and the lower part is dark brown and brown, firm sandy clay loam and loose loamy sand. The substratum to a depth of about 60 inches is yellowish brown, loose loamy sand. In some areas thin lenses of gravelly loam are in the substratum. In other areas the subsoil has more gravel and clay.

Permeability is moderately rapid in the upper part of the subsoil and very rapid in the substratum. Runoff is medium. The root zone is deep, and the available water capacity is moderate or low. The surface layer and subsoil are commonly strongly acid to slightly acid. The shrink-swell potential is low.

In most areas this soil is used as cropland. It is moderately well suited to cultivated crops. Erosion is a severe hazard if the soil is cultivated. This soil can be cropped successfully, but the cropping system should include a high proportion of long-term hay or pasture. Conservation of moisture is very important because of droughtiness. The soil is better suited to early-maturing crops than to late-maturing crops. Deep-rooted plants such as alfalfa make the best growth during dry periods. No-till or minimum tillage, using crop residue, planting cover crops, and other management practices help to control erosion, conserve moisture, and maintain the content of organic matter. Because nutrients are moderately rapidly leached, this soil generally responds better to smaller but more frequent or more timely applications of fertilizer than to one large application.

This soil is moderately well suited to use as woodland. Tree seedlings are difficult to establish during dry periods. Plant competition can be controlled by spraying, mowing, or disking. Species adapted to dry sites should be selected for planting.

The soil is suited as a site for buildings, local roads and streets, and recreation uses, although the slope is moderately limiting. Sanitary facilities, such as sewage lagoons and sanitary landfills, are limited by the possible pollution of underground water supplies. Buildings should be designed to conform to the natural slope of the land. Land shaping is needed in some areas. Sloughing is a hazard in excavations. Cover should be maintained on the site as much as possible during construction to reduce soil loss by erosion. Trails in recreation areas should be protected against erosion and established across the slope if possible. This soil is a probable source of sand.

This soil is in capability subclass IIIe and in woodland suitability subclass 3o.

Pg—Pits, gravel. Gravel pits consist of surface-mined areas from which aggregate material has been removed for construction, from areas of its natural geological occurence. Gravel pits are on kames and outwash terraces. Typically, they are associated with Chili, Oshtemo, Bogart, and other soils that are underlain by gravel and sand outwash. Most pits range from 2 to 50 acres in size. Actively mined pits are continually being enlarged. Most pits characteristically have a high wall on one or more sides.

The material that is mined consists of stratified layers of gravel and sand of varying thickness and orientation. The kind and grain size of aggregate are relatively uniform within any one layer but commonly differ from layer to layer. Some layers contain a significant amount of silt and sand. Selectivity in mining is commonly feasible.

The material that remains after mining is generally unsuited to plants. The content of organic matter and available water capacity are low.

This unit is commonly not used for farming or as woodland.

This unit is not assigned to a capability subclass or a woodland suitability subclass.

Pq—Pits, quarry. This map unit consists of open excavations from which sandstone bedrock has been removed by strip mining. These quarries are commonly in areas where the layer of soil material is relatively thin over sandstone bedrock. Typically, quarries are adjacent to areas of Lordstown, Loudonville, and Mitiwanga soils. The mined areas range from 3 to 80 acres in size.

Because of the nature of strip mining, all overlying soil material has been removed and spread out as spoil adjacent to the excavations, or it has been used as fill or as base under access roads. The soil material in spoil banks varies within short horizontal distances. Generally, the stripped soil material is very low in content of organic matter and has a variable available water capacity. Therefore, it is poorly suited to the growth of plants. It is subject to erosion and is a source of siltation.

Establishing vegetation in areas that are no longer mined reduces the hazard of erosion. Grasses and trees that can tolerate the fairly low available water capacity and the unfavorable soil properties should be selected for seeding and planting. Blanketing the area with favorable soil material may be necessary to establish a good vegetative cover.

Ponded areas of this land type are generally suitable for development of habitat for wildlife and some recreation uses.

This unit is not assigned to a capability subclass or a woodland suitability subclass.

PsA—Platea silt loam, 0 to 2 percent slopes. This is a deep, nearly level, somewhat poorly drained soil on broad flats on uplands. Most areas are irregular in shape and range from 5 to 120 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 37 inches thick. The upper part is yellowish brown, mottled, friable silt loam and firm silty clay loam; the middle part is a dark yellowish brown, very firm and brittle, silty clay loam fragipan that has mottles between depths of about 17 and 34 inches; and the lower part is dark yellowish brown, firm silt loam. The substratum to a depth of about 60 inches is yellowish brown, firm silt loam.

Included with this soil in mapping and making up about 15 percent of most areas are small areas of poorly drained Sheffield soils in depressions.

A water table is perched between depths of 6 and 24 inches in winter and spring and during other extended wet periods. Permeability is moderately slow in the upper part of the subsoil and very slow in the fragipan. This soil dries slowly in spring. Runoff is slow. The root zone is restricted mainly to the zone above the fragipan. This zone has a low water capacity and is extremely acid to medium acid, except where lime has been added.

In most areas this soil is used as woodland or pasture. In a few areas it is used for cultivated crops. Wetness limits suitability of this soil for crops planted early in spring and for grazing early in spring. In drained areas the soil is suited to corn, wheat, hay, and pasture. In undrained areas it can be used for hay and pasture, but minimizing soil compaction and maintaining desirable forage stands are difficult. Surface drains are used to remove excess surface water. Subsurface drains are used to remove excess water from the root zone. These drains must be closely spaced for uniform drainage. This soil needs to be cultivated at a suitable moisture content because it is sticky and soft when wet. Hard clods and a crusty surface form if it is cultivated when wet. Using crop residue and planting cover crops improve the content of organic matter and tilth and increase water infiltration.

This soil is suited to use as woodland. Species selected for planting should be tolerant of some wetness and the root-restricting layer in the lower part of the subsoil. Plant competition can be reduced by spraying, mowing, and disking.

Because of seasonal wetness, this soil is better suited to houses without basements than to houses with basements. It is poorly suited to septic tank absorption fields because of the seasonal wetness and very slowly permeable fragipan. Building sites should be landscaped for good surface drainage away from the foundation. Ditches and subsurface drains are used to improve drainage. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Local roads can be improved by using artificial drainage and suitable base material to reduce damage from frost action, wetness, and low strength. Wetness also limits use of this soil for recreation.

This soil is in capability subclass IIIw and in woodland suitability subclass 2d.

PsB—Platea silt loam, 2 to 6 percent slopes. This is a deep, gently sloping, somewhat poorly drained soil on slightly convex low knolls and side slopes on uplands. Most areas are irregular in shape and range from 20 to 80 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 27 inches thick. The upper part is yellowish brown and light olive brown, mottled, firm silt loam and silty clay loam; and the lower part is a brown and dark yellowish brown, mottled, very firm and brittle silty clay loam fragipan. The substratum to a depth of about 60 inches is brown and grayish brown, mottled, firm silty clay loam.

Included with this soil in mapping and making up about 15 percent of most areas are small areas of poorly drained Sheffield soils in depressions.

A water table is perched above the very slowly permeable fragipan in winter and spring and during other extended wet periods. This soil dries slowly in spring. Runoff is medium. The root zone is restricted mainly to the zone above the fragipan. This zone has a low available water capacity and is extremely acid to medium acid, except where lime has been added.

In most areas this soil is used for cultivated crops and hay. Wetness delays planting and limits the choice of crops. It also delays grazing in spring. In drained areas the soil is suited to corn, hay, and pasture. In undrained areas it can be used for hay and pasture, but minimizing soil compaction and maintaining desirable forage stands are difficult. Subsurface drains are used to remove excess water from the subsoil. They should be closely spaced for uniform drainage. Maintaining good tilth is important in reducing surface crusting and erosion.

Planting cover crops, using crop residue, and other management practices improve the content of organic matter and tilth, help reduce soil loss by erosion, and increase water infiltration.

This soil is suited to use as woodland. Species selected for planting should be tolerant of some wetness and the root-restricting layer in the lower part of the subsoil.

Because of seasonal wetness, this soil is better suited to houses without basements than to houses with basements. It is poorly suited to septic tank absorption fields because of the seasonal high water table and very slowly permeable fragipan. Building sites should be landscaped for surface drainage away from the foundation. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Local roads can be improved by using artificial drainage and suitable base material to reduce damage from frost action, wetness, and low strength. Some areas are good pond sites.

This soil is in capability subclass IIIe and in woodland suitability subclass 2d.

ReA—Ravenna silt loam, 0 to 2 percent slopes. This is a deep, nearly level, somewhat poorly drained soil on uplands. Most areas are broad or irregular in shape and range from 15 to 75 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 45 inches thick. The upper part is yellowish brown and brown, mottled, friable and firm loam and clay loam; the middle part is a dark brown and yellowish brown, mottled, very firm, dense loam fragipan; and the lower part is brown, mottled, firm loam. The substratum to a depth of about 60 inches is brown, firm loam.

Included with this soil in mapping are small areas of moderately well drained Canfield soils on slight rises. Also included are small areas of poorly drained Sebring soils in depressions. The included soils make up about 10 percent of most areas.

Permeability is moderate above the fragipan and slow in the fragipan. A water table is perched between depths of 6 and 24 inches in winter and spring and during other extended wet periods. Runoff is slow. The root zone is mainly restricted to the moderately deep zone above the fragipan. This zone has a low available water capacity and is very strongly acid to medium acid, except where lime has been added.

In most areas this soil is used for cultivated crops and hay. Wetness limits suitability of this soil for crops planted early in spring and for grazing early in spring. In drained areas the soil is suited to corn, hay, and pasture. In undrained areas it can be used for hay and pasture, but minimizing soil compaction and maintaining desirable forage stands are difficult. Surface and subsurface drains are used to remove excess water. Because of the slowly permeable fragipan, subsurface drains should be closely spaced for uniform drainage. This soil is highly susceptible to surface crusting. Using crop residue and planting cover crops improves the content of organic matter and tilth and increases water infiltration. Perennial plants selected for planting should be tolerant of wetness. Grazing should be controlled to prevent excessive compaction.

In undrained areas this soil is suited to use as woodland. Species selected for planting should be tolerant of some wetness and the root-restricting layer in the lower part of the subsoil. Plant competition can be reduced by spraying, mowing, or disking.

This soil is poorly suited to septic tank absorption fields, and unless artificial drainage is provided it is poorly suited as a site for buildings. Because of seasonal wetness, it is better suited to houses without basements than to houses with basements. Ditches and subsurface drains are used to improve drainage. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Building sites should be landscaped for good surface drainage away from foundations. Local roads can be improved by providing artificial drainage and suitable base material. The soil is suited to pond reservoirs. Drainage is needed for intensive recreation uses, ballfields and tennis courts, for example.

This soil is in capability subclass IIw and in woodland suitability subclass 2d.

ReB—Ravenna silt loam, 2 to 6 percent slopes. This is a deep, gently sloping, somewhat poorly drained soil on low knolls on uplands. Most areas are broad or irregular in shape and range from 15 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 41 inches thick. The upper part is yellowish brown, mottled, friable and firm silt loam, loam, and clay loam; the middle part is a dark yellowish brown and dark brown, mottled, firm, dense loam fragipan; and the lower part is brown, firm loam. The substratum to a depth of about 60 inches is brown, firm loam.

Included with this soil in mapping are small areas of poorly drained Sebring soils in depressions and drainageways. Small areas of the moderately well drained Canfield soils are included on some of the higher knolls. The included soils make up about 10 percent of most areas.

Permeability is moderate above the fragipan and slow in the fragipan. A water table is perched between depths of 6 to 24 inches in winter and spring and during other extended wet periods. Runoff is medium. The root zone is mainly restricted to the moderately deep zone above the fragipan. This zone has a low available water capacity and is very strongly acid to medium acid, except where lime has been added.

In most areas this soil is used for cultivated crops and hay. Wetness delays planting and limits the choice of crops. In drained areas the soil is suited to corn, hay, and pasture. In undrained areas it can be used for hay and pasture, but minimizing soil compaction and maintaining desirable forage stands is difficult. Because of the slowly permeable fragipan, subsurface drains should be closely spaced for uniform drainage. Maintaining good tilth is important in reducing surface crusting and erosion. Planting cover crops, using crop residue, and other management practices improve the content of organic matter and tilth, help reduce soil loss by erosion, and increase water infiltration. Grazing should be controlled to prevent excessive compaction.

In undrained areas this soil is suited to use as woodland. Species selected for planting should be tolerant of wetness and the root-restricting layer in the lower part of the subsoil.

Because of seasonal wetness, this soil is better suited to houses without basements than to houses with basements. It is poorly suited to septic tank absorption fields because of the seasonal high water table and slowly permeable fragipan. Although the slope provides some surface drainage, building sites should be landscaped for good surface drainage away from foundations. Ditches and subsurface drains are used to improve drainage. Drains at the base of footings and coatings on exterior basement walls help to prevent wet basements. Local roads can be improved by providing artificial drainage and suitable base material to reduce damage from wetness and frost action. Drainage is needed for intensive recreation uses, ballfields and tennis courts, for example.

This soil is in capability subclass IIe and in woodland suitability subclass 2d.

RmB—Rawson loam, 2 to 6 percent slopes. This is a deep, gently sloping, moderately well drained soil on terraces and uplands. Most areas are long and narrow or irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is dark brown loam about 7 inches thick. The subsoil is about 26 inches thick. The upper part is brown, friable loam; the middle part is yellowish brown and dark yellowish brown, mottled, firm gravelly sandy clay loam; and the lower part is dark yellowish brown, firm clay loam. The substratum to a depth of about 80 inches is dark yellowish brown and yellowish brown, firm silty clay loam and clay loam that has mottles above a depth of about 62 inches. In some areas the surface layer is silt loam, sandy loam, or gravelly loam. In some areas the lower part of the subsoil and the substratum are loam, gravelly loam, or gravelly sandy clay loam.

Included with this soil in mapping and making up about 15 percent of most areas are small areas of somewhat poorly drained Haskins soils in nearly level areas.

A water table is perched between depths of 30 to 48 inches in winter and spring and during other extended wet periods. Permeability is moderate in the upper and middle parts of the subsoil and slow or very slow in the lower part of the subsoil and in the substratum. Runoff is medium. The root zone is mainly moderately deep to compact glacial till or lacustrine material. The available water capacity is moderate. The surface layer is easily tilled within a fairly wide range of moisture content. Reaction in the subsoil ranges from strongly acid to mildly alkaline.

In most areas this soil is used as cropland. This soil is suited to corn, small grains, hay, and pasture. It is especially well suited to crops that mature early in the season. Erosion is the main hazard. Returning crop residue, minimum tillage, contour tillage, growing meadow crops in the cropping sequence, and other management practices commonly help to control erosion, improve tilth, and increase water infiltration. Subsurface drains are used in areas of the included wetter soils and to drain seep spots. The soil is moderately well suited to grazing early in spring. Surface compaction, reduced growth, and poor tilth result from overgrazing or grazing when the soil is soft and sticky.

The soil is well suited to trees, and in a few areas it supports native hardwoods. Seedlings make good growth if competing vegetation is controlled or removed by cutting, spraying, girdling, or mowing.

This soil is moderately well suited as a site for buildings and some sanitary facilities and recreation uses. The seasonal wetness, moderate shrink-swell potential, and slow or very slow permeability in the lower part of the soil limit this soil for these uses. This soil is better suited to houses without basements than to houses with basements. Building sites should be landscaped for good surface drainage away from the foundation. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Increased runoff and erosion occur during construction. They can be reduced by maintaining soil cover wherever possible. Septic tank absorption fields can be improved by increasing the size of the absorption areas. Local roads can be improved by providing suitable base material to reduce the damage from frost action.

This soil is in capability subclass IIe and in woodland suitability subclass 2o.

RsB—Rittman silt loam, 2 to 6 percent slopes. This is a deep, gently sloping, moderately well drained soil on knolls and side slopes at the heads of drainageways on uplands. Most areas are irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 45 inches thick. The upper part is yellowish brown and dark yellowish brown, friable silt loam and firm clay loam; the middle part is dark yellowish brown, very firm, dense clay loam fragipan; and the lower part is dark yellowish brown, firm clay loam. The subsoil is mottled between depths of 15 and 30 inches. The substratum to a depth of about 60 inches is brown, firm clay loam.

Included with this soil in mapping and making up about 15 percent of most areas are small areas of somewhat poorly drained Wadsworth soils on foot slopes and in slight depressions.

A water table is perched between depths of 24 and 36 inches in winter and spring and during other extended wet periods. Permeability is moderate above the fragipan and slow in the fragipan and substratum. Runoff is medium. The root zone is mainly restricted to the zone above the fragipan. This zone has a low available water capacity and is very strongly acid to medium acid, except where lime has been added.

In most areas this soil is used as cropland or pasture. A few areas are in woodland. It is suited to corn, soybeans, hay, and pasture. Row crops can be grown frequently if management is intensive. Grasses and legumes that are tolerant of some wetness are suitable for hay and pasture. This soil tends to erode easily. It is subject to surface crusting and compaction if tillage and harvesting are done when the soil is soft and sticky. Tillage and harvesting should be done at optimum moisture content. Using crop residue and planting cover crops improve the content of organic matter and tilth, help control soil loss by erosion, and increase water infiltration. Slight seasonal wetness delays planting in some areas. Subsurface drains may be needed in areas of the included wetter soils, but water moves slowly into the drains.

This soil is well suited to use as woodland. Machine planting of tree seedlings is practical on this soil. Plant competition can be reduced by spraying, mowing, or disking.

This soil is moderately well suited as a site for buildings. Because of the seasonal wetness, it is better suited to houses without basements than to houses with basements. Drains at the base of footings and coatings on exterior walls help prevent wet basements. Local roads and streets can be improved by providing artificial drainage and suitable base material to reduce damage from frost action. Because of slow permeability and seasonal wetness, it is poorly suited to septic tank absorption fields. It is well suited to recreation uses, golf fairways and paths and trails, for example. It is also suited to pond reservoir areas.

This soil is in capability subclass IIe and in woodland suitability subclass 1o.

RsC—Rittman silt loam, 6 to 12 percent slopes. This is a deep, sloping, moderately well drained soil on ridgetops and on side slopes along well defined waterways. Most areas are long and narrow and range from 3 to 50 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 45 inches thick. The upper part is yellowish brown, mottled, friable silt loam and firm clay loam; and the lower part is dark yellowish brown, very firm, dense clay loam fragipan. The substratum to a depth of about 60 inches is yellowish brown and dark yellowish brown, mottled, firm clay loam and silty clay loam.

Included with this soil in mapping are small areas of somewhat poorly drained Wadsworth soils on foot slopes and along drainageways. The included soils make up as much as 10 percent of most areas.

A water table is perched between depths of 24 and 36 inches in winter and spring and during other extended wet periods. Permeability is moderate above the fragipan and slow in the fragipan and substratum. Runoff is rapid. The root zone is mainly restricted to the moderately deep zone above the dense fragipan. This zone has a low available water capacity and is very strongly acid to medium acid, except where lime has been added.

In most areas this soil is used as cropland and pasture. In a few areas it is used as woodland. This soil is well suited to hay and pasture. It can be cropped successfully; however, the cropping system should include long-term hay and pasture. Erosion is a concern, especially where the slopes are long. Hard clods and a crusty surface form if the soil is cultivated when soft and sticky. Using minimum tillage, contour tillage, sod waterways, and planting cover crops improves the content of organic matter and tilth, helps reduce soil loss by erosion, and increases water infiltration. Subsurface drainage may be needed in areas of the included wetter soils.

This soil is suited to use as woodland. Laying out logging roads and skid trails on the contour facilitates the use of equipment and helps to prevent excessive erosion. Plant competition can be reduced by spraying, mowing, or disking.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. Because of seasonal wetness, it is better suited to houses without basements than to houses with basements. Buildings should be designed to conform to the natural shape of the land. Land shaping is needed in some areas. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Local roads can be improved by strengthening or replacing the base material and providing artificial drainage to prevent damage from frost action. The distribution lines in septic tank fields should be across the slope to prevent seepage to the soil surface. Increased runoff and erosion occur during construction. These can be reduced by maintaining plant cover wherever possible. Areas where this soil is on both side slopes of small natural drainageways often are good pond sites. This soil is well suited to paths and trails.

This soil is in capability subclass IIIe and in woodland suitability subclass 1o.

RsC2—Rittman silt loam, 6 to 12 percent slopes, eroded. This is a deep, sloping, moderately well drained soil on convex ridgetops, hillsides, and side slopes parallel to drainageways on uplands. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material that has more coarse fragments into the present surface layer. Most areas are irregular in shape and range from 3 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 5 inches thick. The subsoil is about 45 inches thick. The upper part is yellowish brown and dark yellowish brown, mottled, firm silty clay loam and clay loam; and the lower part is a dark yellowish brown, very firm and brittle, clay loam fragipan. The substratum to a depth of about 60 inches is brown, firm clay loam.

Included with this soil in mapping are small areas of somewhat poorly drained Wadsworth soils on foot slopes, along drainageways, and in seep spots. Also included are narrow bands of Orrville soils along drainageways. These included soils make up about 15 percent of most areas.

A water table is perched between depths of 24 and 36 inches in winter and spring and during other extended wet periods. The content of organic matter is moderately low. Permeability is moderate above the fragipan and slow in the fragipan and substratum. Runoff is rapid. The root zone is mainly restricted to the moderately deep zone above the dense fragipan. This zone has a low available water capacity and is very strongly acid to medium acid, except where lime has been added. The shrink-swell potential is moderate in the upper part of the subsoil and low in the lower part.

In most areas this soil is used as cropland. In some areas the soil was once cultivated but is now reverting to natural vegetation. This soil is well suited to hay and pasture. It can be cropped successfully; however, the cropping system should include long-term hay and pasture. Erosion is a concern, especially where the slopes are long. Hard clods and a crusty surface form if the soil is cultivated when it is soft and sticky. Using minimum tillage and planting cover crops improve the content of organic matter and tilth, help reduce soil loss by erosion, and increase water infiltration. Random subsurface drainage may be needed in areas of the included wetter soils. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to use as woodland. Laying out logging roads and skid trails on the contour facilitates the use of equipment and helps prevent excessive erosion. Plant competition can be reduced by spraying, mowing, or disking.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. Because of seasonal wetness, it is better suited to houses without basements than to houses with basements. Buildings should be designed to conform to the natural shape of the land. Land shaping is needed in some areas. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Local roads can be improved by strengthening or replacing the base material and providing artificial drainage to prevent damage from frost action. The distribution lines in septic tank absorption fields should be across the slope to prevent seepage to the soil surface. Increased runoff and erosion occur during construction. These can be reduced by maintaining plant cover wherever possible. Areas where this soil is on both side slopes of small natural drainageways are good pond sites. This soil is well suited to paths and trails.

This soil is in capability subclass IIIe and in woodland suitability subclass 1o.

RsD—Rittman silt loam, 12 to 18 percent slopes. This is a deep, moderately steep, moderately well drained soil on convex hillsides and side slopes parallel to drainageways. Most areas range from 3 to 25 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 45 inches thick. The upper part is yellowish brown, mottled, very firm, dense clay loam fragipan. The substratum to a depth of about 60 inches is yellowish brown and dark yellowish brown, firm clay loam and silty clay loam.

Included with this soil in mapping are small areas of somewhat poorly drained Wadsworth soils on foot slopes, along drainageways, and in seep spots. These included soils make up as much as 10 percent of the larger areas.

A water table is perched between depths of 24 and 36 inches in winter and spring and during other extended wet periods. Permeability is moderate above the fragipan and slow in the fragipan and substratum. Runoff is very rapid. The root zone is mainly restricted to the moderately deep zone above the dense fragipan. This zone has a low available water capacity and is very strongly acid to medium acid.

In most areas this soil is used as woodland. In a few areas it is used as cropland and pasture. The major limitations for cultivated crops are the slope and the severe hazard of erosion. Using tillage equipment, especially large machines, is very difficult. This soil is suited to grass and legumes for pasture. Erosion is difficult to control in new seedings unless reseeding is done with companion crops or by the trash mulch or no-till seeding method. A thick plant cover helps control erosion. This soil is highly susceptible to surface crusting if it is cultivated. Minimum tillage, good fertilization, and controlled grazing are important.

This soil is suited to use as woodland. Slope limits the use of planting and logging equipment. Logging roads and skid trails should be laid out on the contour as much as possible and protected from erosion by water bars.

Buildings with special design are moderately well suited to this soil. The slope, slow permeability, and seasonal wetness severely limit the use of this soil as a site for buildings and sanitary facilities. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Trench absorption fields are difficult to lay out and construct. Controlling the downhill flow of effluent is a serious concern. Most local roads require considerable excavation. Cover should be maintained on the site as much as possible during construction to reduce the erosion hazard. Trails in recreation areas should be protected against erosion and laid out on the contour, if possible.

