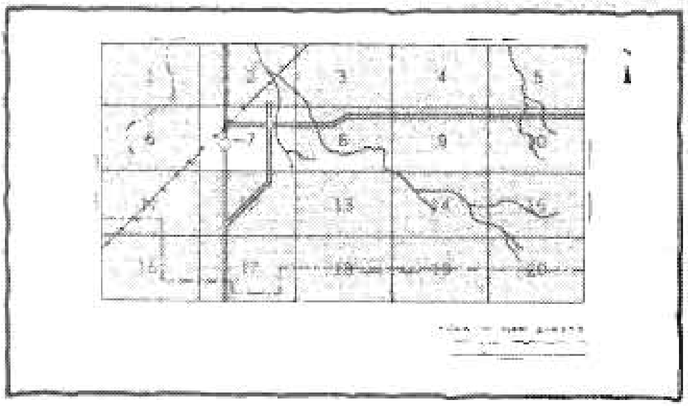
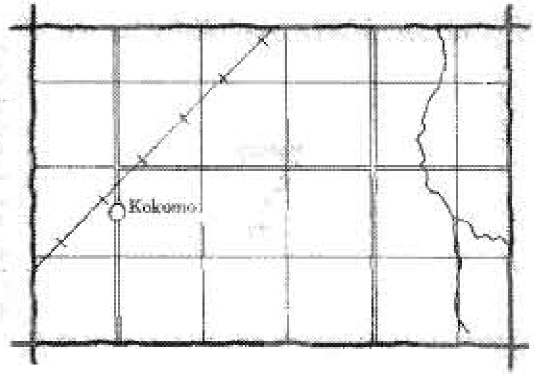
soil survey of **Cuyahoga County, Ohio**

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 USE

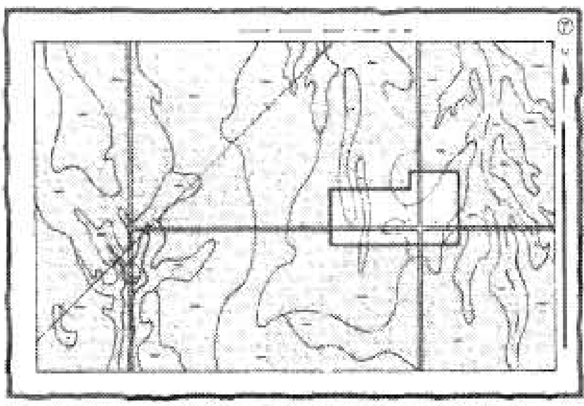
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

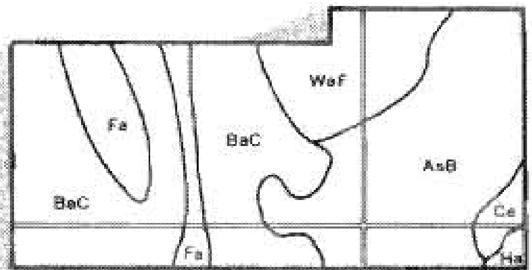




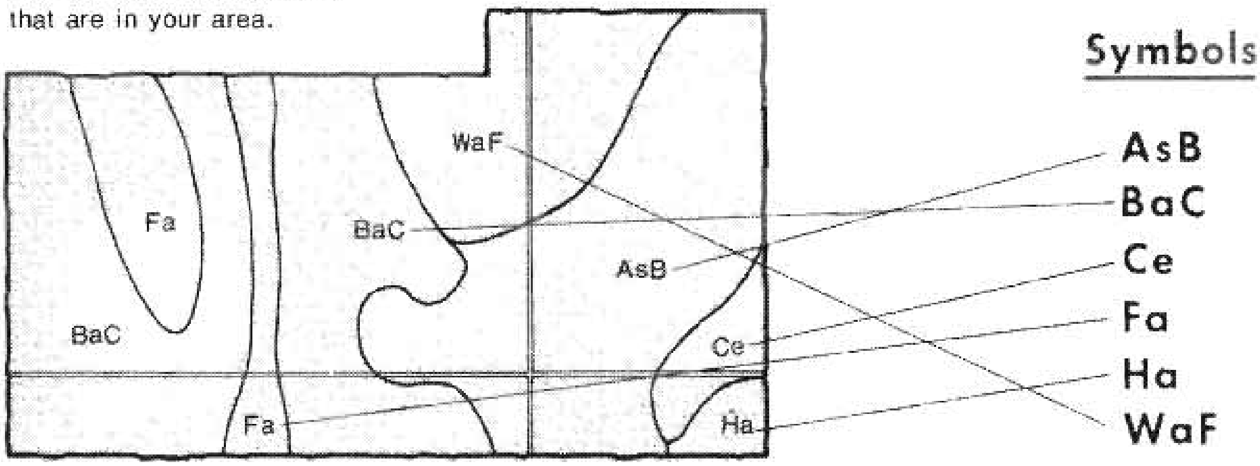
2. Note the number of the map sheet and turn to that sheet.