This soil is in capability subclass IVe and in woodland suitability subclass 1r.

RsE—Rittman silt loam, 18 to 25 percent slopes. This is a steep, deep, moderately well drained soil on side slopes along deep and well defined dissected drainageways on uplands. Most areas are irregular in shape, although some areas are long and narrow. The areas range from 5 to 25 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 5 inches thick. The subsoil is about 40 inches thick. In the upper part it is brown and yellowish brown, mottled, firm clay loam and silty clay loam, and in the lower part it is a brown and dark yellowish brown, mottled, very firm, brittle clay loam fragipan. The substratum to a depth of about 60 inches is dark yellowish brown and brown, firm clay loam and silty clay loam. In eroded areas the surface layer is dark brown, firm silty clay loam.

Included with this soil in mapping are narrow strips of moderately deep Lordstown soils on the lower part of the side slopes. Also included are narrow bands of somewhat poorly drained Orrville soils along drainageways. The included soils make up as much as 10 percent of most areas.

The water table is perched between depths of 24 and 36 inches during wet periods. Permeability is moderate above the fragipan and slow in the fragipan and substratum. Runoff is very rapid. In most places the root zone is moderately deep. It is restricted to the layers above the dense fragipan. This zone has a low available water capacity and is very strongly acid or medium acid unless lime has been added to the soil.

In most areas this soil is used as woodland. In a few areas it is used as pasture. Reseeding by the trash mulch or no-till seeding method reduces the risk of erosion. Pasture rotation and restricted use during wet periods help keep the pasture and soil in good condition.

Large areas of this soil are used for native hardwoods. The soil is well suited to trees and to use as habitat for woodland wildlife. The slope limits the use of equipment. Logging roads and skid trails should be constructed on the contour and protected against erosion by water bars or other practices.

This soil is generally poorly suited to use as sites for buildings and sanitary facilities. Construction is difficult because of the steep slopes. Erosion is a severe hazard if vegetation is removed. Cover should be maintained on building sites as much as possible during construction. Trails in recreation areas should be protected against erosion and laid out on the contour where possible.

This soil is in capability subclass VIe and in woodland suitability subclass 1r.

RsF—Rittman silt loam, 25 to 50 percent slopes. This is a deep, very steep, moderately well drained soil on hillsides and sides of V-shaped valleys formed by deeply entrenched drainageways. Most areas are long and narrow and range from 5 to 40 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 5 inches thick. The subsoil is about 40 inches thick. The upper part is brown and yellowish brown, firm silty clay loam and clay loam; and the lower part is dark yellowish brown, mottled, very firm, dense clay loam fragipan. The substratum to a depth of about 60 inches is dark yellowish brown and brown, firm clay loam.

Included with this soil in mapping are narrow bands of somewhat poorly drained Orrville soils along drainageways. These included soils make up as much as 10 percent of most areas.

The water table is perched between depths of 24 to 36 inches in winter and spring and during other extended wet periods. Permeability is moderate above the fragipan and slow in the fragipan and substratum. Runoff is very rapid. The root zone is mainly restricted to the moderately deep zone above the dense fragipan. This zone has a low available water capacity and is very strongly acid to medium acid, except where lime has been added.

In most areas this soil is used as woodland. Because of the very steep slope, this soil is very poorly suited to use for crops and pasture. Erosion is a very severe hazard unless a thick plant cover is maintained. This soil is suited to trees and habitat for woodland wildlife. The slope severely limits the use of planting and harvesting equipment. Logging roads and skid trails should be well designed and protected from erosion by water bars or other practices.

This soil is unsuited as a site for buildings and septic tank absorption fields. Construction for recreation and urban uses is very difficult, and the hazard of erosion is very high if vegetation is removed. Most slopes are unstable and subject to slippage. Slope stability needs to be considered prior to cutting or filling. Trails in recreation areas should be protected against erosion and established across the slope if possible.

The soil is in capability subclass VIIe and in woodland suitability subclass 1r.

Sb—Sebring silt loam. This is a deep, nearly level, poorly drained soil in basins of former glacial lakes and on terraces. It receives runoff from adjacent higher lying soils and is subject to ponding. Most areas are irregular in shape and range from 5 to 20 acres in size. Slope is 0 to 2 percent.

Typically, the surface layer is very dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is grayish brown, mottled, friable silt loam about 5 inches thick. The subsoil is about 36 inches thick. The upper and middle parts are light brownish gray, mottled, friable and firm silt loam and silty clay loam; and the lower part is yellowish brown, mottled, firm silt loam and silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam that has mottles in the upper 4 inches.

Included with this soil in mapping and making up about 15 percent of most areas are small areas of somewhat poorly drained Fitchville soils on slight rises.

A water table is perched near or above the soil surface in winter and spring and during other extended wet periods. Permeability is moderately slow. The root zone is deep and has a high available water capacity. Runoff is very slow or ponded. The subsoil is medium acid to very strongly acid in the upper part and strongly acid to neutral in the lower part.

In most undrained areas this soil is in woodland and brush. In drained areas it is used for general farm crops. Seasonal wetness severely limits the use of this soil for cultivated crops. In drained areas the soil is suited to some cultivated crops, corn, for example, and to water-tolerant grasses and legumes for hay and pasture. Surface drains are commonly used to remove excess surface water. Subsurface drains can be used to lower the seasonal high water table. However, establishing this type of drainage is difficult because this soil is in low positions on the landscape. Tillage and grazing when the soil is wet causes compaction. Using crop residue, growing cover crops, and tilling and harvesting at proper moisture content are important management practices.

This soil is suited to use as woodland. Use of planting and harvesting equipment is limited during wet seasons. Species selected for planting should be tolerant of wetness. Reforestation with desirable species is difficult because of severe plant competition. Plant competition can be reduced by spraying, mowing, or disking.

This soil is poorly suited as a site for buildings, sanitary facilities, and recreation uses. Moderately slow permeability, ponding, and low strength limit the soil for these uses. Artificial drains are somewhat effective in reducing the wetness. Building sites should be landscaped for good surface drainage away from the foundations. Local roads and streets can be improved by providing artificial drainage and suitable base material to reduce the damage from frost action and wetness and improve soil strength. This soil is a poor source of foundation material, dam fill, or roadfill. Most play areas and walkways need special surfacing.

This soil is in capability subclass IIIw and in woodland suitability subclass 2w.

Sf—Sheffield silt loam. This is a deep, nearly level, poorly drained soil in low-lying or depressional areas and at the heads of drainageways on uplands. It receives runoff from adjacent higher lying soils and is subject to ponding. Slope is 0 to 2 percent. Most areas are irregular in shape and range from 2 to 150 acres in size.

Typically, the surface layer is dark gray, friable silt loam about 8 inches thick. The subsoil is about 32 inches thick. The upper part is light brownish gray, mottled, firm silt loam and silty clay loam; and the lower part is grayish brown and yellowish brown, mottled, firm, dense silty clay loam fragipan. The substratum to a depth of about 60 inches is brown, mottled, firm silty clay loam. In some areas the surface layer is dark grayish brown. In other areas the subsoil does not have a fragipan.

Included with this soil in mapping and making up about 15 percent of most areas are small areas of somewhat poorly drained Platea soils on slight rises.

A seasonal high water table is near or above the surface in winter and spring and during other extended wet periods. Permeability is very slow in the fragipan and moderately slow in the upper part of the subsoil above the fragipan and in the substratum. Runoff is very slow or ponded. The root zone is mainly moderately deep to the fragipan. The available water capacity of this zone is low. The root zone is very strongly acid to slightly acid, except where lime has been added.

This soil is used mainly as woodland and pasture. The major limitations for farming are the very slowly permeable fragipan and seasonal wetness. If the soil is drained, it is suited to crops, hay, and pasture. In drained areas it can be used for hay and pasture, but maintaining tilth and desirable forage stands is difficult. Surface drains are commonly used to improve drainage because movement of water into subsurface drains is very slow. The soil is subject to surface crusting, compaction, and hard clodding if tillage or harvesting is done when the soil is wet. Using crop residue and planting cover crops increase water infiltration and improve the content of organic matter and tilth.

This soil is suited to use as woodland. Use of harvesting equipment is limited during wet seasons. Logging and planting can usually be performed during the drier part of the year. Plant competition can be reduced by spraying, mowing, or disking.

This soil is poorly suited as a site for buildings, recreation uses, and most sanitary facilities. If used for buildings, it is better suited to houses without basements than to houses with basements. Foundations and footings should be designed to prevent structural damage caused by frost action. The soil is suited to sewage lagoons. Sanitary facilities should be connected to central sewers and treatment facilities, if possible. Local roads and streets can be improved by providing artificial drainage and suitable base material to reduce the damage from frost action and improve soil strength. Play areas and walkways usually need special surfacing.

This soil is in capability subclass IIIw and in woodland suitability subclass 2w.

Tg—Tioga loam, frequently flooded. This is a deep, nearly level, well drained soil in the highest positions on flood plains. It is frequently flooded for brief periods in the fall, winter, and spring. Slope is 0 to 2 percent. Most areas are long and narrow and range from 10 to 120 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 10 inches thick. The subsoil is yellowish brown, very friable sandy loam about 20 inches thick. The substratum to a depth of about 62 inches is yellowish brown and brown, loose loamy sand and gravelly loamy sand. In some areas the surface layer is sandy loam or fine sandy loam.

Included with this soil in mapping and making up about 15 percent of most areas are narrow strips of somewhat poorly drained Orrville soils in slightly lower positions on the flood plains.

Permeability is moderate or moderately rapid. Runoff is slow. The root zone is deep and has a moderate available water capacity. The water table is at a depth of 36 to 72 inches in winter and spring. The surface layer and subsoil are strongly acid to slightly acid. This soil has good workability.

This soil is used mainly as woodland and pasture. The major limitation for cultivated crops is flooding. Although the choice of crops is limited, this soil is well suited to corn and soybeans. Some crops, for example, winter wheat, may be severely damaged by flooding in winter and early in spring. This soil is suited to grasses and legumes for pasture. Planting cover crops is important in maintaining the content of organic matter and in protecting the surface during flooding. Tree seedlings that are not damaged by flooding make good growth if competing vegetation is controlled or removed by such practices as spraying, mowing, or disking.

This soil is unsuited as a site for most buildings and sanitary facilities. Diking to control flooding is difficult. Filling helps elevate roads above the normal flood level. This soil is suited to extensive recreation uses, for example, golf fairways, hiking trails, and picnic areas. Special measures are needed in some places to control streambank erosion and gouging by floodwaters.

This soil is in capability subclass IIw and in woodland suitability subclass 2o.

Ud—Udorthents, loamy. These soils are in areas of cut and fill. Where the soil material has been removed, the material is typically similar to the material in the subsoil or substratum of adjacent soils. In fill or disposal areas, the soil material has more variable characteristics because it usually consists of varying amounts of material from the subsoil and substratum of nearby soils. Slope is dominantly 2 to 6 inches, although it ranges from 0 to 10 percent.

Typically, the upper 60 inches is silty clay loam, clay loam, or silt loam. Some of the areas on terraces and flood plains have sandy and gravelly material. The available water capacity is variable, but it is dominantly low or very low in the root zone. Permeability is generally slow. Glacial pebbles and fragments of shale and sandstone are commonly on the soil surface. The soil is firm and dense. Tilth is poor. Hard rains tend to seal the soil surface, reducing infiltration and restricting the emergence and growth of seedlings. A seasonal high water table is present in some areas. Reaction of the root zone ranges from medium acid to mildly alkaline.

In most areas these soils are at sites of new construction. Other areas consist of borrow pits and other excavations. About one-half of the areas do not have any vegetative cover or have only very sparse cover. A few areas are in hay or pasture. Erosion is a severe hazard in areas where the surface is bare. Suitable plant cover is needed to control erosion.

The suitability of the soils as a site for buildings and sanitary facilities varies. Onsite investigation is needed to determine the potential and limitation for any proposed use.

This soil is not assigned to a capability subclass or woodland suitability subclass.

Ur—Urban land. Urban land consists of areas of 5 acres or more that are covered with buildings, pavement, or other manmade surfaces. Included are commercial and industrial areas. The slope ranges from 0 to 6 percent. A high percentage of the total area is covered by construction. Only limited acreage is natural soil. As a result, runoff from these areas is increased in volume and rate. Urban land potentially can be a source of pollution to nearby streams. Onsite investigation is needed to determine the potential and limitation for any proposed use.

This unit is not assigned to a capability subclass or woodland suitability subclass.

Wa—Wabasha silty clay loam, ponded. This is a deep, nearly level, very poorly drained soil on flood plains. It is subject to frequent flooding of long duration and is ponded much of the year. The depth of the water fluctuates with the level of the Cuyahoga River. Slope is 0 to 2 percent. Most areas are irregular in shape and range from 5 to 150 acres in size.

Typically, the surface layer is very dark grayish brown and black, friable silty clay loam about 8 inches thick. The subsoil is dark gray and gray, mottled, firm silty clay loam about 37 inches thick. The substratum to a depth of about 65 inches is light olive brown, mottled, firm silty clay. In some areas the surface layer is silty clay or mucky silty clay loam. In a few areas organic material is in the surface layer and the upper part of the subsoil.

Included with this soil in mapping are small areas of Carlisle soils that formed in organic material. Also included are small areas of Wallkill soils that have 16 to 40 inches of alluvium over muck. The included soils make up about 20 percent of most areas.

The water table is above and near the surface in fall, winter, and spring. Permeability is slow. The depth of rooting of most plants is related to the depth to the water table. The available water capacity is high. The soil puddles and clods easily. The shrink-swell potential is high. The subsoil is slightly acid to mildly alkaline.

In most areas this soil is used as woodland or pasture. This soil is poorly suited to use as cropland and woodland. However, it is suited to habitat for wetland wildlife. Ponding severely limits the use of planting and logging equipment. Species selected for planting should be tolerant of ponding and flooding.

This soil is unsuited as a site for buildings, sanitary facilities, and recreation uses. Ponding, flooding, slow permeability, and high shrink-swell potential severely limit this soil for these uses. Very few areas have been artificially drained, and it is difficult or impossible to locate suitable outlets for drains.

This soil is in capability subclass Vw and in woodland suitability subclass 5w.

WbA—Wadsworth silt loam, 0 to 2 percent slopes. This is a deep, nearly level, somewhat poorly drained soil on uplands. Most areas are broad or irregular in shape and range from 3 to 200 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 50 inches thick. The upper part is yellowish brown, mottled, friable and firm silty clay loam; the middle part is a yellowish brown and dark brown, mottled, very firm, dense silty clay loam fragipan; and the lower part is yellowish brown, mottled, firm silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm silty clay loam.

Included with this soil in mapping are small areas of poorly drained Sebring soils in depressions. Also included are small areas of moderately well drained Rittman soils on slight rises. These soils make up about 15 percent of most areas.

A water table is perched between depths of 12 and 24 inches in winter and spring and during other extended wet periods. Permeability is moderately slow or moderate above the fragipan and slow or very slow in the fragipan. Runoff is slow. The root zone is mainly restricted to the moderately deep zone above the fragipan. This zone has a low available water capacity and is strongly acid to extremely acid, except where lime has been added.

In most areas this soil is used for general farm crops, pasture, and trees. Wetness limits suitability of this soil for crops planted early in spring and for early spring grazing. In drained areas the soil is suited to corn, wheat, hay, and pasture. In undrained areas it can be used for hay and pasture, but minimizing soil compaction and maintaining desirable forage stands are difficult. Surface and subsurface drains are used to remove excess water. Subsurface drains must be closely spaced for uniform drainage. This soil needs to be cultivated at a suitable moisture content because it is sticky and soft when wet. Hard clods and a crusty surface form if it is cultivated when wet. Using crop residue and planting cover crops improve the content of organic matter and tilth and increase water infiltration.

This soil is suited to use as woodland. Species tolerant of some wetness and the root-restricting layer in the lower part of the subsoil should be selected for planting.

This soil is poorly suited to septic tank absorption fields, and unless artificial drainage is provided it is poorly suited as a site for buildings. Because of seasonal wetness, it is better suited to houses without basements than to houses with basements. Ditches and subsurface drains are used to improve drainage. Building sites should be landscaped for good surface drainage away from the foundation. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Local roads can be improved by providing artificial drainage and suitable base material to reduce damage from frost action. Drainage is needed for intensive recreation uses, for example, ballfields and tennis courts.

This soil is in capability subclass IIIw and in woodland suitability subclass 2d.

WbB—Wadsworth silt loam, 2 to 6 percent slopes. This is a deep, gently sloping, somewhat poorly drained soil on low knolls on uplands. Most areas are broad or irregular in shape and range from 2 to 300 acres.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 42 inches thick. The upper part is yellowish brown, mottled, firm silty clay loam; the middle part is dark yellowish brown, firm and very firm, dense silty clay loam fragipan; and the lower part is yellowish brown, mottled, firm silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, firm silty clay loam.

Included with this soil in mapping are small areas of poorly drained Sebring soils in depressions. Small areas of the moderately well drained Rittman soils are on some of the higher knolls. These included soils make up about 15 percent of most areas.

A water table is perched between depths of 12 and 24 inches in winter and spring and during other extended wet periods. Permeability is moderately slow or moderate above the fragipan and slow or very slow in the fragipan. Runoff is medium. The root zone is mainly restricted to the moderately deep zone above the fragipan. This zone has a low available water capacity and is strongly acid to extremely acid, except where lime has been added.

In most areas this soil is used for general farm crops, pasture, and trees. Wetness delays planting and limits the choice of crops. In drained areas the soil is suited to corn, wheat, hay, pasture, and nursery stock (fig. 5). In undrained areas it can be used for hay and pasture, but minimizing soil compaction and maintaining desirable forage stands are difficult. Subsurface drains are used to remove excess water from the subsoil. They should be closely spaced for uniform drainage. Maintaining good tilth is important in reducing surface crusting and erosion. Planting cover crops, using crop residue, and other management practices improve the content of organic matter and tilth, help reduce soil loss by erosion, and increase water infiltration.

This soil is suited to use as woodland. Species selected for planting should be tolerant of some wetness and a root-restricting layer in the lower part of the subsoil.

Because of seasonal wetness, this soil is better suited to houses without basements than to houses with basements. It is poorly suited to septic tank absorption

Figure 5.—If drained, Wadsworth soils are suited to the production of nursery stock.

fields because of the seasonal high water table and the slowly or very slowly permeable fragipan. Ditches and subsurface drains are used to improve drainage. Although the slope provides some surface drainage, building sites should be landscaped for good surface drainage away from foundations. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Local roads can be improved by providing artificial drainage and suitable base material to reduce damage from frost action. The soil is well suited to pond reservoir areas. Drainage is needed for intensive recreation uses, for example, ballfields and tennis courts.

This soil is in capability subclass IIIe and in woodland suitability subclass 2d.

Wc—Wallkill silt loam, ponded. This is a deep, very poorly drained, level soil along streams and in bogs. It is ponded much of the year and is subject to frequent flooding. Slope is 0 to 2 percent. Most areas are oblong and range from 10 to 70 acres in size.

Typically, the surface layer is very dark grayish brown and dark grayish brown, very friable silt loam about 7 inches thick. The subsoil is grayish brown, firm silty clay loam and friable silt loam about 16 inches thick. The substratum to a depth of about 60 inches is dark brown, very friable and friable muck.

Included with this soil in mapping are small areas of Carlisle and Willette soils near the center of areas. Also included are narrow strips of poorly drained Canadice and Sebring soils that formed in lakebed sediment. These soils are commonly on the periphery of mapped areas. Included soils make up about 15 percent of most areas.

Water is near the surface and ponds for long periods. Runoff is very slow. Permeability is moderate in the mineral soil and moderately rapid or rapid in the organic deposit. The rooting depth of most plants is related to the depth to the water table. The available water capacity is very high. The subsoil ranges from strongly acid to mildly alkaline.

In most areas this soil is in wetland vegetation and is used as habitat for wetland wildlife. This soil is poorly suited to use as cropland, pasture, and woodland and unsuited for building site development, sanitary facilities, and recreation uses. Frequent flooding, ponding, seepage, low soil strength, and excess humus are limitations. Drainage outlets are difficult to establish. The fluctuating water level limits the survival of many trees. In most areas the soil provides good habitat for ducks, muskrats, and other wetland wildlife.

This soil is in capability subclass Vw and is not assigned to a woodland suitability subclass.

Wt—Willette muck, ponded. This is a deep, very poorly drained, level soil in bogs and swales on lake plains and uplands. It is ponded much of the year and is subject to frequent flooding. Slope is 0 to 2 percent. Most areas are oval and range from 3 to 100 acres in size.

Typically, the surface layer is black, very friable muck about 10 inches thick. The next layer is black, very friable muck about 12 inches thick. The substratum to a depth of about 60 inches is gray, firm silty clay. In some areas a thinner organic layer is above the mineral material, and in other areas the organic layer is thicker.

Included with this soil in mapping and making up about 15 percent of most areas are small areas of Wallkill and Canadice soils.

Water is near the surface and ponds for long periods. Runoff is very slow. Permeability is moderately rapid in the muck layers and slow in the substratum. The content of organic matter is very high. The rooting depth of most plants is related to the depth to the water table. The available water capacity is very high. The subsoil is medium acid to mildly alkaline.

In most areas this soil is in natural vegetation, including sedges and some water-tolerant trees.

This soil is poorly suited to farming because of the very poor natural drainage and ponding. Both ditches and subsurface drains can be used to improve drainage; however, in most areas drainage outlets are difficult to establish. Subsidence or shrinkage occurs after draining. Controlling drainage so that the water table can be raised or lowered helps reduce the amount of shrinkage. In drained areas this soil is suited to some cultivated and specialty crops.

This soil is poorly suited to use as woodland. In undrained areas the soil supports some cattails, reeds, sedges, and water-tolerant trees. The wetness seriously limits the selection of trees to plant.

This soil is unsuited as a site for buildings, sanitary facilities, and most recreation uses because of flooding, ponding, low strength, and the slow permeability and high shrink-swell potential in the substratum. In undrained areas the soil provides good habitat for ducks, muskrats, and other wetland wildlife.

This soil is in capability subclass Vw. It is not assigned to a woodland suitability subclass.

WuD—Wooster silt loam, 12 to 18 percent slopes. This is a deep, moderately steep, well drained soil on convex hillsides and on side slopes parallel to drainageways. Most areas are long and narrow and range from 10 to 35 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 48 inches thick. The upper part is yellowish brown and dark yellowish brown, friable and firm loam; the middle part is a dark brown and dark yellowish brown, firm, dense loam fragipan that has mottles in the lower 7 inches; and the lower part is brown, mottled firm loam. The substratum to a depth of about 60 inches is dark yellowish brown, friable gravelly loam. In some areas the soil does not have a fragipan and is more permeable. In other areas it is slightly wetter.

Permeability is moderately slow. Runoff is very rapid. The root zone is restricted mainly to the moderately deep zone above the fragipan. This zone is very strongly acid to medium acid and has a low available water capacity.

In most areas this soil is used as woodland or pasture. Because of the slope and hazard of erosion, this soil is better suited to hay and pasture than to row crops. Row crops can be grown occasionally if erosion is controlled and good management is applied. Minimizing tillage, managing crop residue, planting cover crops, and tilling and harvesting at the proper moisture level help control erosion, improve tilth, and increase water infiltration.

Using this soil as pasture and hayland effectively controls erosion. Proper stocking rates, plant selection, pasture rotation, and timely deferment of grazing, in addition to good fertilization, help keep the pasture and soil in good condition. Reseeding with cover crops or companion crops or by the trash mulch or no-till seeding method reduces the risk of erosion.

This soil is well suited to use as woodland. Seedlings survive and make good growth if competing vegetation is controlled or removed by such practices as spraying, mowing, or disking. Logging roads and skid trails should be protected against erosion by water bars and established across the slope where possible.

This soil is moderately well suited for building sites if buildings are specially designed to fit the slope. Cover should be maintained on the site as much as possible during construction to help prevent wet basements from the lateral movement of water above the fragipan. Trench absorption fields are difficult to lay out and construct. Controlling the downhill flow of effluent is a serious concern. Most local roads require considerable excavation. Trails in recreation areas should be protected from erosion and laid out on the contour where possible.

This soil is in capability subclass IVe and in woodland suitability subclass 1r.

prime farmland

In this section, prime farmland is defined and discussed, and the prime farmland soils in Geauga County are listed.

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in providing the nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, feed, forage, fiber, and oilseed crops. Such soils have soil properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. The moisture supply, of course, must be adequate, and the growing season has to be sufficiently long. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may presently be used as cropland, pasture, or woodland, or they may be in other uses. They are either used for producing food or fiber or are available for these uses. Urban and built-up land or water areas cannot be considered prime farmland.

Prime farmland soils usually get an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent.

Soils that have a high water table may qualify as prime farmland soils if this limitation is overcome by drainage measures. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information on the criteria for prime farmland soils can be obtained at the local office of the Soil Conservation Service.

prime farmland in Geauga County

About 177,800 acres, or nearly 68 percent of the county is prime farmland. The areas of prime farmland are scattered throughout the county and are dominant in all the associations on the general soil map except 7, 11, and 12. The crops grown on this land are mainly corn, wheat, oats, and grass-legume hay.

A recent trend in land use in some parts of the county has resulted in the loss of some prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are wet, more erodible, droughty, or difficult to cultivate and less productive than prime farmland.

The following map units, or soils, make up prime farmland in Geauga County. The location of each map unit is shown on the detailed soil maps at the back of this publication. The extent of each unit is given in table 4. The soil qualities that affect use and management are described in the section "Detailed soil map units." This list does not constitute a recommendation for a particular land use.

BgB—Bogart loam, 2 to 6 percent slopes
CcA—Caneadea silt loam, 0 to 2 percent slopes (where drained)
CcB—Caneadea silt loam, 2 to 6 percent slopes (where drained)
CdB—Canfield silt loam, 2 to 6 percent slopes
CnA—Chili loam, 0 to 2 percent slopes
CnB—Chili loam, 2 to 6 percent slopes
Da—Damascus silt loam (where drained)
DrA—Darien silt loam, bedrock substratum, 0 to 2 percent slopes (where drained)
DrB—Darien silt loam, bedrock substratum, 2 to 6 percent slopes (where drained)
EhB—Ellsworth silt loam, 2 to 6 percent slopes
EhB2—Ellsworth silt loam, 2 to 6 percent slopes, eroded
FcA—Fitchville silt loam, 0 to 2 percent slopes (where drained)
FcB—Fitchville silt loam, 2 to 6 percent slopes (where drained)
GfB—Glenford silt loam, 2 to 6 percent slopes
HsA—Haskins loam, 0 to 2 percent slopes (where drained)
HsB—Haskins loam, 2 to 6 percent slopes (where drained)
JtA—Jimtown silt loam, 0 to 3 percent slopes (where drained)

LrB—Lordstown loam, 2 to 6 percent slopes
LyB—Loudonville silt loam, 2 to 6 percent slopes
MgA—Mahoning silt loam, 0 to 2 percent slopes (where drained)
MgB—Mahoning silt loam, 2 to 6 percent slopes (where drained)
MsA—Mahoning silt loam, shale substratum, 0 to 2 percent slopes (where drained)
MsB—Mahoning silt loam, shale substratum, 2 to 6 percent slopes (where drained)
MtA—Mitiwanga silt loam, 0 to 3 percent slopes (where drained)
OsB—Oshtemo sandy loam, 2 to 6 percent slopes
ReA—Ravenna silt loam, 0 to 2 percent slopes (where drained)
ReB—Ravenna silt loam, 2 to 6 percent slopes (where drained)
RmB—Rawson loam, 2 to 6 percent slopes
RsB—Rittman silt loam, 2 to 6 percent slopes
Sb—Sebring silt loam (where drained)
WbA—Wadsworth silt loam, 0 to 2 percent slopes (where drained)
WbB—Wadsworth silt loam, 2 to 6 percent slopes (where drained)

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 A. Tkatschenko, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops 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.

In 1967, slightly less than 100,000 acres in the county was used for crops and pasture, according to the Conservation Needs Inventory of that year (*16*). Of this total, 12,189 acres was used for row crops, mainly corn; 8,070 acres for close-grown crops, mainly oats and wheat; 22,645 acres for hay and rotation hay and pasture; and 19,057 acres for permanent pasture. The rest of the acreage consisted of idle cropland, orchards, vineyards, and bush fruit.

The potential of the soils in Geauga County for increased production of food is fair. Food production, however, could be increased by extending the latest crop-production technology to all cropland in the county.

In 1967, soil drainage was a major management need on about two-thirds of the acreage used for crops and pasture (*16*). Some of the soils in the county are naturally so wet that the production of crops common to the area is generally not possible without artificial drainage. These soils, which make up 18,890 acres, include the poorly drained Sebring, Canadice, Sheffield, Damascus, and Holly soils and the very poorly drained Wabasha soils. Also in this category are the organic Carlisle, Willette, and Wallkill soils, which make up 2,651 acres.

Unless artificially drained, the somewhat poorly drained soils are so wet that crops are damaged during most years and planting or harvesting is delayed. In this category are Caneadea, Mahoning, Wadsworth, Platea, Ravenna, Darien, Mitiwanga, Haskins, Fitchville, Jimtown, and Orrville soils. These soils make up 129,267 acres.

Small areas of wet soils along drainageways and in swales are commonly included in areas of the moderately drained Ellsworth, Rittman, Canfield, Geeburg, Bogart, and Glenford soils. Artificial drainage is needed in these areas.

The design of surface and subsurface drainage systems varies with the kind of soil. A combination of surface and subsurface drainage is needed in most areas of the poorly drained and very poorly drained soils that are used for intensive row cropping. Drains have to be more closely spaced in soils that have slow or very slow permeability than in the more permeable soils. Subsurface drainage is very slow in Canadice, Caneadea, Mahoning, and Wabasha soils, for example. Finding adequate outlets for subsurface drainage systems is difficult in depressed areas on uplands and in broad flat areas on terraces.

Special drainage systems are needed in organic soils to control the depth and the period of drainage, because these soils oxidize and subside when the pore space is filled with air. Keeping the water table at the level required by crops during the growing season and raising it to the surface during other parts of the year minimize oxidation and subsidence. Information on drainage systems for each kind of soil in the county is available at the local office of the Soil Conservation Service.

In 1967, soil erosion was a major problem on about one-third of the cropland and pasture in Geauga County (*16*). Where the slope is more than 2 percent, erosion is a hazard. Productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Erosion is especially damaging on soils that have a clayey subsoil, for example, Caneadea, Ellsworth, and Geeburg soils. Erosion also reduces productivity on soils that tend to be droughty, for example, Chili and Oshtemo soils. Erosion on farmland also results in the sedimentation of streams. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal and recreation use and for fish and wildlife. Soil erosion and wetness are limitations on some soils in the county, particularly Fitchville, Haskins, Mahoning, Wadsworth, Platea, and Ravenna soils that have slopes of more than 2 percent.

In eroded spots on many of the gently sloping and sloping soils, preparing a good seedbed and tilling are difficult because part of the original friable surface layer has been eroded away. Such spots are common in the eroded Ellsworth and Rittman soils.

Erosion control measures provide protective surface cover, reduce runoff, and increase the infiltration rate. A cropping system that keeps vegetative cover on the soil for extended periods can hold soil losses to an amount that will not reduce the productive capacity of the soils. On livestock farms, where part of the acreage is in pasture and hay, including legume and grass forage crops in the cropping system reduces the risk of erosion, adds nitrogen to the soil and improves tilth.

In many areas of the sloping Chili, Loudonville, Ellsworth, Rittman, and Canfield soils, slopes are so short and so irregular that contour tillage or terracing is not practical. On these soils, a cropping system that provides substantial vegetative cover is needed to control erosion, unless minimum tillage or no-till is practiced.

Minimizing tillage and leaving crop residue on the surface help to increase water infiltration and reduce the hazard of runoff and erosion. These practices can be adapted to most of the soils in the county. No-tillage for corn is effective in reducing erosion on sloping soils and can be adapted to most of the other soils. It is more difficult, however, to practice successfully on the somewhat poorly drained to very poorly drained soils.

Terraces and diversions reduce the length of the slope and slow runoff; thus, they reduce the risk of erosion on long slopes. These practices are most effective on deep, well drained soils that have smooth slopes. Chili and Oshtemo soils are suited to terraces. Most of the soils, however, are not well suited to terraces and diversions because of irregular slope, excessive wetness in the terrace channels, and a clayey subsoil or bedrock at a depth of 20 to 40 inches, which would be exposed in the terrace channels.

Grassed waterways are natural or constructed outlets that are protected by grass cover. Natural drainageways make the best waterways. Commonly, minimum shaping produces a good channel. Channels should be wide and flat so that farm machinery can cross them easily.

Soil blowing is a hazard on the organic soils, for example, Carlisle and Willette soils, and on soils that have a fairly high content of sand in the surface layer, for example, Oshtemo soils. Maintaining vegetative cover, mulching the surface, or keeping the surface rough through proper tillage minimizes the hazard of soil blowing on these soils. Also, windbreaks of suitable shrubs, for example, Tatarian honeysuckle or autumn-olive, are effective in reducing the risk of soil blowing.

Contouring and stripcropping are helpful in controlling erosion; however, their use is somewhat limited in Geauga County because the slopes are generally short and irregular. Contouring and possibly stripcropping are practical only in some places, for example, in areas of Ellsworth, Rittman, and Canfield soils.

Information about erosion-control practices for each kind of soil in the county is available at the local office of the Soil Conservation Service.

Soil fertility is naturally low in many soils on the uplands. The soils on flood plains, for example, Tioga, Orrville, Holly, and Wabasha soils, have a higher content of plant nutrients than most of the upland soils. Many of the soils on uplands are naturally acid in the surface layer. If these soils have never been limed, applications of ground limestone are needed to raise the pH level sufficiently to grow alfalfa and other crops that require nearly neutral soils. The available phosphorous and potassium levels are naturally low in most of these soils.

Carlisle and Willette soils are commonly strongly acid to mildly alkaline, except where lime has been added. In some areas, special fertilizers are needed because these soils are deficient in boron and other trace elements.

On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime 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 friable and porous. Most of the soils used for crops in the county have a silt loam surface layer that is light in color and moderate or moderately low in content of organic matter. Generally, intense rainfall puddles or compacts the surface layer, which becomes a hard crust when it dries. This crust is nearly impervious to water, and it reduces infiltration and increases runoff. Regular additions of crop residue, manure, and other organic material can improve soil structure and reduce the likelihood of crusting.

Poor tilth can be a problem on the Mahoning, Ellsworth, Geeburg, Canadice, and Caneadea soils because the surface layer generally has more clay than that of most soils in the county. If the soils are plowed when wet, they tend to be cloddy when dry. As a result, preparing a good seedbed is difficult.

Fall plowing is generally not a good practice. Many of the soils that are plowed in the fall are nearly as dense and hard at planting time as they were before they were plowed. In addition, the gently sloping to moderately steep soils, and some areas of the nearly level soils, are subject to erosion and soil blowing after they are plowed in the fall.

Irrigation is not used to a great extent in Geauga County. Generally, the county receives ample rainfall for crop moisture requirements; however, intervals commonly occur when rainfall is not timely or well distributed. During these periods, supplemental irrigation of crops helps to increase crop production.

Many soils in the county are suited to irrigation and can be irrigated if water is available. Soils that are suitable for sprinkler irrigation are those that have slopes of 6 percent or less and need only a minimum of artificial drainage. Because the Oshtemo, Chili, Tioga, Loudonville, and Lordstown soils are permeable and do not hold enough water for crop growth during extended dry periods, irrigation on these soils has to be more frequent than on most other soils. Bogart and Rawson soils are well suited to irrigation. Other soils that can be irrigated if adequately drained are the Jimtown, Damascus, Haskins, Orrville, and Holly soils. The other soils in the county are not so well suited to irrigation because of excessive slope, slow intake rate, surface crusting, limited ability to store available moisture, or poor or very poor natural drainage. More information on irrigation is available from the Cooperative Extension Service and the local office of the Soil Conservation Service. Use of water from streams and ponds is controlled by the Ohio Department of Natural Resources.

Field crops suited to the soils and climate of Geauga County include many that are not now commonly grown. Corn is the main row crop. Grain sorghum, sunflowers, potatoes, and similar crops can be grown.

Oats and wheat are the most common close-growing crops. Rye, barley, buckwheat, and flax can be grown, and grass seed can be produced from bromegrass, timothy, fescue, redtop, and bluegrass.

Grapes are the main specialty crop and are commonly grown in the northern part of the county. A small acreage is in cabbages, potatoes, cucumbers, and sweet corn. Grapes are more suitable for droughty soils than some other crops because of their deep roots. Deep, well drained soils that have a medium fertility level and a pH of 5.5 to 6.5 are best suited for grapes.

Soils that have good internal drainage and a loamy surface layer, for example, Chili, Oshtemo, and Tioga soils are well suited to cabbages, cucumbers, sweet corn, potatoes, and other vegetables. These soils warm up relatively early in the spring, have a good water intake, and can be tilled within a wide range of moisture content without severe compaction or damage to soil structure. Spring planting must be delayed on Tioga soils, however, because of flooding.

Information on specific practices, fertilization rates, or seeding varieties can be obtained from the local offices of the Cooperative Extension Service and the Soil Conservation Service or from field representatives of commercial packing and processing companies.

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 for those crops.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The 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 (*15*). 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

When Geauga County was settled in the 1800's, most of the county was covered by hardwood forest. In 1967, approximately 100,000 acres or about 38 percent of the county was covered with trees (*16*). The most important product from trees is maple sirup.

The variation in soils and topography has resulted in a diversity of tree species. The major vegetative types in the county are beech forest, mixed mesophytic forest, and Elm-Ash Swamp Forest (*9*).

The beech forest makes up the largest part of the county and consists primarily of beech, sugar maple, and oaks. These trees are on the somewhat poorly to well drained, gently sloping to very steep soils on uplands and outwash terraces. The second most extensive type is the mixed mesophytic forest, which consists of white oak, red oak, hickory, beech, sugar maple, and some hemlock. These trees are on moderately well drained and well drained, moderately steep to very steep soils in dissected areas on till plains and end moraines. The soils are moderately deep and are along the major rivers and streams throughout the county. The next most extensive type of forest is the Elm-Ash-Swamp Forest, which consists of white ash, swamp white oak, pin oak, silver-red maple and elm. These trees are on somewhat poorly drained to very poorly drained soils that formed in glacial outwash, lacustrine sediment, and alluvium in nearly level to depressed wetland areas of the county. Most of the large elm trees have recently been destroyed by Dutch Elm disease, and therefore these trees make up a smaller part of the forest than they once did.

The largest concentration of woodland is along the major rivers and their tributaries, which include the Chagrin, Cuyahoga, and Grand Rivers. Most of the woodland has been cutover, and many areas have been grazed. A popular new harvesting method that has been used to some extent is called "high grading". Where this method has been used, mainly hollow, diseased, and the less desirable trees remain, in addition to grapevines and other undergrowth. Many woodland areas throughout the county are infested with grapevines. In places the grapevines are so concentrated that they have caused the tops of potential timber trees to break. Vigorous growth of grapevines can drastically reduce timber production.

Abandoned farms and areas around ponds and reservoirs have been reforested with conifers. Coniferous trees have also been planted for the production of Christmas trees and windbreaks. White, red, and Austrian pines are most commonly used for planting.

Information on forest management is available from the Ohio Department of Natural Resources, Division of

Forestry; the Cooperative Extension Service, Agricultural Stabilization and Conservation Service; and the Soil Conservation Service.

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; *d*, restricted root depth; *c*, clay in the upper part of 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, d, c, 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 few trees may be blown down by strong winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

windbreaks and environmental plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service; the Ohio Department of Natural Resources, Division of Forestry; the Cooperative Extension Service or from a nursery.

recreation

John A. Tkatschenko, district conservationist, Soil Conservation Service, helped prepare this section.

Geauga County has more than 120 public, commercial, and private outdoor recreation areas and open space areas (fig. 6). The facilities include 31 parks, 26 hunting and fishing areas, 23 camping areas, 28 private outdoor areas, 12 golf courses, 5 museums, and 2 nature preserves.

The largest park in the county is Punderson State Park, which covers an area of 733 acres. Boating, fishing, swimming, toboggan runs, tennis courts, camping, and a lodge are available in the park. The

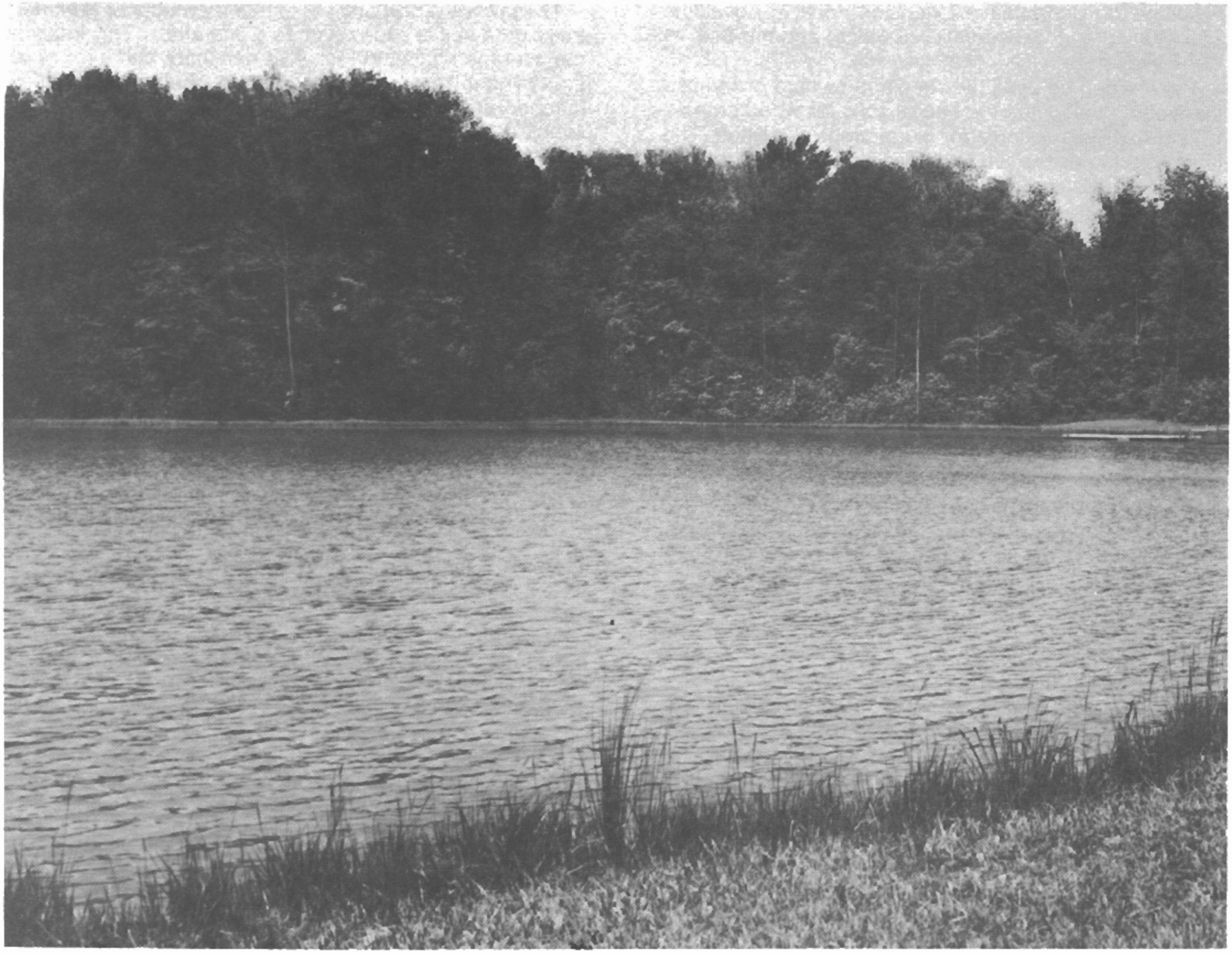

Figure 6.—This lake on Ellsworth silt loam, 6 to 12 percent slopes, is used for recreation.

second largest park is Big Creek Park. It covers 635 acres and is operated by Geauga County. This park has extensive nature trails, surfaced trails for the elderly and handicapped, and horseback and snowmobile trails.

Holden, a nationally known arboretum and wildlife sanctuary in Geauga County is 850 acres in size. East Branch Reservoir, LaDue Reservoir, and Punderson Lake can be used for boating and fishing. Hunting is permitted in several large state wildlife areas.

Among the museums open to the public is that of the American Society for Metals, which features a geodesic dome designed by the internationally known architect R. Buckminster Fuller.

The soils of the survey area are rated in table 9 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 9, 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 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

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

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 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor (*1*). A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are foxtail, goldenrod, smartweed, ragweed, and fescue.

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, maple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are shrub honeysuckle, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine and spruce.

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 duckweed, wild millet, willow, reed canarygrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and shallow ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, muskrat, mink, and beaver.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 11 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 12 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 12 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 40 inches 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 12 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 12 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 13 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 13, 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. 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 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium.

A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and 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

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 15 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 is as much as 15 or 20 percent 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 (*3*) and the system adopted by the American Association of State Highway and Transportation Officials (*2*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, 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 oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

physical and chemical properties

Table 16 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.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 16, 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 17 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 is not considered flooding, nor is water in swamps and marshes.

Table 17 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 are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The 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 17 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is 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.

physical and chemical analyses of selected soils

Many of the soils in Geauga County were sampled by the Soil Characterization Laboratory, Department of Agronomy, Ohio State University, Columbus, Ohio. The resulting physical and chemical data include particle size distribution, reaction, organic matter content, calcium carbonate equivalent, and extractable cations.

These data were used in the classification and correlation of the soils and in the evaluation of their behavior under various land uses. Of the soils sampled, five profiles were selected as representative of their respective series. Two are described in this survey. The series and their laboratory identification numbers are: Ellsworth (GA-S16), Canfield (GA-S17), Ravenna (GA-S20), Ellsworth shale substratum (GA-25), Mahoning silt loam (GA-S19), and Mahoning shale substratum (GA-26).

In addition to the data about the soils in Geauga County, laboratory data are also available about the same soils in nearby counties in northeast Ohio. These data and the Geauga County data are on file at the Department of Agronomy, the Ohio State University, Columbus, Ohio; the Ohio Department of Natural Resources, Division of Lands and Soil, Columbus, Ohio; and the Soil Conservation Service, State Office, Columbus, Ohio. Some of the data have been published (*10, 11*).

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*17*). 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 18, 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 Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aqualf (*Aqu*, meaning water, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Ochraqualfs (*Ochr*, meaning light colored surface layer, plus *aqualf*, the suborder of the Alfisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Aeric* identifies the subgroup that is drier than the typical great group. An example is Aeric Ochraqualfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Aeric Ochraqualfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*14*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*17*). 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."

Bogart series

The Bogart series consists of deep, moderately well drained soils on terraces and outwash plains. These soils formed in glacial outwash deposits. Permeability is moderate or moderately rapid in the solum and rapid in the underlying material. Slopes range from 2 to 6 percent.

Bogart soils are commonly adjacent to Chili and Jimtown soils and are similar to Rawson soils. Rawson soils formed in glacial outwash and the underlying glacial till or lacustrine material on terraces and uplands. Chili soils are well drained and do not have mottles in the subsoil. Jimtown soils are somewhat poorly drained and have more gray in the subsoil.

Typical pedon of Bogart loam, 2 to 6 percent slopes, about 2.75 miles south of Auburn Corners, in Auburn Township, 0.83 mile west along Crackel Road from its intersection with Auburn Road, then 65 yards north:

Ap—0 to 9 inches; brown (10YR 4/3) loam; moderate fine and medium granular structure; friable; many roots; 5 percent coarse fragments; medium acid; abrupt smooth boundary.

B21t—9 to 15 inches; yellowish brown (10YR 5/4) loam; moderate fine and medium subangular blocky structure; friable; common roots; thin very patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; brown (10YR 4/3) fillings in worm and root channels; few fine and medium distinct stains and concretions (iron and manganese oxides); 2 percent coarse fragments; very strongly acid; clear wavy boundary.

B22t—15 to 23 inches; yellowish brown (10YR 5/4) loam; many fine and medium distinct light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6 and 5/8) mottles; moderate medium and coarse subangular blocky structure; firm; common roots; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; common fine and medium distinct black (10YR 2/1) concretions (iron and manganese oxides); 7 percent coarse fragments; very strongly acid; clear wavy boundary.

B23t—23 to 35 inches; yellowish brown (10YR 5/4) gravelly sandy clay loam; common fine and medium distinct light brownish gray (10YR 6/2) and common medium distinct strong brown (7.5YR 5/6 and 5/8) mottles; weak medium and coarse subangular blocky structure; firm; few roots; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds; common fine and medium distinct black (10YR 2/1) stains and concretions (iron and manganese oxides); 15 percent coarse fragments; very strongly acid; clear wavy boundary.

B3—35 to 47 inches; brown (10YR 5/3) gravelly sandy clay loam; few fine and medium distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; firm; thin very patchy dark brown (7.5YR 4/4) clay films on faces of peds; few fine distinct black (10YR 2/1) stains and concretions (iron and manganese oxides); 25 percent coarse fragments; very strongly acid; clear wavy boundary.

C—47 to 60 inches; yellowish brown (10YR 5/4) gravelly sandy loam; massive; friable; 35 percent coarse fragments; medium acid.

The solum is 30 to 50 inches thick. Free carbonates are at a depth of more than 48 inches. Amount of gravel is variable in most pedons because of stratification and ranges from 0 to 10 percent by volume in the A and B horizons above a depth of 20 inches, from 15 to 30 percent as an average of B and C horizons from 20 to 40 inches, and from 10 to 45 percent in the B and C horizons below a depth of 40 inches.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. Some pedons have an A1 horizon as much as 5 inches thick and an A2 horizon as much as 8 inches thick. The A horizon is very strongly acid to slightly acid, except where lime has been added. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, chroma of 3 to 6 to a depth of 30 inches. Chroma is 2 to 6 below a depth of 30 inches. The B horizon is commonly sandy loam, loam, sandy clay loam, clay loam, or a gravelly analog of these textures. In some pedons thin subhorizons of silt loam or silty clay loam are in the lower part of the B2 horizon and in the B3 horizon. Reaction is very strongly acid to slightly acid. The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. It has uniform or stratified texture and commonly is a gravelly analog of sandy loam, loamy sand, or sand. Less commonly it is sandy loam, loamy sand, or sand. It is commonly strongly acid to slightly acid. Less commonly, it is neutral or mildly alkaline.

Brecksville series

The Brecksville series consists of moderately deep, well drained, slowly permeable soils that formed in residuum of shale bedrock on uplands. Slopes range from 25 to 70 percent.

Brecksville soils are similar to Ellsworth and Lordstown soils. Ellsworth soils are deep to bedrock and have an argillic horizon. Lordstown soils have less clay in the B horizon and are underlain by sandstone bedrock.

Typical pedon of Brecksville silt loam, 25 to 70 percent slopes, about 1 mile southeast of Chagrin Falls, in Bainbridge Township, 0.25 mile southeast along Chagrin Road from the Cuyahoga County line, then 535 yards east:

A1—0 to 4 inches; very dark gray (10YR 3/1) silt loam; moderate medium and fine granular structure; friable; many roots; very strongly acid; abrupt smooth boundary.

B1—4 to 8 inches; yellowish brown (10YR 5/4) silt loam; weak medium and coarse subangular blocky structure; friable; common roots; very strongly acid; clear smooth boundary.

B21—8 to 14 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium and coarse subangular blocky structure; firm; few roots; medium continuous pale brown (10YR 6/3) silt coatings on faces of peds; 5 percent shale fragments; very strongly acid; clear wavy boundary.

B22—14 to 20 inches; yellowish brown (10YR 5/4) silty clay loam; few medium distinct brownish yellow (10YR 6/6) mottles; weak medium subangular blocky structure; firm; few roots; medium continuous pale brown (10YR 6/3) silt coatings on faces of peds; 10 percent shale fragments; very strongly acid; abrupt smooth boundary.

B3—20 to 25 inches; light olive brown (2.5Y 5/4) shaly silty clay loam; common medium distinct yellowish brown (10YR 5/6) and olive (5Y 5/3) mottles; weak medium platy structure; firm; few roots; medium continuous olive (5Y 5/3) silt coatings on faces of peds; 20 percent shale fragments; very strongly acid; clear wavy boundary.

C—25 to 36 inches; light olive brown (2.5Y 5/4) shaly silty clay loam; many coarse distinct grayish brown (2.5Y 5/2) mottles; moderate medium platy structure (platiness inherited from shale bedrock); firm; 40 percent shale fragments; very strongly acid; abrupt smooth boundary.

Cr—36 to 42 inches; olive (5Y 5/3); thin-bedded shale bedrock; dark brown (7.5YR 4/4) stains.

Thickness of the solum and depth to paralithic contact of shale ranges from 20 to 40 inches. Coarse fragments of shale or siltstone range from 0 to 5 percent by volume in the A horizon, 0 to 25 percent in the B horizon, and 15 to 40 percent in the C horizon. The solum ranges from strongly acid to extremely acid.

The A1 horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. The B2 horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 or 4. Subhorizons that have chroma of 1 or 2 are in the lower part of some pedons. The B2 horizon is dominantly silty clay loam or shaly silty clay loam. In some pedons the lower part has subhorizons of shaly silty clay and silty clay. The C horizon has hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 1 to 4. It is shaly silty clay loam or shaly silty clay.

Canadice series

The Canadice series consists of deep, poorly drained, very slowly permeable soils that formed in lake-laid sediment in the basins of former glacial lakes. Slopes range from 0 to 2 percent.

Canadice soils are commonly adjacent to Caneadea soils and are similar to Sebring and Wabasha soils. Caneadea soils are somewhat poorly drained and have less gray in the subsoil. Sebring soils have less clay in the subsoil and substratum. Wabasha soils formed in alluvium and slack-water deposits on flood plains. Their surface layer is darker colored.

Typical pedon of Canadice silt loam, about 1 mile south of Fowlers Mill, in Munson Township, 0.9 mile south along Butternut Road from its intersection with Wye Road, then 700 feet east:

Ap—0 to 10 inches; dark gray (10YR 4/1) silt loam; moderate fine and medium subangular blocky structure; firm; many roots; yellowish brown (10YR 5/8) coatings lining root channels; medium acid; abrupt smooth boundary.

B21tg—10 to 19 inches; gray (10YR 5/1) silty clay; many coarse distinct dark brown (7.5YR 4/4) mottles; moderate medium and coarse angular blocky structure; firm; common roots; thin continuous gray (10YR 5/1) clay films on faces of peds; many fine very dark brown (10YR 2/2) concretions (iron and manganese oxides); neutral; gradual wavy boundary.

B22tg—19 to 32 inches; gray (10YR 5/1) silty clay; many coarse distinct yellowish brown (10YR 5/8) mottles; moderate coarse prismatic structure parting to moderate coarse angular blocky; firm; few roots; thin continuous gray (10YR 5/1) clay films on faces of peds; many fine very dark brown (10YR 2/2) concretions (iron and manganese oxides); neutral; gradual wavy boundary.

B3tg—32 to 40 inches; olive brown (2.5Y 4/4) silty clay; many coarse distinct grayish brown (10YR 5/2) mottles; weak coarse prismatic structure parting to moderate medium and coarse angular blocky; firm; few roots; thin continuous gray (10YR 5/1) clay films on faces of peds; neutral; clear wavy boundary.

C—40 to 60 inches; light olive brown (2.5Y 5/4) silty clay; massive; firm; few roots; gray (N 5/0) coatings in vertical partings; slight effervescence; mildly alkaline.

The solum is 30 to 60 inches thick. It is generally free of coarse fragments, although in some pedons the B and C horizons are as much as 5 percent by volume.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. Some pedons have an A1 horizon 1 to 6 inches thick. Reaction ranges from very strongly acid to medium acid, except where lime has been added. The B2 horizon has hue of 10YR to 5Y and value of 4 to 6. It has chroma of 0 to 2 to a depth of 30 inches, and below that it has chroma of 1 to 4. It is silty clay, clay, or silty clay loam. The B horizon is medium acid to neutral. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is dominantly silty clay or clay. Some pedons have thin subhorizons of fine sandy loam and silt loam. The C horizon is mildly alkaline or moderately alkaline.

Caneadea series

The Caneadea series consists of deep, somewhat poorly drained, slowly permeable soils that formed in lake-laid sediments on lake plains. Slopes range from 0 to 6 percent.

Caneadea soils are commonly adjacent to Canadice soils and are similar to Fitchville and Mahoning soils. Canadice soils are poorly drained and are on flats and in shallow depressions. Fitchville soils have less clay in the subsoil than Caneadea soils. Mahoning soils formed in glacial till and have more coarse fragments in the subsoil and substratum.

Typical pedon of Caneadea silt loam, 0 to 2 percent slopes, about 6 miles south of Chagrin Falls in

Bainbridge Township, 0.75 mile northwest along State Route 43 from its intersection with Giles Road, then 1,400 feet east:

O1—2 inches to 0; fresh and partly decomposed leaf and twig litter.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam; moderate medium granular structure; friable; many roots; strongly acid; abrupt smooth boundary.

A2—4 to 6 inches; brown (10YR 5/3) silt loam; many medium distinct light brownish gray (10YR 6/2) and common medium distinct yellowish brown (10YR 5/8) mottles; weak medium and coarse subangular blocky structure; firm; many roots; strongly acid; clear wavy boundary.

B1—6 to 10 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; common roots; thin patchy grayish brown (10YR 5/2) clay films and light brownish gray (10YR 6/2) patchy silt coatings on faces of peds; very strongly acid; clear wavy boundary.

B21t—10 to 15 inches; yellowish brown (10YR 5/4) silty clay; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium angular and subangular blocky structure; firm; few roots; thin patchy grayish brown (10YR 5/2) clay films and light brownish gray (2.5Y 6/2) patchy silt coatings on faces of peds; very strongly acid; clear wavy boundary.

B22t—15 to 18 inches; yellowish brown (10YR 5/4) silty clay; common medium distinct light brownish gray (2.5Y 6/2) mottles; moderate coarse prismatic structure parting to weak thick platy; firm; few roots; thin patchy grayish brown (10YR 5/2) clay films and thin patchy grayish brown (2.5Y 5/2) silt coatings on faces of peds; strongly acid; clear wavy boundary.

B23t—18 to 30 inches; brown (10YR 4/3) silty clay; common medium distinct light brownish gray (10YR 6/2) mottles; moderate coarse prismatic structure parting to weak thick platy; firm; thin patchy grayish brown (10YR 5/2) clay films and thin patchy light brownish gray (2.5Y 6/2) silt coatings on vertical faces of peds; many medium distinct very dark brown (10YR 2/2) stains and concretions (iron and manganese oxides); slightly acid; gradual wavy boundary.

B3t—30 to 44 inches; brown (10YR 4/3) silty clay; many medium and coarse distinct light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure parting to weak thick platy; firm; thin patchy grayish brown (10YR 5/2) clay films on vertical faces of peds; common medium distinct very dark brown (10YR 2/2) stains and concretions (iron and manganese oxides); neutral; clear wavy boundary.

C—44 to 60 inches; brown (10YR 4/3) silty clay; many medium distinct light brownish gray (2.5Y 6/2) mottles; massive; firm; laminated; grayish brown (10YR 5/2) coatings in vertical partings; strong effervescence; moderately alkaline.

The solum is 40 to 50 inches thick. The soil is typically free of coarse fragments, although in some pedons it has a few pebbles.

The A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. The Ap horizon, where present, has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The A horizon is strongly acid or very strongly acid except where lime has been added. The B2 horizon has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 2 to 4. It is silty clay, clay, or silty clay loam. It is strongly acid or very strongly acid in the upper part and ranges from slightly acid to mildly alkaline in the lower part. The C horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 2 to 4. It is silty clay or silty clay loam and is mildly alkaline or moderately alkaline.

Canfield series

The Canfield series consists of deep, moderately well drained soils that formed in glacial till on uplands. These soils have a dense fragipan that restricts rooting depth and the movement of water. Permeability is moderate above the fragipan and slow in the fragipan and substratum. Slopes range from 2 to 12 percent.

Canfield soils are commonly adjacent to Ravenna and Wooster soils and are similar to Rittman and Rawson soils. Ravenna soils are somewhat poorly drained and have more gray in the subsoil. Wooster soils are better drained and do not have mottles above the fragipan. Rittman soils have more clay in the subsoil. Rawson soils formed in glacial outwash and the underlying glacial till or in lacustrine material. They do not have a fragipan.

Typical pedon of Canfield silt loam, 2 to 6 percent slopes, about 7 miles southwest of Burton, in Auburn Township, 630 yards east along Stafford Road from its intersection with Wing Road, then 330 yards south:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; friable; 10 percent coarse fragments; neutral; abrupt smooth boundary.

A2—7 to 9 inches; yellowish brown (10YR 5/4) silt loam; weak thick platy structure; friable; 5 percent coarse fragments; slightly acid; clear wavy boundary.

B1—9 to 12 inches; yellowish brown (10YR 5/6) loam; weak medium subangular blocky structure; firm; 5 percent coarse fragments; medium acid; gradual wavy boundary.

B21t—12 to 16 inches; yellowish brown (10YR 5/6) loam; moderate fine and medium subangular blocky structure; firm; 5 percent coarse fragments; thin patchy clay films on horizontal faces of peds; thin continuous clay films on vertical faces of peds; strongly acid; abrupt wavy boundary.

B22t—16 to 19 inches; yellowish brown (10YR 5/6) loam; common medium faint strong brown (7.5YR 5/6) and common medium distinct pale brown (10YR 6/3) mottles; moderate medium and coarse subangular blocky structure; firm; 5 percent coarse fragments; thin continuous clay films on faces of peds; strongly acid; clear wavy boundary.

B23t—19 to 25 inches; dark yellowish brown (10YR 4/4) loam; many medium and coarse distinct strong brown (7.5YR 5/6), pale brown (10YR 6/3), and light brownish gray (2.5Y 6/2) mottles; moderate coarse subangular blocky structure; firm; 10 percent coarse fragments; thin continuous clay films on faces of peds; very strongly acid; abrupt wavy boundary.

Bx1—25 to 32 inches; dark yellowish brown (10YR 4/4) loam; many coarse distinct pale brown (10YR 6/3) and strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to weak medium platy; firm and brittle; 10 percent coarse fragments; light gray (2.5Y 7/2) coatings on faces of peds; thin continuous clay films on faces of peds; very strongly acid; abrupt wavy boundary.

Bx2—32 to 48 inches; dark brown (7.5YR 4/4) gravelly sandy loam; moderate very coarse (6 to 8 inches) prismatic structure; very firm and brittle; thick continuous light gray (2.5Y 7/2) clay seams on strong brown (7.5Y 5/6) borders of prisms; 20 percent coarse fragments; very strongly acid; clear wavy boundary.

B3—48 to 60 inches; yellowish brown (10YR 5/4) loam; common fine distinct light grayish brown (10YR 6/2) and strong brown (7.5YR 5/6) mottles; massive; firm; 10 percent coarse fragments; medium acid; gradual wavy boundary.

C—60 to 78 inches; brown (10YR 5/3) sandy loam; massive; firm; 10 percent coarse fragments; slightly acid.

The solum is 45 to 65 inches thick. Carbonates are between depths of 50 to 80 inches in some pedons. Reaction is strongly acid or very strongly acid in the upper part of the solum, except where lime has been added. It is very strongly acid to neutral in the fragipan and strongly acid to mildly alkaline in the B3 horizon. Below the Ap horizon the content of coarse fragments ranges from 2 to 20 percent throughout.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is loam, silt loam, clay loam, or a gravelly analog. Weighted average clay content is 18 to 27 percent. The Bx horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam, silt loam, sandy loam, or a gravelly analog. The C horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 or 5, and chroma of 3 or 4. It is loam, silt loam, sandy loam, or a gravelly analog.

Carlisle series

The Carlisle series consists of deep, very poorly drained soils that formed in organic deposits in bogs and swales on uplands, terraces, and flood plains. Permeability is moderately rapid. Slopes range from 0 to 2 percent.

The Carlisle soils are commonly adjacent to Wabasha and Wallkill soils and are similar to Willette soils. Wabasha soils formed in clayey alluvium and slack-water deposits, and Willette soils formed in 16 to 51 inches of organic material over mineral deposits.

Typical pedon of Carlisle muck, ponded, about 2 miles south of Chardon, in Munson Township, 1.85 miles east along Woodiebrook Road from its intersection with Wilson Mills Road, then 660 feet south:

Oa1—0 to 4 inches; black (10YR 2/1) broken face and rubbed sapric material; no fibers; 30 to 50 percent mineral; moderate medium granular structure; very friable; slightly acid; clear smooth boundary.

Oa2—4 to 12 inches; black (10YR 2/1) broken face and rubbed sapric material; 5 percent fibers, none rubbed; weak coarse subangular blocky structure; friable; slightly acid; gradual smooth boundary.

Oa3—12 to 25 inches; black (10YR 2/1) broken face and rubbed sapric material; 15 percent fibers, 5 percent rubbed; weak medium and coarse subangular blocky structure; friable; 2 percent woody fragments; slightly acid; clear smooth boundary.

Oa4—25 to 35 inches; dark reddish brown (5YR 3/2) broken face, very dark grayish brown (10YR 3/2) rubbed sapric material; 25 to 30 percent fibers, 10 percent rubbed; massive; friable; 3 percent woody fragments 1 to 3 inches in diameter; slightly acid; clear smooth boundary.

Oa5—35 to 60 inches; dark brown (7.5YR 3/2) broken face and rubbed sapric material; 20 to 25 percent fibers, 10 percent rubbed; massive; friable; 5 to 10 percent woody fragments 1 to 3 inches in diameter; slightly acid.

The organic matter commonly extends to a depth of more than 60 inches. Woody fragments, twigs, branches, and logs are throughout the profile in most pedons and are as much as 10 to 25 percent by volume in some pedons. The reaction throughout the soil ranges from strongly acid to mildly alkaline.

The surface layer typically has hue of 10YR, value of 2, and chroma of 1 or 2. It is dominantly sapric material. The subsurface layer has hue of 10YR or 5YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly sapric material. The bottom layer has colors similar to those of the subsurface layer. It is dominantly sapric material, although thin layers of hemic material are in some pedons.

Chili series

The Chili series consists of deep, well drained, moderately rapidly permeable soils on stream terraces, outwash plains, and kames. These soils formed in loamy material over sandy and gravelly stratified outwash deposits. Slopes range from 0 to 18 percent and from 25 to 50 percent.

Chili soils are commonly adjacent to Bogart and Oshtemo soils and are similar to Bogart and Wooster soils. Bogart soils are moderately well drained and have gray mottles in the subsoil. Oshtemo soils have less clay and gravel in the subsoil. Wooster soils formed in glacial till and have a fragipan.

Typical pedon of Chili loam, 2 to 6 percent slopes, 1.5 miles south-southwest of Auburn Corners, in Auburn Township, 990 yards west along Bartholomew Road from its intersection with State Route 44, then 385 yards north:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam; moderate medium granular structure; friable; many roots; 3 percent coarse fragments; slightly acid; abrupt smooth boundary.

B1—8 to 12 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; firm; common roots; 2 percent coarse fragments; strongly acid; clear smooth boundary.

B21t—12 to 16 inches; brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; firm; few roots; thin patchy brown (7.5YR 4/4) clay films on faces of peds; 8 percent coarse fragments; strongly acid; clear smooth boundary.

B22t—16 to 25 inches; yellowish red (5YR 5/6) gravelly clay loam; moderate medium and coarse subangular blocky structure; firm; few roots; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds; 25 percent coarse fragments; medium acid; gradual smooth boundary.

B23t—25 to 32 inches; reddish brown (5YR 4/4) gravelly sandy clay loam; few medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds; 30 percent coarse fragments; medium acid; gradual smooth boundary.

B24t—32 to 37 inches; brown (7.5YR 4/4) gravelly sandy clay loam; moderate medium subangular blocky structure; firm; thin very patchy dark brown (7.5YR 4/4) clay films on faces of peds; 20 percent coarse fragments; medium acid; gradual smooth boundary.

B31—37 to 43 inches; reddish brown (5YR 4/4) gravelly sandy loam; massive; very friable; thin very patchy brown (7.5YR 4/4) clay films bridging pebbles and sand grains; 35 percent coarse fragments; slightly acid; gradual wavy boundary.

B32—43 to 61 inches; brown (7.5YR 4/4) very gravelly loamy sand; single grained; loose; thin very patchy dark brown (7.5YR 4/4) clay films bridging pebbles and sand grains; 55 percent coarse fragments; slightly acid; abrupt wavy boundary.

C—61 to 64 inches; yellowish brown (5YR 5/4) gravelly sand; single grained; loose; 35 percent coarse fragments; slight effervescence; mildly alkaline.

The solum is 40 to 70 inches thick. Content of gravel usually increases with depth and ranges from 2 to 25 percent by volume in the A horizon and upper part of the B horizon to 25 to 60 percent in the B3 and C horizons.

The Ap horizon has hue of 10YR or 7.5YR, value of 4, and chroma of 2 or 3. Some pedons have an A1 horizon 2 to 5 inches thick and an A2 horizon as much as 4 inches thick. The A horizon is commonly loam or gravelly loam. It is less commonly silt loam. It is very strongly acid to slightly acid, except where lime has been added. The B2 horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 3 to 6. It is loam, clay loam, sandy clay loam, or a gravelly analog. Some pedons have thin subhorizons of sandy loam, gravelly sandy loam, or silty clay loam. Reaction is strongly acid to medium acid. The B3 horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 3 to 6. It is gravelly or very gravelly sandy loam, loamy sand, or loam. Reaction is medium acid or slightly acid. The C horizon typically has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is medium acid to mildly alkaline.

Damascus series

The Damascus series consists of deep, poorly drained soils that formed in stratified outwash deposits on stream terraces and outwash plains. Permeability is moderate in the upper part of the subsoil and rapid or very rapid in the substratum. Slopes range from 0 to 2 percent.

Damascus soils are commonly adjacent to Jimtown and Haskins soils and are similar to Holly and Sebring soils. Jimtown and Haskins soils are somewhat poorly drained and have less gray in the subsoil. Haskins soils formed in glacial outwash and the underlying glacial till or in lacustrine material on outwash plains and uplands. Holly soils formed in alluvium on flood plains and do not have an argillic horizon. Sebring soils formed in water-laid deposits. They have more silt and less sand and gravel in the subsoil and substratum.

Typical pedon of Damascus silt loam, about 2.5 miles south of Auburn Corners, in Auburn Township, 1,040 yards north along State Route 44 from its intersection with Crackel Road, then 715 yards west:

Ap—0 to 10 inches; dark gray (10YR 4/1) silt loam; weak fine granular structure; friable; many roots; 5 percent coarse fragments; slightly acid; abrupt smooth boundary.

B1g—10 to 14 inches; gray (5Y 5/1) loam; weak medium subangular blocky structure; friable; many roots; 8 percent coarse fragments; slightly acid; clear wavy boundary.

B21tg—14 to 24 inches; dark gray (10YR 4/1) clay loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate medium prismatic structure parting to weak medium and coarse subangular blocky; firm; few roots; thin continuous dark gray (10YR 4/1) clay films on faces of peds; 10 percent coarse fragments; slightly acid; clear wavy boundary.

B22tg—24 to 26 inches; gray (5Y 5/1) gravelly loam; few coarse prominent dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; firm; few roots; thin patchy dark gray (10YR 4/1) clay films on faces of peds; 15 percent coarse fragments; slightly acid; clear wavy boundary.

B3g—26 to 32 inches; gray (N 5/0) sandy loam; few coarse prominent light olive brown (2.5Y 5/4) mottles; weak coarse subangular blocky structure; firm; few roots; light olive brown (2.5Y 5/4) clay films bridging sand grains and pebbles; 10 percent coarse fragments; slightly acid; abrupt wavy boundary.

IIC1—32 to 36 inches; light olive brown (2.5Y 5/4) gravelly loamy sand; few medium prominent gray (5Y 5/1) mottles; single grained; loose; few roots; 20 percent coarse fragments; neutral; abrupt wavy boundary.

IIC2—36 to 45 inches; gray (5Y 5/1) and light olive brown (2.5Y 5/4) stratified loam and gravelly loamy sand; massive; single grained; loose; thin lenses of silt loam; 5 to 25 percent coarse fragments; slight effervescence; mildly alkaline; clear wavy boundary.

IIC3g—45 to 60 inches; gray (5Y 5/1) gravelly sandy loam; massive; friable; 25 percent coarse fragments; slight effervescence; mildly alkaline.

The solum is 30 to 48 inches thick. Coarse fragments range from 0 to 30 percent by volume in horizons above a depth of 20 inches, from 5 to 30 percent in the solum between 20 to 40 inches, and up to 25 percent in the C horizon. Reaction ranges from very strongly acid to slightly acid in the A and B horizons. It is strongly acid to neutral in the upper part of the C horizon and slightly acid to mildly alkaline in the lower part, becoming more alkaline with depth.

The Ap horizon has hue of 10YR, value of 4, and chroma of 1 or 2. Some pedons have an A1 horizon 1 to 5 inches thick and an A2 horizon. The B2 horizon has hue of 10YR to 5Y or N, value of 4 to 6, and chroma of 0 to 2. It is loam, sandy clay loam, clay loam, or a gravelly analog. Thin subhorizons of silty clay loam are in some pedons. The C horizon has hue of 10YR to 5Y or N, value of 4 to 6, and chroma of 0 to 4. It is loam, sandy loam, loamy sand, or a gravelly analog.

Darien series

The Darien series consists of deep, somewhat poorly drained, slowly permeable soils that formed in glacial till on uplands. Slopes range from 0 to 6 percent.

Darien soils are similar to Mahoning and Mitiwanga soils. Mahoning soils have more clay in the subsoil and have illitic mineralogy. Mitiwanga soils have sandstone bedrock at a depth of 20 to 40 inches.

Typical pedon of Darien silt loam, bedrock substratum, 0 to 2 percent slopes, about 2.3 miles west of Thompson, in Thompson Township, 550 yards southwest along Thompson Road from its intersection with Leroy Road, then 165 yards west:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine and medium granular structure; friable; many roots; 5 percent coarse fragments; medium acid; abrupt smooth boundary.

A2—8 to 12 inches; light yellowish brown (10YR 6/4) silt loam; common medium faint yellowish brown (10YR 5/4) and few medium distinct strong brown (7.5YR 5/8) and gray (10YR 6/1) mottles; weak fine and medium granular structure; friable; common roots; dark grayish brown (10YR 4/2) organic coatings in old worm and root channels; 5 percent coarse fragments; medium acid; clear wavy boundary.

B1—12 to 18 inches; grayish brown (2.5Y 5/2) loam; many medium prominent strong brown (7.5YR 5/8) and common medium distinct gray (10YR 6/1) mottles; weak medium subangular blocky structure; friable; few roots; thin patchy very pale brown (10YR 7/3) silt coatings on faces of peds; few fine distinct very dark brown (10YR 2/2) stains and concretions (iron and manganese oxides); 8 percent coarse fragments; strongly acid; clear wavy boundary.

B21t—18 to 23 inches; dark yellowish brown (10YR 4/4) clay loam; many medium distinct strong brown (7.5YR 5/6) mottles; moderate fine and medium subangular blocky structure; firm; few roots; thin patchy gray (10YR 6/1) clay films on faces of peds; many fine and medium black (10YR 2/1) stains and concretions (iron and manganese oxides); 8 percent coarse fragments; strongly acid; gradual wavy boundary.

B22t—23 to 31 inches; dark yellowish brown (10YR 4/4) clay loam; few medium distinct yellowish brown (10YR 5/6) and common fine and medium distinct light brownish gray (2.5Y 6/2) mottles; moderate medium subangular blocky structure; firm; gray (10YR 6/1) clay films that are medium patchy on vertical faces of peds and thin very patchy on horizontal faces; many fine and medium black (10YR 2/1) stains and concretions (iron and manganese oxides); 8 percent coarse fragments; strongly acid; clear wavy boundary.

B3t—31 to 40 inches; dark yellowish brown (10YR 4/4) clay loam; few medium distinct yellowish brown (10YR 5/6) and common fine and medium distinct light brownish gray (2.5Y 6/2) mottles; weak coarse subangular blocky structure; firm; thin very patchy gray (10YR 6/1) clay films on faces of peds; common fine and medium black (10YR 2/1) stains and concretions (iron and manganese oxides); 10 percent coarse fragments; strongly acid; clear wavy boundary.

C—40 to 55 inches; brown (10YR 4/3) clay loam; few medium distinct yellowish brown (10YR 5/6) and common fine and medium distinct light brownish gray (2.5Y 6/2) mottles; massive; firm; 12 percent coarse fragments; medium acid; clear wavy boundary.

IICr—55 inches; interbedded siltstone and shale bedrock.

The solum is 30 to 45 inches thick. The depth to fractured shale and siltstone bedrock ranges from 40 to 60 inches. Content of coarse fragments ranges from 2 to 15 percent by volume in the A and B2 horizons and from 10 to 20 percent in the B3 and C horizons.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is very strongly acid to medium acid. The B2 horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 3 or 4. It is clay loam or silty clay loam. The Bt horizon is strongly acid or medium acid. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. It is clay loam or shaly silty clay loam and is medium acid to neutral.

Ellsworth series

The Ellsworth series consists of deep, moderately well drained, slowly or very slowly permeable soils that formed in glacial till on uplands. Slopes range from 2 to 50 percent.

Ellsworth soils are commonly adjacent to Brecksville and Mahoning soils and are similar to Geeburg, Glenford, and Rittman soils. Mahoning soils are somewhat poorly drained and have more gray in the subsoil. Brecksville soils have more shale fragments in the subsoil and are underlain by shale bedrock at a depth of 20 to 40 inches. Geeburg soils have more clay in the subsoil and substratum. Rittman soils have less clay in the subsoil and have a fragipan. Glenford soils have fewer coarse fragments in the solum.

Typical pedon of Ellsworth silt loam, 2 to 6 percent slopes, about 1 mile south of Fullertown, in Newbury Township, 412 yards west along Perkin Road from its intersection with Sperry Road, then 190 yards north:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine and medium granular structure; friable; many roots; 3 percent coarse fragments; very strongly acid; abrupt smooth boundary.

B1—9 to 13 inches; brown (10YR 5/3) silty clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; firm; many roots; 3 percent coarse fragments; very strongly acid; clear smooth boundary.

B21t—13 to 18 inches; brown (10YR 4/3) clay; common medium distinct strong brown (7.5YR 5/6) and few fine distinct light brownish gray (10YR 6/2) mottles; moderate medium prismatic structure parting to strong medium subangular and angular blocky; firm; common roots; thin patchy brown (10YR 5/3) clay films on faces of peds; 3 percent coarse fragments; very strongly acid; clear smooth boundary.

B22t—18 to 24 inches; brown (10YR 4/3) clay; common medium distinct strong brown (7.5YR 5/6) and many fine and medium distinct grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) mottles; moderate coarse prismatic structure parting to moderate medium and coarse subangular and angular blocky; firm; few roots; thin patchy grayish brown (10YR 5/2) clay films on faces of peds; 5 percent coarse fragments; strongly acid; clear smooth boundary.

B23t—24 to 32 inches; dark brown (10YR 4/3) silty clay loam; many coarse distinct strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium and coarse subangular and angular blocky; firm; few roots; thin patchy grayish brown (2.5Y 5/2) clay films on faces of peds; common fine and medium dark brown (7.5YR 3/2) stains and concretions (iron and manganese oxides); 5 percent fragments; slightly acid; clear smooth boundary.

B3t—32 to 38 inches; dark brown (10YR 4/3) silty clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm; thin patchy grayish brown (2.5Y 5/2) clay films on the vertical faces of peds; common fine and medium dark brown (7.5YR 3/2) stains and concretions (iron and manganese oxides); 7 percent coarse fragments; neutral; clear smooth boundary.

C1—38 to 48 inches; dark brown (10YR 4/3) silty clay loam; massive with weak vertical partings; firm; grayish brown (2.5Y 5/2) and strong brown and reddish yellow (7.5YR 5/8 and 6/8) borders on vertical partings; 7 percent coarse fragments; slight effervescence; mildly alkaline; gradual smooth boundary.

C2—48 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; massive with weak vertical partings; firm; light gray (5Y 6/1) coatings; strong brown and reddish yellow (7.5YR 5/8 and 6/8) borders on vertical partings; 10 percent coarse fragments; strong effervescence; mildly alkaline.

The solum is 28 to 46 inches thick. Depth to bedrock is typically more than 60 inches; however, it is 40 to 60 inches in bedrock substratum phases. The content of coarse fragments, mostly shale and sandstone, is less than 10 percent throughout the soil. Except where lime has been added, the upper part of the solum is strongly acid to very strongly acid, and the lower part is medium acid to mildly alkaline.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Some pedons have an A1 horizon 1 to

3 inches thick and an A2 horizon 3 to 8 inches thick. The B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is silty clay, clay, silty clay loam, or clay loam. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is silty clay loam or clay loam and is mildly alkaline or moderately alkaline.

Fitchville series

The Fitchville series consists of deep, somewhat poorly drained, moderately slowly permeable soils. These soils formed in lacustrine deposits on terraces and in basins of former glacial lakes. Slopes range from 0 to 6 percent.

Fitchville soils are commonly adjacent to Glenford and Sebring soils and are similar to Caneadea, Platea, and Wadsworth soils. Glenford soils are moderately well drained and have less gray in the subsoil. Sebring soils are poorly drained and have more gray in the subsoil. Caneadea soils have more clay in the subsoil and substratum. Platea and Wadsworth soils formed in glacial till and have a fragipan.

Typical pedon of Fitchville silt loam, 0 to 2 percent slopes, 4.2 miles south of Burton, in Troy Township, 550 yards south along Rapids Road from its intersection with Stafford Road, then 120 yards east:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium and fine granular structure; friable; many roots; strongly acid; abrupt smooth boundary.

B&A—7 to 15 inches; 85 percent yellowish brown (10YR 5/4) silt loam (B2t); common medium distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; common roots; 15 percent thick continuous light brownish gray (10YR 6/2) silt loam (A2); few fine very dark brown (10YR 2/2) stains and concretions (iron and manganese oxides); very strongly acid; clear wavy boundary.

B21t—15 to 23 inches; yellowish brown (10YR 5/6) silty clay loam; many medium distinct light brownish gray (10YR 6/2) and common fine faint yellowish brown (10YR 5/4) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; few roots; thin patchy gray (10YR 5/1) clay films and thin very patchy light brownish gray (10YR 6/2) silt coatings on faces of peds; few fine very dark brown (10YR 2/2) stains and concretions (iron and manganese oxides); very strongly acid; clear wavy boundary.

B22t—23 to 34 inches; dark yellowish brown (10YR 4/4) silty clay loam; many medium distinct yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) mottles; weak coarse prismatic structure parting to moderate medium and coarse subangular blocky; firm; gray (10YR 5/1) coatings on faces of peds; thin patchy clay films on faces of peds; common medium black (10YR 2/1) stains and concretions (iron and manganese oxides); strongly acid; gradual wavy boundary.

B23t—34 to 46 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium distinct yellowish brown (10YR 5/8) and grayish brown (10YR 5/2) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm; gray (10YR 5/1) coatings on faces of peds; thin patchy clay films on faces of peds; common medium black (10YR 2/1) stains and concretions (iron and manganese oxides); strongly acid; gradual wavy boundary.

B3—46 to 59 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium distinct yellowish brown (10YR 5/8) and gray (10YR 6/1) mottles; weak coarse prismatic structure; friable; laminated; thin grayish brown (10YR 5/2) coatings mainly on vertical faces of peds; thin very patchy clay films on vertical faces of peds; common medium dark brown (7.5YR 3/2) stains and concretions (iron and manganese oxides); slightly acid; clear smooth boundary.

C—59 to 69 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; laminated; neutral.

The solum is 30 to 60 inches thick. Pedons commonly do not have coarse fragments, although the C horizon is as much as 5 percent by volume.

The Ap horizon has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 2. Some pedons have an A1 horizon 1 to 4 inches thick and have an A2 horizon. The A horizon is very strongly acid to medium acid, except where lime has been added. The Bt horizon has hue of 2.5Y to 7.5YR, value of 4 to 6, and chroma of 2 to 6. It is silt loam or silty clay loam and is very strongly acid to medium acid. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is laminated or stratified and commonly is silt loam or silty clay loam. Thin lenses of loam or fine sandy loam are in some pedons. Reaction ranges from medium acid to mildly alkaline.

Geeburg series

The Geeburg series consists of deep, moderately well drained, very slowly permeable soils that formed in glacial till on uplands. Slopes range from 2 to 12 percent.

Geeburg soils are similar to Ellsworth and Rittman soils. Ellsworth and Rittman soils have less clay in the subsoil and substratum, and Rittman soils have a fragipan.

Typical pedon of Geeburg silt loam, 2 to 6 percent slopes, about 3 miles southeast of Parkman, in Parkman Township, 1,045 yards west along Bradford Road from its intersection with Hobart Road, then 360 yards south:

Ap—0 to 7 inches; brown (10YR 4/3) silt loam; moderate fine and medium granular structure; friable; many roots; 2 percent coarse fragments; neutral; abrupt smooth boundary.

B1—7 to 10 inches; yellowish brown (10YR 5/4) silty clay loam; common medium faint yellowish brown (10YR 5/6 and 5/8) mottles; weak fine and medium subangular blocky structure; firm; common roots; brown (10YR 4/3) organic stains on faces of peds; 2 percent coarse fragments; strongly acid; clear smooth boundary.

B21t—10 to 13 inches; dark yellowish brown (10YR 4/4) silty clay; common medium distinct light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate fine and medium subangular blocky; firm; common roots; grayish brown (2.5Y 5/4) clay films that are thin continuous on vertical faces of peds and thin patchy on horizontal faces; 2 percent coarse fragments; very strongly acid; clear wavy boundary.

B22t—13 to 19 inches; dark yellowish brown (10YR 4/4) silty clay; common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium angular and subangular blocky; firm; common roots; thin continuous grayish brown (2.5Y 5/2) clay films on vertical faces of peds and thin patchy brown (10YR 4/3) clay films on horizontal faces; 3 percent coarse fragments; very strongly acid; clear wavy boundary.

B23t—19 to 30 inches; dark yellowish brown (10YR 4/4) silty clay; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium and coarse angular and subangular blocky; firm; few roots; thin continuous grayish brown (2.5Y 5/2) clay films on vertical faces of peds and thin patchy brown (10YR 4/3) clay films on horizontal faces; few fine very dark brown (10YR 2/2) stains (iron and manganese oxides); 2 percent coarse fragments; neutral; clear wavy boundary.

C1—30 to 42 inches; dark yellowish brown (10YR 4/4) silty clay; massive with vertical partings; firm; gray (10YR 6/1) coatings in vertical partings; common white (2.5Y 8/2) calcium carbonate splotches; common fine and medium dark brown (7.5YR 3/2) stains (iron and manganese oxides); 2 percent coarse fragments; slight effervescence; mildly alkaline; diffuse wavy boundary.

C2—42 to 60 inches; yellowish brown (10YR 5/4) silty clay; common medium faint yellowish brown (10YR 5/6) mottles; massive with vertical partings; firm; grayish brown (2.5Y 5/2) coatings in partings; common white (2.5Y 8/2) calcium carbonate splotches; few fine distinct dark brown (7.5YR 3/2) stains (iron and manganese oxides); 3 percent coarse fragments; slight effervescence; mildly alkaline.

The solum is 20 to 40 inches thick. The content of coarse fragments, mainly shale and sandstone, is less than 5 percent by volume throughout the soil.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Some pedons have an A1 horizon 1 to 4 inches thick. The A horizon is strongly acid or very strongly acid, except where lime has been added. The B2t horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 5. It is silty clay or clay. Reaction is strongly acid or very strongly acid in the upper part of the B2t horizon and medium acid to mildly alkaline in the lower part. The C horizon is clay or silty clay and is mildly alkaline or moderately alkaline.

Glenford series

The Glenford series consists of deep, moderately well drained, moderately slowly permeable soils. These soils formed in glaciolacustrine or stream-deposited material on lake plains and terraces. Slopes range from 2 to 12 percent.

Glenford soils are commonly adjacent to Fitchville and Sebring soils and are similar to Ellsworth soils. Fitchville and Sebring soils are wetter and are more gray in the subsoil. Ellsworth soils formed in glacial till and have more clay and coarse fragments in the subsoil and substratum.

Typical pedon of Glenford silt loam, 2 to 6 percent slopes, about 4 miles south of Chardon, in Munson Township, 1,680 yards west along U.S. Route 322 from its intersection with Bass Lake Road, then 16 yards north:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium and fine granular structure; friable; many roots; 2 percent small pebbles; neutral; abrupt smooth boundary.

B1—8 to 12 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; common roots; grayish brown (10YR 5/2) organic stains along root channels; 3 percent small pebbles; medium acid; clear wavy boundary.

B21t—12 to 16 inches; yellowish brown (10YR 5/4) silt loam; few medium faint yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; common roots; thin patchy dark brown (7.5YR 4/4) clay films in pores and root channels; few medium grayish brown (10YR 5/2) organic stains along root channels; strongly acid; clear wavy boundary.

B22t—16 to 21 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct yellowish brown (10YR 5/8) and common coarse distinct light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure parting to moderate medium platy; friable; few roots; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds and in voids; strongly acid; clear wavy boundary.

B23t—21 to 25 inches; yellowish brown (10YR 5/4) silty clay loam; many coarse prominent light brownish gray (10YR 6/2) and common medium distinct strong brown (7.5YR 5/8) mottles; weak coarse prismatic structure parting to moderate medium platy; firm; thin very patchy dark brown (7.5YR 4/4) clay films in pores; strongly acid; clear wavy boundary.

B31—25 to 31 inches; yellowish brown (10YR 5/4) silt loam; few coarse distinct light brownish gray (10YR 6/2) and few medium distinct yellowish brown (10YR 5/8) mottles; weak coarse prismatic structure parting to weak medium platy; friable; medium acid; clear wavy boundary.

B32—31 to 39 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct yellowish brown (10YR 5/8) and common coarse distinct light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure parting to weak medium platy; friable; medium acid; clear wavy boundary.

C—39 to 60 inches; yellowish brown (10YR 5/4) silt loam; massive; laminated; friable; a few horizontal streaks of dark yellowish brown (10YR 4/4) and light brownish gray (10YR 6/2); medium acid.

The solum is 35 to 60 inches thick.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Some pedons have an A1 horizon 1 to 4 inches thick. The B2 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam or silty clay loam. The B horizon is very strongly acid to medium acid in the upper part and medium acid to neutral in the lower part. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is laminated. Silt loam and silty clay loam are the dominant textures, although thin strata of loam, fine sandy loam, and silty clay are in many pedons.

Haskins series

The Haskins series consists of deep, somewhat poorly drained soils that formed in glacial outwash and in the underlying glacial till or lacustrine material on outwash plains and uplands. Permeability is moderate in the upper and middle parts of the subsoil and slow or very slow in the lower part of the subsoil and in the underlying material. Slopes range from 0 to 6 percent.

Haskins soils are commonly adjacent to Rawson soils and are similar to Jimtown soils. Jimtown soils formed in glacial outwash and do not have glacial till or lacustrine material in the substratum. Rawson soils are moderately well drained and are less gray in the subsoil.

Typical pedon of Haskins loam, 2 to 6 percent slopes, about 3 miles north of Auburn Center, in Newbury Township, 465 yards west along Bell Street from its intersection with Auburn Road, then 125 yards south:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam; weak fine and medium granular structure; friable; many roots; 2 percent coarse fragments; medium acid; abrupt smooth boundary.

A2—7 to 10 inches; brown (10YR 5/3) loam; common medium distinct light brownish gray (10YR 6/2) and yellowish brown (10YR 5/8) mottles; weak medium and coarse subangular blocky structure; friable; common roots; dark grayish brown (10YR 4/2) organic stains on faces of peds and along root channels; 5 percent coarse fragments; strongly acid; clear wavy boundary.

B1—10 to 17 inches; yellowish brown (10YR 5/4) loam; common medium distinct light brownish gray (10YR 6/2) and yellowish brown (10YR 5/8) mottles; moderate coarse subangular blocky structure; friable; few roots; thin patchy light brownish gray (2.5Y 6/2) silt coatings on vertical faces of peds; 5 percent coarse fragments; strongly acid; clear wavy boundary.

B21t—17 to 21 inches; yellowish brown (10YR 5/4) sandy clay loam; common medium distinct light brownish gray (10YR 6/2) and yellowish brown (10YR 5/8) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; firm; few roots; thin patchy grayish brown (10YR 5/2) clay films on faces of prisms; thin very patchy light brownish gray (2.5Y 6/2) silt coatings on faces of peds; 5 percent coarse fragments; strongly acid; clear wavy boundary.

B22t—21 to 26 inches; yellowish brown (10YR 5/4) sandy clay loam; common medium distinct light brownish gray (10YR 6/2) and strong brown (7.5YR 5/8) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm; few roots; thin patchy grayish brown (10YR 5/2) clay films on vertical faces of prisms; common medium very dark brown (10YR 2/2) concretions and stains (iron and manganese oxides); 5 percent coarse fragments; strongly acid; clear wavy boundary.

B23t—26 to 31 inches; dark yellowish brown (10YR 4/4) gravelly sandy clay loam; few medium distinct light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm; grayish brown (10YR 5/2) clay films in voids and bridging sand grains and pebbles; many medium distinct very dark brown (10YR 2/2) concretions (iron and manganese oxides); 15 percent coarse fragments; strongly acid; abrupt wavy boundary.

IIB3t—31 to 43 inches; dark brown (10YR 4/3) clay loam; common medium distinct light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) mottles; weak very coarse prismatic structure parting to weak thick platy; firm; thin patchy grayish brown (10YR 5/2) clay films on vertical faces of peds and in voids; many medium distinct very dark brown (10YR 2/2) concretions (iron and manganese oxides); 5 percent coarse fragments; slightly acid; gradual wavy boundary.

IIC1—43 to 53 inches; brown (10YR 4/3) clay loam; common medium and coarse distinct yellowish brown (10YR 5/6) mottles; massive; firm; 8 percent coarse fragments; neutral; gradual wavy boundary.

IIC2—53 to 60 inches; brown (10YR 4/3) clay loam; common medium and coarse distinct yellowish brown (10YR 5/6) mottles; massive; firm; 10 percent coarse fragments; strong effervescence; moderately alkaline.

The solum is 32 to 48 inches thick and typically extends into the underlying fine textured material. Gravel content ranges from 2 to 20 percent in the upper part of the B horizon and 0 to 10 percent in the lower part of the B horizon and in the C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. It is neutral to strongly acid. The B horizon has hue of 10YR or 2.5Y, value of 4 to 5, and chroma of 2 to 4. It is dominantly clay loam or sandy clay loam, but the range includes loam and thin strata of sandy loam and gravelly phases of these textures. The B horizon is slightly acid to strongly acid in the upper part and neutral to strongly acid in the lower part. The IIB horizon has hue of 10YR to 5Y or N, value of 4 or 5, and chroma of 0 to 3. It is clay, silty clay, silty clay loam, or clay loam. It is slightly acid to mildly alkaline. The IIC horizon is clay, silty clay, clay loam, or silty clay loam.

Holly series

The Holly series consists of deep, poorly drained soils that formed in alluvium on flood plains. Permeability is moderate or moderately slow. Slopes range from 0 to 2 percent.

Holly soils are commonly adjacent to Orrville soils and are similar to Damascus, Sebring, and Wabasha soils. Orrville soils are somewhat poorly drained and are in slightly higher positions on the flood plains. Damascus and Sebring soils have an argillic horizon. Damascus soils are on terraces. Sebring soils are on terraces and in basins of former glacial lakes and have more silt and less sand in the subsoil. Wabasha soils have a darker colored surface layer and have more clay in the subsoil and substratum.

Typical pedon of Holly silt loam, frequently flooded, about 3.4 miles east-southeast of Chesterland, in Munson Township, 0.5 mile south along Rockhaven Road from its intersection with Wye Road, then 17 yards west:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium and fine granular structure; friable; many fine roots; 2 percent coarse fragments; medium acid; abrupt smooth boundary.

B21g—9 to 12 inches; dark gray (10YR 4/1) silt loam; weak medium and coarse subangular blocky structure; firm; 5 percent coarse fragments; common fine black stains (iron and manganese oxides); thin very patchy very dark gray (10YR 3/1) organic coatings on faces of peds; slightly acid; abrupt smooth boundary.

B22g—12 to 17 inches; dark gray (10YR 4/1) clay loam; common medium distinct brown (7.5YR 4/4) mottles; weak coarse subangular blocky structure; firm; few fine roots; 5 percent coarse fragments; slightly acid; abrupt smooth boundary.

B23g—17 to 21 inches; dark gray (10YR 4/1) clay loam; many medium distinct dark yellowish brown (10YR 4/4) mottles; weak coarse subangular blocky structure; firm; many medium black (10YR 2/1) stains and concretions (iron and manganese oxides); 5 percent coarse fragments; slightly acid; clear smooth boundary.

C1g—21 to 25 inches; gray (10YR 5/1) clay loam; many coarse distinct yellowish brown (10YR 5/4) mottles; massive; friable; 15 percent coarse fragments; slightly acid; clear smooth boundary.

C2g—25 to 30 inches; very dark gray (N 3/0) gravelly loam; many coarse prominent dark yellowish brown (10YR 4/4) and common fine distinct gray (N 6/0) mottles; massive; friable; about 25 percent coarse fragments; neutral; abrupt smooth boundary.

C3g—30 to 35 inches; gray (N 5/0) sandy loam; common medium distinct light olive brown (2.5Y 5/4) mottles; massive; friable; 10 percent coarse fragments; neutral; clear smooth boundary.

C4g—35 to 60 inches; gray (N 5/0) gravelly sandy loam; common medium distinct light olive brown (2.5Y 5/4) mottles; massive; very friable; 20 percent coarse fragments; slight effervescence; mildly alkaline.

The solum is 20 to 40 inches thick. Content of coarse fragments ranges from 0 to 15 percent by volume in the B horizon and 10 to 25 percent in the C horizon.

The Ap horizon has hue of 10YR, value of 4, and chroma of 1 or 2. Some pedons have a thin A1 horizon. The A horizon is dominantly silt loam, although it is loam in some pedons. Reaction is slightly acid or medium acid. The B horizon has hue of 10YR, 5Y, or N, value of 4 to 6, and chroma of 2 or less. It is silt loam, loam, or clay loam. Thin subhorizons less than 4 inches thick that have coarser or finer texture are present in some pedons. The B horizon ranges from neutral to strongly acid. The C horizon has hue of 10YR to 5Y or N, value of 3 to 6, and chroma of 2 or less. It is silt loam, loam, sandy loam, or a gravelly analog above a depth of 40 inches. Below a depth of 40 inches the C horizon typically is stratified sandy loam, loamy sand, sand, or a gravelly analog. Thin strata of clay loam and silty clay loam are in some pedons. The C horizon is slightly acid to mildly alkaline.

Jimtown series

The Jimtown series consists of deep, somewhat poorly drained, moderately permeable soils that formed in stratified outwash deposits on stream terraces and outwash plains. Slopes range from 0 to 3 percent.

Jimtown soils are commonly adjacent to Bogart and Damascus soils and are similar to Haskins soils. Bogart soils are moderately well drained and are in slightly higher positions on the landscape. They are less gray in the subsoil. Damascus soils are poorly drained and are more gray in the subsoil. Haskins soils formed in glacial outwash and the underlying glacial till or lacustrine material on outwash plains and uplands.

Typical pedon of Jimtown silt loam, 0 to 3 percent slopes, about 3 miles southwest of Montville, in Montville Township, 715 yards north along Kile Road from its intersection with Chardon Windsor Road, then 83 yards east:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine and medium granular structure; friable; many roots; 2 percent coarse fragments; medium acid; abrupt smooth boundary.

B1—9 to 14 inches; yellowish brown (10YR 5/4) loam; common medium distinct light brownish gray (10YR 6/2) and common medium and coarse distinct strong brown (7.5YR 5/6 and 5/8) mottles; weak medium subangular blocky structure; friable; common roots; thin patchy light gray (10YR 7/2) silt coatings, white (10YR 8/1) dry, on horizontal and vertical faces of peds; 2 percent coarse fragments; medium acid; clear wavy boundary.

B21t—14 to 20 inches; yellowish brown (10YR 5/4) sandy clay loam; common medium distinct light brownish gray (10YR 6/2) and common medium and coarse distinct strong brown (7.5YR 5/6 and 5/8) mottles; weak medium and fine subangular blocky structure; firm; common roots; thin patchy light gray (10YR 6/1) and light brownish gray (10YR 6/2) clay films on horizontal and vertical faces of peds; thin patchy light gray (10YR 7/2) silt coatings, white (10YR 8/1) dry, on faces of peds; 2 percent coarse fragments; medium acid; clear wavy boundary.

B22t—20 to 26 inches; yellowish brown (10YR 5/4) loam; common medium distinct light brownish gray (10YR 6/2) and common medium and coarse distinct strong brown (7.5YR 5/8 and 5/6) mottles; weak medium and fine subangular blocky structure; firm; few roots; thin very patchy light gray (10YR 6/1) and light brownish gray (10YR 6/2) clay films on faces of peds; medium very patchy light gray (10YR 7/2) silt coatings, white (10YR 8/1) dry, on vertical faces of peds; 3 percent coarse fragments; strongly acid; abrupt smooth boundary.

B23t—26 to 32 inches; yellowish brown (10YR 5/4) fine sandy loam; common fine faint yellowish brown (10YR 5/6) and few medium distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; few roots; thin very patchy brown (10YR 5/3) clay films bridging sand grains and pebbles on faces of peds; slightly acid; abrupt smooth boundary.

B3t—32 to 40 inches; yellowish brown (10YR 5/4) gravelly loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; firm; thin very patchy brown (10YR 5/3) clay films on faces of peds; clay films bridging sand grains and pebbles; 25 percent coarse fragments; slightly acid; abrupt smooth boundary.

C1—40 to 53 inches; dark grayish brown (10YR 4/2) gravelly loamy sand; single grained; loose; 40 percent coarse fragments; mildly alkaline; clear smooth boundary.

C2—53 to 60 inches; dark gray (10YR 4/1) gravelly loamy sand; single grained; loose; 20 percent coarse fragments; mildly alkaline.

The solum is 30 to 48 inches thick. The content of coarse fragments ranges from 2 to 15 percent in the A and B horizons above a depth of 20 inches, from 0 to 50 percent in the B and C horizons between depths of 20 and 40 inches, and as much as 60 percent in the B and C horizons below a depth of 40 inches.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 to 3. Some pedons have an A1 horizon as much as 5 inches thick and an A2 horizon as much as 8 inches thick. The A horizon is very strongly acid to neutral. The B horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 2 to 4. It is loam, sandy clay loam, fine sandy loam, or a gravelly analog. Thin subhorizons of silt loam or silty clay loam are in some pedons. The B horizon is slightly acid to very strongly acid. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 0 to 4. It is loamy sand, sandy loam, fine sandy loam, loamy fine sand, sand, or a gravelly analog. It is slightly acid to moderately alkaline.

Lordstown series

The Lordstown series consists of moderately deep, well drained, moderately permeable soils that formed in glacial till and in residuum of sandstone bedrock on uplands. Slopes range from 2 to 70 percent.

Lordstown soils are commonly adjacent to Loudonville and Mitiwanga soils and are similar to Brecksville, Loudonville, and Wooster soils. Brecksville soils have more clay in the subsoil and are underlain by shale bedrock. Loudonville soils have fewer coarse fragments in the solum and have an argillic horizon. Mitiwanga soils are wetter and are gray in the subsoil. Wooster soils are deep to bedrock and have a fragipan.

Typical pedon of Lordstown channery loam from an area of Lordstown-Rock outcrop complex, 18 to 70 percent slopes, about 3 miles north-northwest of Middlefield, in Huntsburg Township, 770 yards north of the intersection of State Route 608 and Durkee Road:

O1—4 inches to 0; fresh and partially decomposed leaves and twigs.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) channery loam; moderate medium granular structure; very friable; many roots; 20 percent coarse fragments; very strongly acid; abrupt smooth boundary.

A2—4 to 6 inches; brown (10YR 5/3) channery loam; weak fine and medium granular structure; very friable; many roots; very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2) organic coatings in old root and worm channels; 20 percent coarse fragments; very strongly acid; clear wavy boundary.

B21—6 to 12 inches; dark yellowish brown (10YR 4/4) channery loam; weak medium subangular blocky structure; friable; common roots; very dark grayish brown (10YR 3/2) organic coatings in old root and worm channels; 25 percent coarse fragments; very strongly acid; clear wavy boundary.

B22—12 to 21 inches; yellowish brown (10YR 5/4) channery fine sandy loam; weak medium and coarse subangular blocky structure; friable; common roots; very dark grayish brown (10YR 3/2) organic coatings in old root and worm channels; 30 percent coarse fragments; very strongly acid; gradual wavy boundary.

C—21 to 28 inches; yellowish brown (10YR 5/4) very channery fine sandy loam; massive; friable; few roots; very dark grayish brown (10YR 3/2) organic coatings in old root and worm channels; 50 percent coarse fragments; very strongly acid; abrupt wavy boundary.

R—28 inches; thin- to thick-bedded jointed sandstone conglomerate bedrock.

Thickness of the solum and depth to bedrock ranges from 20 to 40 inches. The content of coarse fragments ranges from 10 to 35 percent by volume in the A horizon, 15 to 35 percent in the B horizon, and 20 to 60 percent in the C horizon.

The A1 horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. It is very strongly acid to slightly acid. The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is loam, fine sandy loam, or a channery analog. Reaction is strongly acid or very strongly acid. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is medium acid to very strongly acid.

Loudonville series

The Loudonville series consists of moderately deep, well drained, moderately permeable soils that formed on uplands in glacial till and in residuum of the underlying sandstone bedrock. Slopes range from 2 to 12 percent.

Loudonville soils are commonly adjacent to Lordstown and Mitiwanga soils and are similar to Lordstown and Wooster soils. Lordstown soils do not have an argillic horizon and have more coarse fragments in the solum. Mitiwanga soils are on low knolls and flats and are grayish in the upper part of the subsoil. Wooster soils are deep to bedrock and have a fragipan.

Typical pedon of Loudonville silt loam, 2 to 6 percent slopes, about 2.6 miles north-northwest of Middlefield, in Middlefield Township, about 245 yards southeast along State Route 608 from its intersection with Durkee Road, then 522 yards west:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; moderate medium granular structure; friable; many roots; 3 percent coarse fragments; medium acid; abrupt smooth boundary.

B1—8 to 12 inches; yellowish brown (10YR 5/4) loam; weak fine and medium subangular blocky structure; friable; common roots; 3 percent coarse fragments; very strongly acid; clear wavy boundary.

B21t—12 to 20 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; firm; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds; 5 percent coarse fragments; very strongly acid; gradual wavy boundary.

B22t—20 to 26 inches; yellowish brown (10YR 5/4) loam; weak medium subangular blocky structure; firm; thin very patchy dark brown (7.5YR 4/4) clay films on faces of peds; common medium very dark brown (10YR 2/2) stains and concretions (iron and manganese oxides); 8 percent coarse fragments; very strongly acid; clear wavy boundary.

IIB3—26 to 34 inches; yellowish brown (10YR 5/4) sandy loam; common medium distinct light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) mottles; weak medium and coarse subangular blocky structure; friable; few fine and medium dark brown (7.5YR 3/2) stains and concretions (iron and manganese oxides); 10 percent coarse fragments; strongly acid; abrupt wavy boundary.

IIR—34 inches; sandstone bedrock.

The thickness of the solum and depth to sandstone bedrock range from 20 to 40 inches. The content of coarse fragments ranges from 0 to 5 percent by volume in the Ap horizon, 2 to 15 percent in the B2 horizon, and 10 to 60 percent in the IIB3 and IIC horizons. Reaction in the solum is medium acid to very strongly acid, except where lime has been added.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. Some pedons have an A1 horizon 1 to 4 inches thick and an A2 horizon. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The B2 horizon is loam, clay loam, silt loam, or silty clay loam. The IIB3 horizon is loam, sandy loam, or a channery analog.

Mahoning series

The Mahoning series consists of deep, somewhat poorly drained, slowly or very slowly permeable soils that formed in glacial till on uplands. Slopes range from 0 to 12 percent.

Mahoning soils are commonly adjacent to Ellsworth soils and are similar to Caneadea, Darien, and Wadsworth soils and are less gray in the subsoil. Caneadea soils formed in lacustrine material and have more clay in the B and C horizons. Darien soils have less clay in the subsoil and have mixed mineralogy. Wadsworth soils have a fragipan.

Typical pedon of Mahoning silt loam, 2 to 6 percent slopes, about 3.5 miles north of Newbury, in Munson Township, 740 yards east along Bean Road from its intersection with Auburn Road, then 100 yards south:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; friable; many fine roots; 2 to 5 percent coarse fragments; neutral; abrupt smooth boundary.

B1—8 to 12 inches; grayish brown (10YR 5/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium and coarse subangular blocky structure; firm; common fine roots; grayish brown (10YR 5/2) coatings on faces of peds; many fine black (10YR 2/1) concretions (iron and manganese oxides); 2 to 5 percent coarse fragments; medium acid; abrupt smooth boundary.

B21t—12 to 14 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium and coarse subangular blocky structure; firm; common fine roots; grayish brown (10YR 5/2) coatings on faces of peds; thin patchy clay films on faces of peds, common black (10YR 2/1) stains (iron and manganese oxides); 2 to 5 percent coarse fragments; very strongly acid; clear wavy boundary.

B22t—14 to 18 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium prismatic structure parting to strong medium and coarse subangular blocky; firm; grayish brown (10YR 5/2) coatings on faces of peds; thin patchy clay films on faces of peds; common black (10YR 2/1) stains (iron and manganese oxides); 2 to 5 percent coarse fragments; strongly acid; clear smooth boundary.

B23t—18 to 27 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; moderate coarse prismatic structure parting to strong medium and coarse subangular blocky; firm; gray (10YR 5/1) coatings on surfaces of peds; thin continuous clay films on faces of peds; common black (10YR 2/1) stains (iron and manganese oxides); about 5 percent coarse fragments; neutral; clear smooth boundary.

B31—27 to 32 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; weak coarse prismatic structure parting to weak thick platy; firm; thin patchy clay films and grayish brown (10YR 5/2) and light gray (10YR 7/1) coatings on vertical faces of peds; 2 to 5 percent coarse fragments; slight effervescence; mildly alkaline; clear wavy boundary.

B32—32 to 36 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; weak coarse prismatic structure parting to moderate medium platy; grayish brown (10YR 5/2) coatings on vertical faces of peds; 2 to 5 percent coarse fragments; slight effervescence; mildly alkaline; clear wavy boundary.

C—36 to 60 inches; dark yellowish brown (10YR 4/4) silty clay loam; massive with weak vertical partings; firm; common grayish brown (10YR 5/2) coatings on vertical partings; thin patchy gray (10YR 6/1) calcans on vertical partings; 5 percent coarse fragments; strong effervescence; moderately alkaline.

The solum is 30 to 42 inches thick. Depth to bedrock is typically more than 60 inches, although it is 40 to 60 inches in bedrock substratum phases. The upper part of the solum is strongly acid to very strongly acid. Except where lime has been added, the lower part of the solum ranges from medium acid to mildly alkaline.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or 3. Some pedons have an A1 horizon 1 to 5 inches thick and an A2 horizon. The B horizon has hue of 10YR or 2.5Y, value of 4 or 6, ahd chroma of 2 to 4. It is commonly silty clay loam. Less commonly it is silty clay, clay, or clay loam. The color of the C horizon is similar to that of the B horizon. The C horizon is commonly silty clay loam, although in some pedons it is clay loam.

Mitiwanga series

The Mitiwanga series consists of moderately deep, somewhat poorly drained, moderately permeable soils that formed in glacial till 20 to 40 inches thick over sandstone bedrock on uplands. Slopes range from 0 to 3 percent.

Mitiwanga soils are commonly adjacent to Lordstown and Loudonville soils and are similar to Darien, Ravenna, and Wadsworth soils. Lordstown and Loudonville soils are well drained and are less gray in the subsoil. Darien, Ravenna, and Wadsworth soils are deep to bedrock. Ravenna and Wadsworth soils have a fragipan.

Typical pedon of Mitiwanga silt loam, 0 to 3 percent slopes, about .5 mile north of Thompson in Thompson Township, 1,100 yards north along State Route 528 from its intersection with Thompson Road, then 270 yards west:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium and fine granular structure; friable; many roots; common black (10YR 2/1) concretions (iron and manganese oxides); 2 percent coarse fragments; medium acid; abrupt smooth boundary.

B1—9 to 15 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; common dark grayish brown (10YR 4/2) fillings in old root channels; grayish brown (10YR 5/2) coatings on faces of peds; 2 percent coarse fragments; strongly acid; abrupt smooth boundary.

B21t—15 to 21 inches; grayish brown (2.5Y 5/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; thick continuous light brownish gray (2.5Y 6/2) coatings on faces of peds; thin patchy clay films on faces of peds; 2 percent coarse fragments; very strongly acid; clear smooth boundary.

B22t—21 to 26 inches; dark yellowish brown (10YR 4/4) clay loam; common medium distinct brown (7.5YR 4/4) mottles; moderate coarse subangular blocky structure parting to weak thick platy; firm; light brownish gray (2.5Y 6/2) coatings on faces of peds; thin patchy grayish brown (10YR 5/2) clay films on vertical faces of peds; few black (10YR 2/1) stains (iron and manganese oxides); 2 percent coarse fragments; very strongly acid; clear smooth boundary.

B23t—26 to 31 inches; dark yellowish brown (10YR 4/4) clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to weak thick platy; firm; light brownish gray (2.5Y 6.2) coatings on faces of peds; thin patchy clay films on faces of peds; 2 percent coarse fragments; very strongly acid; abrupt smooth boundary.

IIR—31 inches; sandstone bedrock.

The thickness of the solum and depth to a lithic contact range from 20 to 40 inches, although they are dominantly 30 to 40 inches. The content of coarse fragments is 2 to 10 percent by volume in the A horizon and 2 to 25 percent in the B horizon.

Some pedons have an A1 horizon 1 to 4 inches thick and an A2 horizon. The A horizon ranges from very strongly acid to medium acid, except where lime has been added. The B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. It is silt loam, silty clay loam, clay loam, or loam. Reaction ranges from very strongly acid to medium acid.

Orrville series

The Orrville series consists of deep, somewhat poorly drained, moderately permeable soils that formed in alluvium on flood plains. Slopes range from 0 to 2 percent.

Orrville soils are commonly adjacent to Holly, Tioga, and Wabasha soils. Holly soils are poorly drained, and Wabasha soils are very poorly drained. Both soils are more grayish in the subsoil. Wabasha soils have more clay in the solum and have a darker colored surface layer. Tioga soils are well drained and are not gray in the subsoil.

Typical pedon of Orrville silt loam, frequently flooded, about 3.4 miles east-southeast of Chesterland, in Munson Township, 1,210 yards south along Rockhaven Road from its intersection with Wye Road, then 17 yards east:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B21—6 to 10 inches; yellowish brown (10YR 5/4) silt loam; many medium distinct grayish brown (10YR 5/2) and common medium distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; friable; common fine roots; strongly acid; clear wavy boundary.

B22—10 to 15 inches; yellowish brown (10YR 5/4) silt loam; many medium distinct light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; friable; common fine roots; 2 percent coarse fragments; medium acid; clear wavy boundary.

B23g—15 to 21 inches; grayish brown (10YR 5/2) loam; many medium distinct brown (7.5YR 4/4) mottles; weak coarse subangular blocky structure; friable; common fine roots; 2 percent coarse fragments; strongly acid; gradual wavy boundary.

B3g—21 to 31 inches; grayish brown (10YR 5/2) loam; massive; friable; 2 percent coarse fragments; strongly acid; clear wavy boundary.

C1g—31 to 40 inches; gray (5Y 5/1) fine sandy loam; common medium distinct olive (5Y 5/3) and common medium prominent brown (7.5YR 4/4) mottles; massive; friable; 5 percent coarse fragments; strongly acid; clear wavy boundary.

C2g—40 to 46 inches; gray (5Y 5/1) loamy fine sand; single grained; friable; 10 percent coarse fragments; medium acid; clear smooth boundary.

C3g—46 to 60 inches; gray (N 5/0) gravelly loamy sand; single grained; loose; 20 percent coarse fragments; medium acid.

The solum is 24 to 40 inches thick. Content of coarse fragments is 0 to 5 percent by volume in the A horizon and 0 to 15 percent in the B horizon.

The A horizon is slightly acid to strongly acid, except where lime has been added. The B horizon has hue of 10YR, 2.5Y, or N, value of 4 to 6, and chroma of 0 to 6. It is silt loam, loam, or clay loam. The B horizon ranges from slightly acid to strongly acid. The C horizon is typically stratified below a depth of 40 inches. Commonly the texture is fine sandy loam, sandy loam, sand, or a gravelly analog. Thin stony layers are in some pedons. Reaction ranges from neutral to strongly acid.

Oshtemo series

The Oshtemo series consists of deep, well drained soils that formed in stratified loamy and sandy material on stream terraces, outwash plains, and kames. Permeability is moderately rapid in the upper part of the subsoil and very rapid in the substratum. Slopes range from 2 to 18 percent and from 25 to 50 percent.

The Oshtemo soils are commonly adjacent to and are similar to Chili soils. Chili soils have more gravel and clay in the subsoil.

Typical pedon of Oshtemo sandy loam, 2 to 6 percent slopes, about 1.9 miles south of Auburn Corners, in Auburn Township, 330 yards south along State Route 44 from its intersection with Bartholomew Road, then 165 yards east:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) sandy loam; moderate medium granular structure; friable; many roots; 4 percent coarse fragments; slightly acid; abrupt smooth boundary.

B1—9 to 15 inches; dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; common roots; 6 percent coarse fragments; slightly acid; clear smooth boundary.

B21t—15 to 24 inches; dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; few roots; thin very dark yellowish brown (10YR 4/4) clay bridging between sand grains and small pebbles; 10 percent coarse fragments; slightly acid; clear smooth boundary.

B22t—24 to 33 inches; dark brown (7.5YR 4/4) sandy loam; weak medium and coarse subangular blocky structure; friable; thin very patchy dark yellowish brown (10YR 4/4) clay bridging between sand grains and small pebbles; 8 percent coarse fragments; strongly acid; clear smooth boundary.

B23t—33 to 38 inches; dark brown (7.5YR 4/4) sandy clay loam; weak medium subangular blocky structure; firm; thin very patchy dark yellowish brown (10YR 4/4) clay bridging between sand grains and small pebbles; 5 percent coarse fragments; strongly acid; abrupt smooth boundary.

B3—38 to 52 inches; dark brown (7.5YR 4/4) loamy sand; single grained; loose; 8 percent coarse fragments; medium acid; clear smooth boundary.

C1—52 to 64 inches; brown (10YR 5/3) loamy sand; single grained; loose; 10 percent coarse fragments; medium acid; abrupt smooth boundary.

C2—64 to 66 inches; brown (10YR 5/3) gravelly loamy sand; single grained; loose; 35 percent coarse fragments; slightly acid.

The solum is 40 to 65 inches thick, although the range is dominantly 45 to 55 inches. Content of coarse fragments ranges from 1 to 10 percent by volume in the A horizon and upper part of the B horizon, from 1 to 30 percent in the lower part of the B horizon, and from 1 to 40 percent in the C horizon. The solum ranges from slightly acid to strongly acid, except for the lower part of the B3 horizon, which is neutral in some pedons.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Some pedons have an A1 horizon 1 to 5 inches thick and an A2 horizon. The B2 horizon has hue of 5YR to 10YR, value of 3 to 5, and chroma of 3 to 6. It is sandy clay loam, sandy loam, or a gravelly analog. The C horizon has hue of 10YR, value of 5, and chroma of 2 to 4. It is loamy sand, sand, gravelly loamy sand, or gravelly sand. It is medium acid to neutral.

Platea series

The Platea series consists of deep, somewhat poorly drained soils that formed in glacial till on uplands. Permeability is moderately slow above the fragipan and very slow in the fragipan. Slopes range from 0 to 6 percent.

Platea soils are commonly adjacent to Ellsworth and Sheffield soils and are similar to Fitchville and Wadsworth soils. Ellsworth soils are moderately well drained and are less gray in the upper part of the subsoil. Ellsworth and Fitchville soils do not have a fragipan. Sheffield soils are poorly drained and are more gray in the subsoil. Wadsworth soils have a part of the argillic horizon above the fragipan.

Typical pedon of Platea silt loam, 0 to 2 percent slopes, about 3 miles southeast of Huntsburg, in Huntsburg Township, 715 yards west along Burton Windsor Road from its intersection with Bundyburg Road, then 220 yards south:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine and medium granular structure; friable; many roots; few medium very dark brown (10YR 2/2) stains and concretions (iron and manganese oxides); 3 percent coarse fragments; very strongly acid; abrupt smooth boundary.

B1—8 to 11 inches; yellowish brown (10YR 5/4) silt loam; common fine faint yellowish brown (10YR 5/6 and 5/8) mottles; weak medium subangular blocky structure; friable; common roots; thin continuous and patchy grayish brown (10YR 5/2) silt coatings on faces of peds; few medium very dark brown (10YR 2/2) stains and concretions (iron and manganese oxides); 3 percent coarse fragments; very strongly acid; clear wavy boundary.

B2—11 to 17 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) and common medium faint yellowish brown (10YR 5/6 and 5/8) mottles; moderate medium subangular blocky structure; firm; common roots; medium continuous and thin patchy light brownish gray (10YR 6/2) coatings on vertical faces of peds; few medium very dark grayish brown (10YR 3/2) stains and concretions (iron and manganese oxides); 3 percent coarse fragments; very strongly acid; clear wavy boundary.

Bx1—17 to 22 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; moderate very coarse prismatic structure parting to moderate medium platy; very firm and brittle; few roots along faces of prisms; medium continuous and thin very patchy grayish brown (10YR 5/2) clay films; yellowish brown (10YR 5/6 and 5/8) borders of prisms; common fine and medium very dark brown (10YR 2/2) stains and concretions (iron and manganese oxides); 5 percent coarse fragments; medium acid; gradual wavy boundary.

Bx2—22 to 28 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) and few fine prominent reddish brown (5YR 4/4) mottles; moderate very coarse prismatic structure parting to moderate thick platy; very firm and brittle; few roots along faces of prisms; medium patchy and thin very patchy gray (10YR 5/1) clay films; yellowish brown (10YR 5/8) borders of prisms; common fine and medium very dark brown (10YR 2/2) stains and concretions (iron and manganese oxides); 8 percent coarse fragments; slightly acid; clear wavy boundary.

Bx3—28 to 34 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak very coarse prismatic structure parting to weak coarse subangular blocky; firm; few roots along faces of prisms; thick patchy gray (10YR 5/1) clay films; yellowish brown (10YR 5/8) borders of prisms; 10 percent coarse fragments; neutral; clear wavy boundary.

B3—34 to 45 inches; dark yellowish brown (10YR 4/4) silt loam; weak very coarse prismatic structure; firm; thick patchy gray (10YR 5/1) clay flows on yellowish brown (10YR 5/8) borders of prisms; 14 percent coarse fragments; slight effervescence; mildly alkaline; gradual wavy boundary.

C—45 to 60 inches; yellowish brown (10YR 5/4) silt loam; massive; firm; 8 percent coarse fragments; strong effervescence; moderately alkaline.

The solum is 34 to 48 inches thick. Depth to carbonates ranges from 30 to 42 inches. The content of coarse fragments ranges from 2 to 5 percent above the Bx horizon and from 2 to 10 percent in the Bx and C horizons.

Some pedons have an A1 horizon 2 to 4 inches thick and an A2 horizon 2 to 4 inches thick. The A horizon is medium acid to extremely acid, except where lime has been added. The B2 horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. It is silt loam or silty clay loam. Reaction is medium acid to extremely acid. The Bx horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. It is commonly silty clay loam. Less commonly it is clay loam or silt loam. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 4. It is silty clay loam or silt loam.

Ravenna series

The Ravenna series consists of deep, somewhat poorly drained soils that formed in glacial till on uplands. Permeability is moderate above the fragipan and slow in the fragipan.

Ravenna soils are commonly adjacent to Canfield and Wooster soils and are similar to Platea and Wadsworth soils. Canfield and Wooster soils are better drained and are less gray in the subsoil. Platea soils have more silt and less sand in the subsoil and do not have an argillic horizon above the fragipan. Wadsworth soils have less sand and more clay above the fragipan.

Typical pedon of Ravenna silt loam, 2 to 6 percent slopes, about 3 miles south-southeast of Newbury, in Auburn Township, 105 yards south along Messenger Road from its intersection with Franks Road, then 85 yards west:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; friable; many roots; 3 percent coarse fragments; slightly acid; abrupt smooth boundary.

B1—9 to 12 inches; yellowish brown (10YR 5/4) silt loam; many medium distinct light brownish gray (10YR 6/2) and few fine faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; common roots; thin continuous dark grayish brown (10YR 4/2) silt coatings on vertical faces of peds; 5 percent coarse fragments; medium acid; clear wavy boundary.

B21t—12 to 15 inches; yellowish brown (10YR 5/4) loam; common medium distinct light brownish gray (10YR 6/2) and common medium faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; common roots; medium patchy gray (10YR 5/1) clay films on faces of peds; thin patchy dark grayish brown (10YR 4/2) silt coatings on vertical faces of peds; 5 percent coarse fragments; medium acid; clear wavy boundary.

B22t—15 to 19 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; common roots; medium patchy gray (10YR 5/1) clay films on faces of peds; many medium and coarse dark brown (7.5YR 3/2) concretions (iron and manganese oxides); 5 percent coarse fragments; very strongly acid; clear wavy boundary.

Bx1—19 to 31 inches; dark yellowish brown (10YR 4/4) loam; few fine distinct light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure parting to moderate medium platy; firm and brittle; few roots; medium continuous light brownish gray (10YR 6/2) clay films on vertical yellowish brown (10YR 5/6) borders of prisms; moderate medium and coarse very dark brown (10YR 2/2) concretions (iron and manganese oxides); 8 percent coarse fragments; very strongly acid; clear wavy boundary.

Bx2—31 to 43 inches; dark brown (10YR 4/3) loam; few fine distinct light brownish gray (10YR 6/2) and common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak medium platy; firm and brittle; medium continuous light brownish gray (10YR 6/2) clay films on vertical yellowish brown (10YR 5/6) borders of prisms; common medium dark brown (7.5Y 3/2) concretions (iron and manganese oxides); 10 percent coarse fragments; very strongly acid; clear wavy boundary.

B3—43 to 50 inches; brown (10YR 4/3) loam; weak coarse subangular blocky structure; firm; medium gray (10YR 6/1) coatings on vertical yellowish brown (10YR 5/6) borders of prisms; common medium dark brown (7.5YR 3/2) concretions (iron and manganese oxides); 12 percent coarse fragments; medium acid; clear wavy boundary.

C—50 to 60 inches; brown (10YR 4/3) loam; massive; firm; common medium distinct dark brown (7.5YR 3/2) concretions (iron and manganese oxides); 12 percent coarse fragments; medium acid.

The solum is 40 to 80 inches thick. Depth to carbonates ranges from 60 to 100 inches.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 3. Some pedons have an A1 horizon 1 to 5 inches thick. The A horizon is medium acid or strongly acid, except where lime has been added. The B2 horizon has hue of 7.5YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. It is clay loam, loam, or silt loam with a weighted average clay content of 18 to 27 percent. Reaction is medium acid to very strongly acid. The Bx horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. It is loam, silt loam, or sandy loam. Reaction is very strongly acid to medium acid. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma or 3 or 4. It is silt loam, loam, or sandy loam. Reaction is medium acid to mildly alkaline.

Rawson series

The Rawson series consists of deep, moderately well drained soils that formed in glacial outwash and in the underlying till or lacustrine material on terraces and uplands. Permeability is moderate in the upper loamy material and slow or very slow in the underlying material. Slopes range from 2 to 6 percent.

The Rawson soils in Geauga County have gray mottles closer to the soil surface than is defined within the range for the series. This difference, however, does not affect the use and management of these soils.

Rawson soils are commonly adjacent to Haskins soils and are similar to Bogart and Canfield soils. Bogart soils formed in glacial outwash and do not have the glacial till or lacustrine material in the substratum. Canfield soils formed in glacial till and have a fragipan. Haskins soils are somewhat poorly drained and are more gray in the subsoil.

Typical pedon of Rawson loam, 2 to 6 percent slopes, about 3 miles north of Auburn Center, in Newbury Township, 300 yards south along Auburn Road from its intersection with Bell Street, then 150 yards east:

Ap—0 to 7 inches; dark brown (10YR 4/3) loam; moderate fine and medium granular structure; friable; many roots; 3 percent coarse fragments; strongly acid; abrupt smooth boundary.

B1—7 to 16 inches; brown (7.5YR 5/4) loam; moderate medium subangular blocky structure; friable; common roots; 5 percent coarse fragments; very strongly acid; clear wavy boundary.

B21t—16 to 21 inches; yellowish brown (10YR 5/4) gravelly sandy clay loam; common medium distinct pale brown (10YR 6/3) and few fine distinct strong brown (7.5YR 5/8) mottles; weak fine and medium subangular blocky structure; firm; common roots; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds and bridging sand grains and pebbles; 20 percent coarse fragments; strongly acid; clear wavy boundary.

B22t—21 to 28 inches; dark yellowish brown (10YR 4/4) gravelly sandy clay loam; common fine distinct light brownish gray (10YR 6/2) and common medium distinct strong brown (7.5YR 5/8) mottles; weak fine and medium subangular blocky structure; firm; few roots; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds and bridging sand grains and pebbles; 25 percent coarse fragments; strongly acid; abrupt wavy boundary.

IIB3t—28 to 33 inches; dark yellowish brown (10YR 4/4) clay loam; weak coarse prismatic structure parting to weak medium subangular blocky; firm; few roots; thin continuous gray (10YR 5/1) clay films on vertical faces of prisms; strong brown (7.5YR 5/6) borders along vertical clay seams; many medium black (10YR 2/1) stains and concretions (iron and manganese oxides); 10 percent coarse fragments; strongly acid; clear wavy boundary.

IIC1—33 to 50 inches; dark yellowish brown (10YR 4/4) silty clay loam; common fine distinct gray (10YR 6/1) and few medium and coarse distinct strong brown (7.5YR 5/6) mottles; massive; firm; many medium and coarse dark brown (10YR 3/3) concretions and stains (iron and manganese oxides); 10 percent coarse fragments; slightly acid; diffuse smooth boundary.

IIC2—50 to 62 inches; yellowish brown (10YR 5/4) clay loam; common fine distinct gray (10YR 6/1) and few medium and coarse distinct strong brown (7.5YR 5/6) mottles; massive; firm; 10 percent coarse fragments; neutral; abrupt smooth boundary.

IIC3—62 to 80 inches; yellowish brown (10YR 5/4) clay loam; massive; firm; 10 percent coarse fragments; strong effervescence; moderately alkaline.

The solum is 26 to 42 inches thick. Coarse fragments range from 0 to 10 percent by volume in the A horizon, from 3 to 30 percent in the B horizon, and from 0 to 10 percent in the IIB and IIC horizons.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Some pedons have a thin A1 horizon 2 to 4 inches thick and an A2 horizon. The A horizon is neutral to very strongly acid. The B2 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It commonly is clay loam, sandy clay loam, loam, or a gravelly analog. Reaction ranges from strongly acid to mildly alkaline. The IIB horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. It is clay, silty clay, silty clay loam, or clay loam. It is strongly acid to mildly alkaline.

Rittman series

The Rittman series consists of deep, moderately well drained soils that have a dense fragipan. The fragipan restricts rooting depth and the movement of water. Permeability is moderate above the fragipan and slow in the fragipan and substratum. These soils formed in glacial till on uplands. Slopes range from 2 to 50 percent.

Rittman soils are commonly adjacent to Wadsworth soils and are similar to Canfield, Ellsworth, and Geeburg soils. Canfield soils have less clay in the subsoil. Ellsworth and Geeburg soils have more clay in the subsoil and do not have a fragipan. Wadsworth soils are somewhat poorly drained and are more gray in the subsoil.

Typical pedon of Rittman silt loam, 2 to 6 percent slopes, about 3 miles southeast of Middlefield, in Parkman Township, 110 yards southeast on Old State Road from its intersection with Shedd Road, then 165 yards west:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; moderate fine and medium granular structure; friable; many roots; 3 percent coarse fragments; medium acid; abrupt smooth boundary.

B1—8 to 15 inches; yellowish brown (10YR 5/4) silt loam; weak fine and medium subangular blocky structure; friable; common roots; thin very patchy light yellowish brown (10YR 6/4) silt coatings on faces of peds; dark grayish brown (10YR 4/2) krotovinas; 5 percent coarse fragments; very strongly acid; clear wavy boundary.

B21t—15 to 20 inches; yellowish brown (10YR 5/4) clay loam; many medium and coarse faint yellowish brown (10YR 5/6 and 5/8) and common fine and medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; few roots; thin patchy brown (10YR 5/3) clay films on faces of peds; medium continuous pale brown (10YR 6/3) silt coatings on vertical faces of peds; 5 percent coarse fragments; very strongly acid; clear wavy boundary.

B22t—20 to 25 inches; dark yellowish brown (10YR 4/4) clay loam; common fine and medium distinct grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) and many fine and medium distinct strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; few roots; gray (10YR 5/1) clay films that are medium continuous on faces of peds and thin very patchy on horizontal faces; medium brown (10YR 4/3) and light gray (10YR 7/1 and 7/2) silt coatings on faces of peds; 5 percent coarse fragments; very strongly acid; clear wavy boundary.

Bx1—25 to 30 inches; dark yellowish brown (10YR 4/4) clay loam; common fine and medium prominent strong brown (7.5YR 5/6 and 5/8) mottles; moderate very coarse prismatic structure parting to weak medium platy; very firm and brittle; few roots along vertical faces of prisms; medium continuous light gray (5Y 6/1) clay films on vertical faces of peds; few fine distinct black (10YR 2/1) concretions and stains (iron and manganese oxides); 5 percent coarse fragments; very strongly acid; gradual wavy boundary.

Bx2—30 to 44 inches; dark yellowish brown (10YR 4/4) clay loam; weak very coarse prismatic structure parting to moderate medium platy; very firm and brittle; medium continuous light gray (5Y 6/1) clay films on vertical faces of peds; common fine and medium distinct black (10YR 2/1) concretions and stains (iron and manganese oxides); 7 percent coarse fragments; very strongly acid; clear wavy boundary.

B3—44 to 53 inches; dark yellowish brown (10YR 4/4) clay loam; weak medium and coarse subangular blocky structure; firm; thin patchy light gray (5Y 6/1) clay films on vertical faces of peds; common fine and medium distinct black (10YR 2/1) concretions and stains (iron and manganese oxides); 7 percent coarse fragments; medium acid; clear wavy boundary.

C—53 to 60 inches; brown (10YR 4/3) clay loam; massive; firm; 10 percent coarse fragments; slightly acid.

The solum is 42 to 60 inches thick. Depth to the top of the fragipan ranges from 18 to 36 inches. Coarse fragments range from 0 to 10 percent by volume above the Bx horizon and from 2 to 15 percent in the Bx and C horizons.

The Ap horizon has hue of 10YR, value of 4 of 5, and chroma of 2 or 3. Some pedons have an A1 horizon 1 to 4 inches thick and an A2 horizon 4 to 6 inches thick. The A horizon is medium acid to very strongly acid, except where lime has been added. The B2 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is clay loam or silty clay loam. Reaction is very strongly acid or strongly acid. The Bx horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is commonly clay loam or silty clay loam. Less commonly it is loam. Reaction is strongly acid or very strongly acid in the upper part of the Bx horizon and very strongly acid to slightly acid in the lower part. The B3 horizon is medium acid to neutral. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silty clay loam or clay loam. Reaction is slightly acid to mildly alkaline. Most pedons have some free carbonates.

Sebring series

The Sebring series consists of deep, poorly drained, moderately slowly permeable soils. These soils formed in water-laid deposits on terraces and in basins of former glacial lakes. Slopes range from 0 to 2 percent.

Sebring soils are commonly adjacent to Fitchville and Glenford soils and are similar to Canadice, Damascus, Holly, and Sheffield soils. Canadice soils have more clay in the B and C horizons. Damascus and Holly soils have more sand in the B horizon. Damascus soils formed in stratified outwash deposits. Holly soils formed in alluvium on flood plains and do not have an argillic horizon. Sheffield soils have a fragipan. Glenford soils are moderately well drained, and Fitchville soils are somewhat poorly drained. Both Glenford and Fitchville soils are less gray in the subsoil.

Typical pedon of Sebring silt loam, about 3 miles east-southeast of Chesterland, in Munson Township, 1.2 miles east on U.S. Route 322 from its intersection with Heath Road, then 1.6 miles south:

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) rubbed; moderate medium and fine granular structure; friable; many roots; very strongly acid; abrupt smooth boundary.

A2g—3 to 8 inches; grayish brown (10YR 5/2) silt loam; common medium distinct yellowish brown (10YR 5/4 and 5/8) mottles; weak medium and coarse subangular blocky structure; friable; many roots; thin continuous grayish brown (10YR 5/2) silt coatings on faces of peds; yellowish brown (10YR 5/4) organic stains in root channels; very strongly acid; clear wavy boundary.

B1g—8 to 13 inches; light brownish gray (10YR 6/2) silt loam; many medium distinct yellowish brown (10YR 5/4) and few medium distinct yellowish brown (10YR 5/8) mottles; weak medium and coarse subangular blocky structure; friable; common roots; thin very patchy grayish brown (10YR 5/2) clay films in voids; thin continuous light brownish gray (10YR 6/2) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

B21tg—13 to 20 inches; light brownish gray (10YR 6/2) silty clay loam; common medium distinct yellowish brown (10YR 5/4 and 5/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; firm; few roots; thin patchy grayish brown (10YR 5/2) clay films on faces of peds and in voids; medium acid; clear wavy boundary.

B22tg—20 to 32 inches; light brownish gray (10YR 6/2) silty clay loam; many medium distinct yellowish brown (10YR 5/4) and common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; firm; few roots; thick continuous grayish brown (10YR 5/2) clay films on vertical faces of peds and thin patchy grayish brown (10YR 5/2) clay films on pores; few fine faint very dark brown (10YR 2/2) (iron and manganese oxides) stains; slightly acid; clear wavy boundary.

B23t—32 to 37 inches; yellowish brown (10YR 5/4) silt loam; many medium distinct light brownish gray (10YR 6/2) and common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak thick platy; firm; few roots; thick continuous grayish brown (10YR 5/2) clay films on faces of peds; neutral; clear wavy boundary.

B3—37 to 44 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct light brownish gray (10YR 6/2) and common medium faint yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; firm; neutral; gradual smooth boundary.

C1—44 to 48 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct light brownish gray (2.5Y 6/2) mottles; massive; friable; weak effervescence; mildly alkaline; gradual smooth boundary.

C2—48 to 60 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; weak effervescence; mildly alkaline.

The solum is 30 to 50 inches thick. The solum typically does not have coarse fragments, although in some pedons the B and C horizons are as much as 5 percent.

The A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The A horizon is very strongly acid to medium acid, except where lime has been added. The B2 horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 0 to 2 above a depth of 30 inches. It is silty clay loam or silt loam. Thin strata of loam or clay loam are in some pedons. Reaction is medium acid to very strongly acid in the upper part of the B2 horizon and neutral to strongly acid in the lower part. The C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 0 to 6. It is commonly stratified or laminated silt loam or silty clay loam. Less commonly it is loam or clay loam.

Sheffield series

The Sheffield series consists of deep, poorly drained soils that formed in glacial till on uplands. Permeability is very slow in the fragipan and moderately slow in the upper part of the subsoil above the fragipan and in the substratum. Slopes range from 0 to 2 percent.

Sheffield soils are commonly adjacent to Platea soils and are similar to Sebring soils. Platea soils are somewhat poorly drained and are less gray in the subsoil. Sebring soils formed in lacustrine deposits and do not have a fragipan.

Typical pedon of Sheffield silt loam, 3.7 miles southeast of Montville in Huntsburg Township, 835 yards east on Chardon Windsor Road from its intersection with State Route 86, then 220 yards north:

Ap—0 to 8 inches; dark gray (10YR 4/1) silt loam; common medium distinct dark brown (7.5YR 4/4) mottles around root channels; weak medium and coarse granular structure; friable; many roots; 2 percent coarse fragments; medium acid; abrupt smooth boundary.

B1g—8 to 11 inches; light brownish gray (2.5Y 6/2) silt loam; many coarse distinct yellowish brown (10YR 5/4) and common medium distinct yellowish brown (10YR 5/8) mottles; weak medium prismatic structure parting to weak coarse subangular blocky; firm; common roots; medium continuous light brownish gray (2.5Y 6/2) silt coatings on faces of peds; many fine very dark brown (10YR 2/2) stains (iron and manganese oxides); 2 percent coarse fragments; medium acid; clear wavy boundary.

B21g—11 to 15 inches; light brownish gray (2.5Y 6/2) silty clay loam; many coarse distinct yellowish brown (10YR 5/8) mottles; weak medium prismatic structure parting to weak coarse subangular blocky; firm; common roots; medium continuous light brownish gray (2.5Y 6/2) silt coatings on faces of peds; many fine very dark brown (10YR 2/2) stains (iron and manganese oxides); 2 percent coarse fragments; medium acid; clear wavy boundary.

B22g—15 to 20 inches; light brownish gray (2.5Y 6/2) silty clay loam; many coarse distinct yellowish brown (10YR 5/4) mottles; weak coarse prismatic structure parting to moderate coarse subangular blocky; firm; few roots; medium continuous light brownish gray (2.5Y 6/2) silt coatings on faces of peds; many medium distinct very dark brown (10YR 2/2) concretions and stains (iron and manganese oxides); 2 percent coarse fragments; slightly acid; clear wavy boundary.

Bx1—20 to 28 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) and many medium distinct light olive brown (2.5Y 5/4) mottles; weak very coarse prismatic structure parting to weak coarse subangular blocky; firm and brittle; few roots; thick continuous gray (10YR 5/1) clay films on vertical faces of peds and medium patchy clay films on horizontal faces of peds and in pores; light brownish gray (10YR 6/2) silt coatings on faces of peds; many medium distinct very dark brown (10YR 2/2) concretions and stains (iron and manganese oxides); 5 percent coarse fragments; neutral; clear wavy boundary.

Bx2—28 to 40 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; weak very coarse prismatic structure parting to weak coarse subangular blocky; firm and brittle; few roots; thick continuous grayish brown (10YR 5/2) clay films in pores and along old root channels; yellowish brown (10YR 5/8) borders along vertical structural breaks; grayish brown (10YR 5/2) silt coatings on faces of peds; 5 percent coarse fragments; neutral; clear wavy boundary.

C—40 to 60 inches; brown (10YR 4/3) silty clay loam; common medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; massive; firm; 5 percent coarse fragments; strong effervescence; moderately alkaline.

The solum is 40 to 50 inches thick. Depth to carbonates ranges from 30 to 45 inches. The solum is typically 2 to 5 percent coarse fragments, by volume, but the range is 2 to 10 percent.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. Some pedons have an A1 horizon 1 to 4 inches thick and have an A2 horizon. The B2 horizon has hue of 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is silt loam or silty clay loam. It is very strongly acid to slightly acid. The Bx horizon has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 2 to 4. It is silt loam or silty clay loam and is medium acid to neutral. The C horizon has colors similar to those of the Bx horizon. It is mildly alkaline or moderately alkaline.

Tioga series

The Tioga series consists of deep, well drained soils that formed in alluvium on flood plains. Permeability is moderate or moderately rapid. Slopes range from 0 to 2 percent.

Tioga soils are commonly adjacent to Orrville soils. Orrville soils are somewhat poorly drained and are more gray in the subsoil.

Typical pedon of Tioga loam, frequently flooded, about 3.5 miles north of Chardon, in Chardon Township, 1,200 yards northeast along Clark Road from its intersection with Robinson Road, then 220 yards east:

A11—0 to 6 inches; dark grayish brown (10YR 4/2) loam; moderate medium granular structure; friable; many roots; 2 percent coarse fragments; medium acid; clear smooth boundary.

A12—6 to 10 inches; dark grayish brown (10YR 4/2) loam; moderate medium granular structure; friable; common roots; 2 percent coarse fragments; medium acid; clear wavy boundary.

B21—10 to 22 inches; yellowish brown (10YR 5/4) sandy loam; weak fine subangular blocky structure; very friable; few roots; few dark grayish brown (10YR 4/2) stains in old root channels; 5 percent coarse fragments; medium acid; gradual wavy boundary.

B22—22 to 30 inches; yellowish brown (10YR 5/4) sandy loam; weak fine subangular blocky structure; very friable; few roots; 5 percent coarse fragments; slightly acid; gradual wavy boundary.
C1—30 to 45 inches; yellowish brown (10YR 5/4) loamy sand; single grained; loose; 10 percent fragments; slightly acid; clear wavy boundary.
C2—45 to 62 inches; brown (10YR 4/3) gravelly loamy sand; common medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; single grained; loose; 25 percent coarse fragments; neutral.

The solum is 18 to 40 inches thick. The content of coarse fragments ranges from 0 to 25 percent by volume below a depth of 40 inches. Reaction is strongly acid to slightly acid in the solum and slightly acid or neutral in the substratum.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. The B horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. It is sandy loam or loam. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is loamy sand, sandy loam, or a gravelly analog.

Wabasha series

The Wabasha series consists of deep, very poorly drained soils that formed in alluvium and slack-water deposits of flood plains. Permeability is slow. Slopes range from 0 to 2 percent.

Wabasha soils are commonly adjacent to Carlisle, Holly, and Orrville soils and are similar to Canadice and Willette soils. Carlisle soils formed in organic material. Willette soils formed in organic material over lakebed sediment. Canadice soils formed in lakebed sediment and have an argillic horizon. Holly and Orrville soils have less clay in the solum. Orrville soils are somewhat poorly drained and are in slightly higher positions on the flood plain.

Typical pedon of Wabasha silty clay loam, ponded, about 4.2 miles south of Burton, in Troy Township, .6 mile south along Rapids Road from its intersection with Stafford Road, then .7 mile west:

A11—0 to 3 inches; very dark grayish brown (10YR 3/2) silty clay loam, gray (10YR 5/1) dry; moderate fine and medium granular structure; friable; many fine roots; neutral; abrupt wavy boundary.
A12—3 to 8 inches; black (10YR 2/1) silty clay loam; dark gray (10YR 4/1) dry; weak coarse subangular blocky structure parting to moderate fine and medium granular; friable; many fine roots; neutral; abrupt smooth boundary.
B1g—8 to 18 inches; dark gray (N 4/0) silty clay; few medium distinct olive brown (2.5Y 4/4) mottles; moderate medium subangular and angular blocky structure; firm; common roots; neutral; clear smooth boundary.
B21g—18 to 26 inches; gray (N 5/0) silty clay; common medium distinct olive brown (2.5Y 4/4) and few coarse prominent olive yellow (2.5Y 6/6) mottles; weak coarse prismatic structure parting to moderate medium and coarse subangular blocky; firm; few roots; neutral; clear smooth boundary.
B22g—26 to 34 inches; gray (N 6/0) silty clay; many fine and medium distinct olive (5Y 5/4 and 5/6) and few coarse prominent olive yellow (5Y 6/6 and 6/8) mottles; moderate coarse and very coarse prismatic structure parting to weak medium and coarse subangular blocky; firm; few roots along vertical structural breaks; thin patchy dark gray (5Y 4/1) coatings on faces of peds; neutral; gradual smooth boundary.
B23g—34 to 45 inches; gray (N 6/0) silty clay; many medium distinct light olive brown (2.5Y 5/4) and few coarse prominent yellowish brown (10YR 5/4 and 5/6) mottles; weak coarse and very coarse prismatic structure parting to weak coarse subangular blocky; firm; thin patchy dark gray (5Y 4/1) coatings on faces of peds; slight effervescence; mildly alkaline; clear wavy boundary.
C—45 to 65 inches; light olive brown (2.5Y 5/4) silty clay; many medium prominent gray (N 6/0) mottles; massive with very weak vertical partings; firm; thin very patchy dark gray (N 4/0) coatings in vertical partings; few thin lenses of sandy loam; slight effervescence; mildly alkaline.

The solum is 40 to 60 inches thick.

The A horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 or 2. It is slightly acid or neutral. The B horizon has hue of 10YR to 5Y or N, value of 4 to 6, and chroma of 0 to 2. It is silty clay or clay and in places has strata less than 1 inch thick of a coarser texture. It is slightly acid to mildly alkaline. The C horizon has hue of 10YR or 5Y, value of 4 to 6, and chroma of 1 to 4. It is mainly silty clay or clay, although thin layers of sandy loam, fine sandy loam, silt loam, or silty clay loam are in some pedons. The C horizon is neutral to moderately alkaline.

Wadsworth series

The Wadsworth series consists of deep, somewhat poorly drained soils that formed in glacial till on uplands. Permeability is moderate or moderately slow above the fragipan and slow or very slow in the fragipan. Slopes range from 0 to 6 percent.

Wadsworth soils are commonly adjacent to Rittman soils and are similar to Fitchville, Mahoning, Platea, and Ravenna soils. Fitchville soils formed in lake-laid sediments and do not have a fragipan. Mahoning soils have more clay in the subsoil and do not have a fragipan. Rittman soils are moderately well drained and are less gray in the subsoil. Platea soils do not have an argillic horizon above the fragipan. Ravenna soils have more sand and less silt in the subsoil and fragipan.

Typical pedon of Wadsworth silt loam, 2 to 6 percent slopes, about 1.5 miles southeast of Middlefield in Middlefield Township, .8 mile south along State Route 528 from its intersection with State Route 87, then 330 yards west:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine and medium granular structure; friable; many roots; 3 percent coarse fragments; strongly acid; abrupt smooth boundary.

B1—7 to 12 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) and many medium faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; many roots; light brownish gray (10YR 6/2) coatings on faces of peds; few medium distinct very dark brown (10YR 2/2) stains and concretions (iron and manganese oxides); 3 percent coarse fragments; very strongly acid; clear wavy boundary.

B21t—12 to 19 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) and many medium distinct strong brown (7.5YR 5/6 and 5/8) mottles; moderate fine and medium subangular blocky structure; firm; common roots; continuous light brownish gray (10YR 6/2) coatings and thin patchy gray (10YR 6/1) clay films on faces of peds; few medium very dark brown (10YR 2/2) concretions and stains (iron and manganese oxides); 5 percent coarse fragments; very strongly acid; clear wavy boundary.

Bx1—19 to 25 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak very coarse prismatic structure parting to weak thick platy; very firm and brittle; common roots along prism faces; medium continuous gray (10YR 5/1) clay films on strong brown (7.5YR 5/6) borders, 5 to 15 millimeters thick; common medium very dark grayish brown (10YR 3/2) and very dark brown (10YR 2/2) concretions and stains (iron and manganese oxides); 5 percent fragments; very strongly acid; gradual wavy boundary.

Bx2—25 to 32 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak very coarse prismatic structure parting to weak thick platy; very firm and brittle; few roots along prism faces; medium continuous gray (10YR 5/1) clay films on strong brown (7.5YR 5/6) borders, 5 to 10 millimeters thick; few medium very dark brown (10YR 2/2) concretions and stains (iron and manganese oxides); 8 percent coarse fragments; strongly acid; gradual wavy boundary.

Bx3—32 to 41 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak very coarse prismatic structure parting to moderate medium platy; very firm and brittle; thin patchy gray (10YR 5/1) clay films on strong brown (7.5YR 5/6) borders, 5 to 10 millimeters thick; few medium very dark brown (10YR 2/2) concretions and stains (iron and manganese oxides); 5 percent coarse fragments; medium acid; clear wavy boundary.

B3—41 to 49 inches; yellowish brown (10YR 5/4) silty clay loam; common fine and medium faint yellowish brown (10YR 5/6) and common fine and medium distinct grayish brown (10YR 5/2) mottles; weak very coarse and coarse subangular blocky structure; firm; thin very patchy brown (10YR 4/3) clay films on vertical and horizontal faces of peds; few medium very dark brown (10YR 2/2) concretions and stains (iron and manganese oxides); 5 percent coarse fragments; slightly acid; clear wavy boundary.

C—49 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; massive; firm; flecks of yellowish red (5YR 4/6); few medium very dark brown (10YR 2/2) concretions and stains (iron and manganese oxides); 10 percent coarse fragments; slight effervescence; mildly alkaline.

The solum is 34 to 60 inches thick. Coarse fragments range from 2 to 5 percent in the solum above the Bx horizon and from 5 to 10 percent in the Bx and C horizons.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 3. Some pedons have an A1 horizon 1 to 5 inches thick and an A2 horizon 2 to 8 inches thick. The A horizon commonly is strongly acid to extremely acid, except where lime has been added. The B2 horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. It is silt loam, silty clay loam, or clay loam and averages 27 to 35 percent clay. Reaction is strongly acid to extremely acid. The Bx horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is clay loam, silty clay loam, or silt loam. Reaction is medium acid to very strongly acid in the upper part of the Bx horizon and medium acid to neutral in the lower part.

Wallkill series

The Wallkill series consists of deep, very poorly drained soils that formed in alluvium overlying organic soil material in bogs and on flood plains. Permeability is moderate in the mineral part and moderately rapid or rapid in the organic part. Slopes range from 0 to 2 percent.

Wallkill soils are commonly adjacent to Carlisle, Willette, and Wabasha soils and are similar to Holly and Orrville soils. Carlisle and Willette soils do not have alluvium over the organic soil material. Holly, Orrville, and Wabasha soils do not have organic material in the substratum.

Typical pedon of Wallkill silt loam, ponded, about 1.25 miles east-southeast of Burton, in Burton Township, 165 yards northwest along State Route 87 from its intersection with Gingerich Road, then 65 yards north:

A11—0 to 2 inches; very dark grayish brown (10YR 3/2) silt loam; moderate fine and medium crumb structure; very friable; many roots; medium acid; clear smooth boundary.

A12—2 to 7 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine and medium granular structure; very friable; many roots; few fine very dark brown (10YR 2/2) stains and concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

B21g—7 to 13 inches; grayish brown (10YR 5/2) silty clay loam; moderate medium and coarse prismatic structure parting to weak medium and coarse subangular blocky; firm; many roots; thin dark brown (7.5YR 4/4) coatings in old root channels; few fine very dark brown (10YR 2/2) stains and concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

B22g—13 to 23 inches; grayish brown (10YR 5/2) silt loam; weak fine and medium subangular blocky structure; friable; many roots; thin dark brown (7.5YR 4/4) coatings in old root channels; few fine faint very dark brown (10YR 2/2) stains and concretions (iron and manganese oxides); abrupt smooth boundary.

IIOa1—23 to 43 inches; dark brown (7.5YR 4/4) broken face and dark brown (7.5YR 3/2) rubbed sapric material; 40 percent fibers, 15 percent rubbed; moderate medium and coarse granular structure; very friable; medium acid; gradual wavy boundary.

IIOa2—43 to 56 inches; dark brown (7.5YR 4/4) broken face and rubbed sapric material; 20 percent fibers, 2 percent rubbed; massive; very friable; slightly acid; gradual wavy boundary.

IIOa3—56 to 63 inches; dark brown (7.5YR 4/4) broken face and dark brown (7.5YR 3/2) rubbed sapric material; 12 percent fibers, 2 percent rubbed; massive; friable; neutral.

Thickness of the alluvium over the organic material ranges from 16 to 40 inches, although it is dominantly 20 to 30 inches. Most pedons do not have coarse fragments, although in some pedons the mineral horizons are as much as 15 percent gravel. The soil ranges from strongly acid to mildly alkaline in the mineral horizons and from medium acid to mildly alkaline in the organic layers.

The A1 horizon has hue of 10YR or 2.5Y, value of 2 to 4, and chroma of 1 or 2. The Bg horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2. It is dominantly silt loam. Subhorizons of silty clay loam or loam are present in some pedons. The IIO horizon has hue of 5YR to 2.5Y, value of 2 or 3, and chroma of 0 to 2. It is mainly sapric material. Subhorizons of hemic material are present in some pedons.

Willette series

The Willette series consists of deep, very poorly drained soils in bogs on lake plains and till plains. These soils formed in organic material that is 16 to 50 inches thick over mineral deposits. Permeability is moderately rapid in the organic layers and slow in the mineral material. Slopes range from 0 to 2 percent.

Willette soils are similar to Carlisle and Wabasha soils. Carlisle soils formed in organic material more than 51 inches thick. Wabasha soils formed in mineral material.

Typical pedon of Willette muck, ponded, about 4 miles south of Burton, in Troy Township, 660 yards east of the intersection of Stafford Road and Rapids Road:

Oa1—0 to 10 inches; black (10YR 2/1) broken face and rubbed sapric material; 5 percent fibers, none rubbed; moderate medium granular structure; very friable; neutral; clear wavy boundary.

Oa2—10 to 16 inches; black (10YR 2/1) broken face, very dark brown (10YR 2/2) rubbed sapric material; 10 percent fibers, 5 percent rubbed; moderate medium granular structure; very friable; 2 percent woody fragments 1 to 4 inches in diameter; neutral; clear wavy boundary.

Oa3—16 to 22 inches; black (10YR 2/1) broken face, very dark grayish brown (10YR 3/2) rubbed material; 15 percent fibers, 5 percent rubbed; weak coarse granular structure; very friable; 3 percent woody fragments 1 to 4 inches in diameter; 30 percent mineral material; neutral; abrupt smooth boundary.

IIC1g—22 to 38 inches; gray (10YR 5/1) silty clay; massive; firm; neutral; clear smooth boundary.

IIC2g—38 to 60 inches; gray (10YR 6/1) silty clay; common medium distinct light olive brown (2.5Y 5/4) mottles; massive; firm; weak effervescence; mildly alkaline.

The depth to the IIC horizon ranges from 16 to 50 inches. Some pedons have layers in the organic part of the control section that are 5 to 15 percent woody fragments. The solum ranges from medium acid to mildly alkaline, and the C horizon ranges from medium acid to moderately alkaline.

The surface tier has hue of 10YR, value of 2, and chroma of 1 or 2 on broken face and rubbed material. The organic part of the subsurface and bottom tiers has hue of 10YR to 5YR, value of 2 or 3, and chroma of 1 to 3 on broken face and rubbed material. The IIC horizon has hue of 10YR or 2.5Y or is neutral, value of 4 to 6, and chroma of 0 to 2. It is commonly silty clay or clay. Less commonly it is silty clay loam or clay loam.

Wooster series

The Wooster series consists of deep, well drained soils that formed in glacial till on uplands. These soils have a moderately slowly permeable fragipan that restricts rooting depth and the movement of water. Slopes range from 12 to 18 percent.

Wooster soils are commonly adjacent to Canfield and Ravenna soils and are similar to Canfield, Chili, Lordstown, and Loudonville soils. Canfield and Ravenna soils are wetter and are more gray in the subsoil. Chili soils have stratified outwash deposits in the substratum and do not have a fragipan. Lordstown and Loudonville soils are moderately deep to bedrock and do not have a fragipan.

Typical pedon of Wooster silt loam, 12 to 18 percent slopes, about 2 miles north of Burton, in Burton Township, .8 mile north along Claridon Troy Road from its intersection with Fisher Road, then 330 yards west:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; moderate fine and medium subangular blocky structure; friable; many roots; 5 percent coarse fragments; medium acid; abrupt smooth boundary.

B1—8 to 11 inches; yellowish brown (10YR 5/4) loam; weak fine and medium subangular blocky structure; friable; many roots; dark brown (10YR 4/3) organic coatings in old root and worm channels and on some faces of peds; 5 percent coarse fragments; medium acid; clear wavy boundary.

B2t—11 to 20 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; firm; common roots; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds; common fine black (10YR 2/1) concretions and stains (iron and manganese oxides); 10 percent coarse fragments; very strongly acid; clear wavy boundary.

Bx1—20 to 25 inches; dark brown (10YR 4/3) loam; weak very coarse prismatic structure parting to moderate medium and thick platy; firm and brittle; few roots on vertical faces of prisms; dark brown (7.5YR 4/4) clay films that are thin patchy on vertical faces of prisms and very patchy on horizontal faces; strong brown (7.5YR 5/6 and 5/8) borders along vertical clay seams; common fine and medium black (10YR 2/1) stains and concretions (iron and manganese oxides); 12 percent coarse fragments; very strongly acid; gradual wavy boundary.

Bx2—25 to 34 inches; dark yellowish brown (10YR 4/4) loam; common fine and medium distinct light brownish gray (10YR 6/2) mottles; weak very coarse prismatic structure parting to moderate medium platy; firm and brittle; few roots along prism faces; thin patchy gray (10YR 5/1) clay films on vertical faces of prisms and thin patchy dark brown (7.5YR 4/4) clay films on horizontal faces; strong brown (7.5YR 5/6 and 5/8) borders along vertical clay seams; thin patchy light yellowish brown (10YR 6/4) silt coatings on vertical faces of prisms; common fine and medium black (10YR 2/1) stains and concretions (iron and manganese oxides); 14 percent coarse fragments; very strongly acid; clear wavy boundary.

B3t—34 to 56 inches; brown (10YR 5/3) loam; common medium distinct grayish brown (10YR 5/2) mottles; weak medium and coarse subangular blocky structure; firm; thin patchy gray (10YR 6/1) clay films on vertical faces of peds and thin very patchy dark brown (7.5YR 4/4) clay films on horizontal faces; strong brown (7.5YR 5/6 and 5/8) borders along vertical clay seams; common fine and medium black (10YR 2/1) stains and concretions (iron and manganese oxides); 14 percent coarse fragments; very strongly acid; clear wavy boundary.

C—56 to 60 inches; dark yellowish brown (10YR 4/4) gravelly loam; massive; friable; 25 percent coarse fragments; strongly acid.

The solum is 40 to 80 inches thick. Reaction is very strongly acid to medium acid in the upper part of the solum and in the fragipan, except where lime has been added. It is very strongly acid to neutral in the B3 and C horizons. Carbonates are at a depth of 60 to 100 inches in some pedons.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Some pedons have an A1 horizon 1 to 5 inches thick. The A horizon is dominantly silt loam, although it is loam in some pedons. The B2 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is loam, silt loam, clay loam, or a gravelly analog. The Bx horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam, silt loam, clay loam, silty clay loam, or a gravelly analog. The C horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 4 to 6. It is dominantly loam and gravelly loam, although in some pedons it is gravelly sandy loam or gravelly silt loam.

formation of the soils

This section describes the major factors of soil formation, tells how these factors have affected the soils in Geauga County, and explains some of the processes in soil formation.

factors of soil formation

Soils are the product of soil-forming processes acting on material deposited or accumulated by geologic forces. The major factors in soil formation are parent material, climate, relief, living organisms, and time.

Climate and living organisms, particularly vegetation, are the active forces in soil formation. Their effect on the parent material is modified by relief and by the length of time the parent material has been acted upon. The relative importance of each factor differs from place to place. In some places one factor dominates and determines most of the soil properties. However, generally the interaction of all five factors determines what kind of soil forms in any given place.

parent material

The soils in Geauga County formed in several kinds of parent material: glacial till, glacial outwash, lacustrine deposits, weathered products of sedimentary rocks, accumulated organic material, and recent alluvium derived from these various materials.

The county was covered by glaciers during several stages of the Pleistocene Age, and consequently glacial drift, a general term applied to extensive glacial deposits of both till and outwash, is the most extensive parent material in the county. The upland soils formed in glacial till, and many of the terrace soils formed in glacial outwash. The till is fairly homogenous and uniform in texture, and the soils that formed in this parent material have a medium textured to fine textured subsoil. Mahoning, Wadsworth, Ravenna, Platea, Ellsworth, Rittman, and Canfield soils formed in glacial till.

Outwash, consisting of sand and gravel, was deposited by the many streams of glacial melt water. In places, glacial kames formed. Much of this fairly well sorted, coarse material was covered by finer textured loamy outwash. Chili and Jimtown soils formed in these outwash materials. Chili soils are brown and reddish brown because they formed where the natural drainage is good. Jimtown soils are mottled with gray because they formed where the water table is high and aeration is poor during part of the year.

Minor areas of lacustrine material or lake-bottom sediment are primarily in the Chagrin and Cuyahoga River systems. The interlayered silty and clayey parent material in these areas is evident in the medium textured to fine textured subsoil of the Sebring, Fitchville, Glenford, Canadice, and Caneadea soils.

Alluvial material, carried and deposited by floodwaters, is the youngest parent material in the county. This material is still accumulating, as fresh sediment is added periodically by the overflow of streams. Such sediment derives mainly from the surface layer of soils and exposed glacial drift in the surrounding higher areas. Holly, Orrville, and Tioga soils formed in deep, loamy, relatively fertile, and strongly acid to mildly alkaline alluvial material.

Organic material has accumulated in a few scattered areas of the Chagrin, Cuyahoga, and Grand River valleys. It consists mainly of the decomposed remains of trees, sedges, and grasses. This material is in depressions and in drainageways where the water table is high and seepage water has kept the area permanently wet. Carlisle and Willette soils formed in deep, fertile, black to reddish brown, and strongly acid to mildly alkaline organic material.

climate

The climate in Geauga County is uniform enough that it has not greatly contributed to differences among the soils. It has been favorable to both physical change and chemical weathering of parent materials and to biological activity.

Rainfall has been adequate for percolating water to leach carbonates to a depth of 2 to 3 1/2 feet in many soils, for example, Platea and Mahoning soils, and to a depth of more than 4 feet in other soils, for example, Chili and Rittman soils. The distribution of rainfall has caused wetting and drying cycles favorable to the translocation of clay minerals and to the formation of soil structure, evident in Mahoning and Ellsworth soils, for example.

Temperature variations have favored physical change and chemical weathering of parent material. Freezing and thawing contribute to the formation of soil structure, and warm temperatures in summer promote chemical reactions in the weathering of primary minerals.

Rainfall and temperature have been favorable to plant growth and the subsequent accumulation of some organic matter in all the soils.

More information about the climate of Geauga County is given in the section "General nature of the county."

relief

Relief can account for the formation of different soils from the same kind of parent material. Glenford, Fitchville, and Sebring soils all formed in lacustrine deposits. The moderately well drained Glenford soils formed where the slope was not steep enough to cause excessive erosion nor so nearly level as to prevent runoff. The somewhat poorly drained Fitchville soils formed where runoff was slow or medium. Nearby, the poorly drained Sebring soils formed on broad flats and in depressions where some organic residue accumulated because the water table was high several months of the year.

living organisms

The native vegetation at the time Geauga County was settled was hardwood forest of beech, maple, oak, hickory, ash, and elm. There were grassy clearings on the marshy openings in the poorly drained swales.

The soils that formed in the forested areas are acid and moderate or low in natural fertility. These soils include Mahoning, Ellsworth, and Loudonville soils. The soils that formed in the marshy swales are poorly drained and very poorly drained, less acid, and somewhat more fertile, for example, Sheffield, Canadice, and Wabasha soils.

Small animals, insects, worms, and roots make the soil more permeable by making channels in the soil. Animals also mix the soil materials through their activities and contribute organic matter to the soil. Wormholes or worm casts are plentiful in the highly organic surface layer of forested and grassed mineral soils, for example, Ellsworth and Rittman soils. Crawfish channels are prevalent in the poorly drained and very poorly drained Canadice, Sebring, and Wabasha soils.

Man also affects the formation of the soils, mainly by plowing, planting, and introducing plants. In some areas the formation of the soils is affected by drainage, irrigation, and removal of soil material for construction purposes. The use of lime and fertilizer changes the chemistry of the soils.

time

Time is needed for the other soil-forming factors to produce their effects. The age of a soil is indicated, to some extent, by the degree of profile formation. In many places, factors other than time have been responsible for most of the differences in kind and distinctness of horizons in the different soils. If the parent material weathers slowly, the profile forms slowly. If slopes are steep and soil is removed almost as fast as it forms, no distinct horizons form.

Most of the soils in the county have a well formed profile, including Ellsworth, Mahoning, and Chili soils. On the flood plains, periodic deposits of fresh sediment interrupt the soil-forming processes. The Holly and Orrville soils on the flood plains are examples of soils in which horizons are not well formed or expressed.

processes of soil formation

Most of the soils in Geauga County have a strongly expressed profile, because the processes of soil formation have produced distinct changes in the material in which the soils formed. For example, the soils that formed in glacial till on uplands and in glacial outwash on terraces along the major valleys show evidence of distinct changes. In contrast, the soils on the flood plains are only slightly modified from the parent material.

There are four main processes responsible for horizon differentiation: *additions, removals, transfers,* and *transformations.* Some of these processes promote horizon differentiation, and others retard or obliterate differences that are already present.

Organic matter is an example of an addition to the soil. Soils that formed where a high water table has restricted decomposition of organic matter have a deep, dark colored surface layer. The surface layer is high in organic matter and has good structure. Base saturation exceeds 50 percent. Examples of such soils are Carlisle, Willette, and Wabasha soils. In most soils some organic matter accumulates as a thin mat on the surface, but this mat is usually obliterated by cultivation. Severe erosion can remove all evidence of this addition to the soil profile.

Leaching of carbonates from calcareous parent material is a significant loss that precedes many other chemical changes. Most of the glacial till in Geauga County has a low content of carbonates, generally 5 to 15 percent. In most of the soils, carbonates have been leached to a depth of 36 inches or more; consequently, the soil in the upper 36 inches is acid. Other minerals in the soil are subject to the same chemical weathering, but their resistance is higher and therefore removal is slower. Following the removal of carbonates, alteration of such minerals as biotite and feldspar results in changes in color within the profile. Free iron oxides are produced and, if segregated by a fluctuating high water table, are the cause of gray colors and mottling. This process is evident in Sebring soils. Unless the water table is seasonally high within the profile, the upper horizons typically have brownish colors that have stronger chroma of redder hue than those in the C horizon.

Seasonal wetting and drying is largely responsible for the transfer of clay from the A horizon to the ped surfaces in the B horizon. The fine clays become suspended in percolating water moving through the A horizon and are carried downward to the B horizon. In the B horizon the fine clays are deposited on the surface of peds by drying or by precipitation caused by free carbonates. This transfer of fine clays accounts for the patchy or nearly continuous clay films on the faces of peds in the B horizon of Ellsworth and Fitchville soils. Transformation of mineral compounds is evident in most of the soils. The results of transformation are most apparent if the formation of horizons is not affected by rapid erosion or by accumulation of material at the surface. The primary silicate minerals are weathered chemically to produce secondary minerals, mainly those of the layer-lattice silicate clays. Most of the layer-lattice clays remain in place in the soil profile; however, clay from the A horizon is transferred to the deeper horizons.

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glossary

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

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

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

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.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

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.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

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.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

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.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial melt water. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 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.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

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.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

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.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.5 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.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. 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.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

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.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

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.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the 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.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

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.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 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.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. 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."

Surface soil. The A horizon including all subdivisions (A1, A2, and A3).

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.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by melt water streams, in a glacial lake or other body of still water in front of a glacier.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.