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



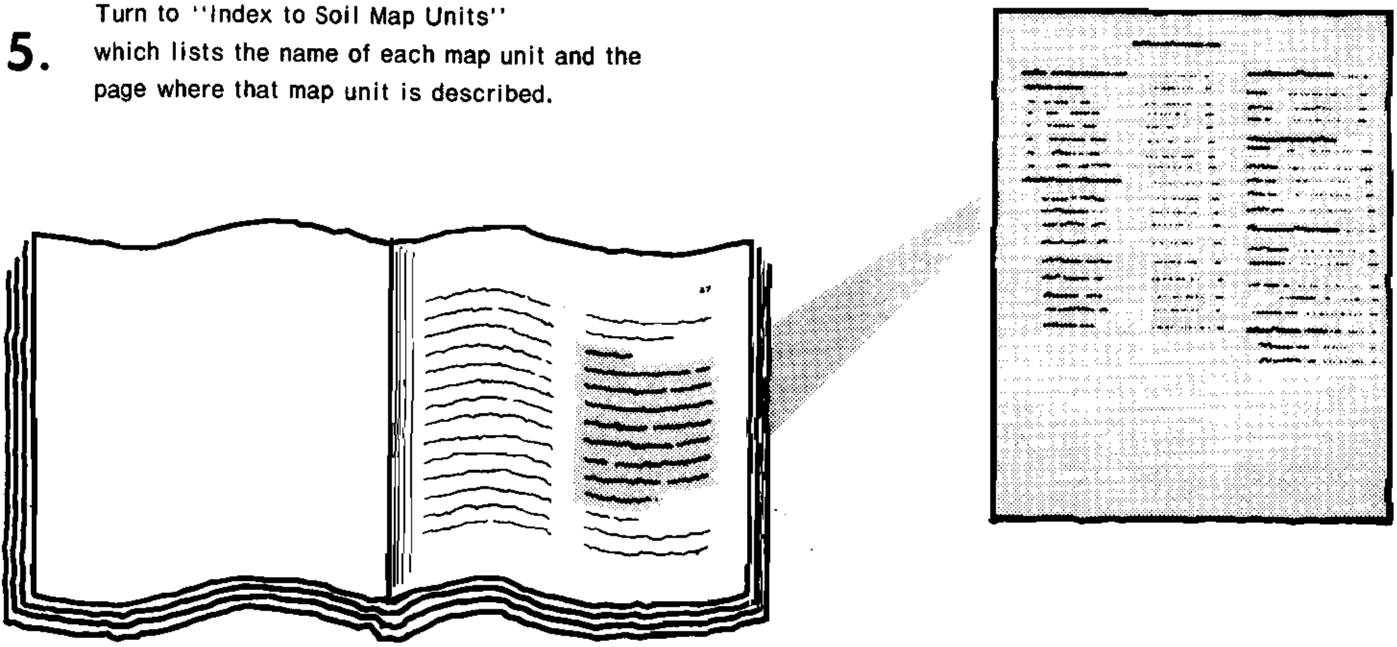


4. List the map unit symbols that are in your area.

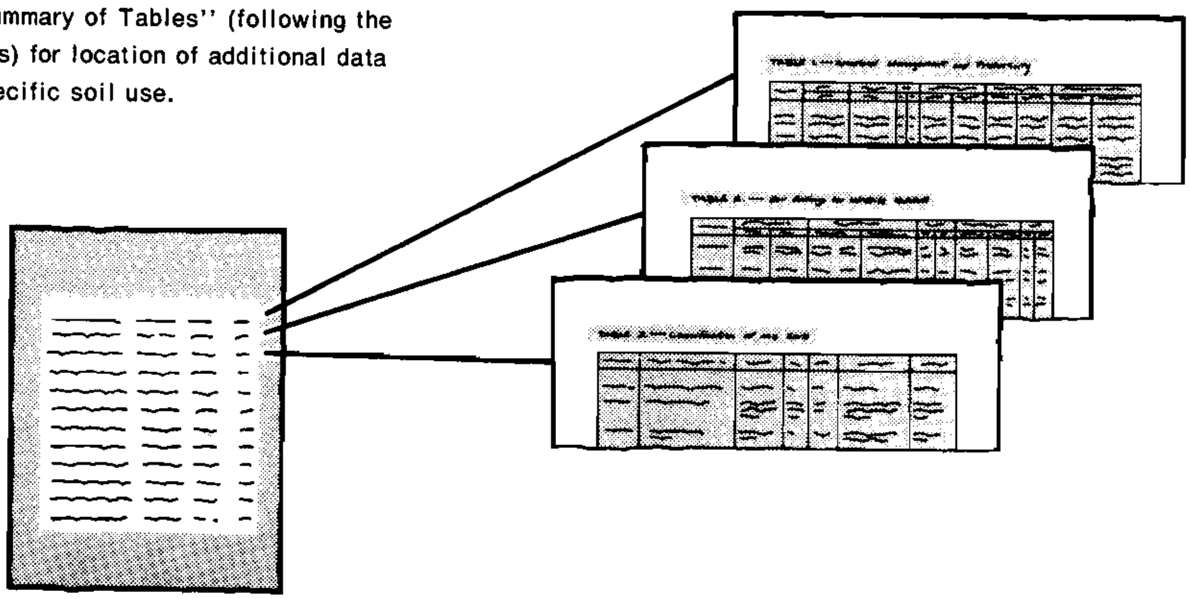


HIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was performed in the period 1973-1977. Soil names and descriptions were approved in 1978. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1977. This survey was made cooperatively by the Soil Conservation Service; the 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 Cuyahoga Soil and Water Conservation District. The survey was materially aided by funds provided by the Cuyahoga County Regional Planning Commission.

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

Cover: Euclid silt loam is suited to such recreational uses as paths and trails. Brecksville silt loam, 25 to 70 percent slopes, is on the wooded slopes in the background.

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Issued December 1980

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foreword

This soil survey contains information that can be used in land-planning programs in Cuyahoga County, Ohio. 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 has been prepared for many different users. Farmers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to 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

soil survey of **Cuyahoga County, Ohio**

By D. K. Musgrave and D. M. Holloran, Ohio Department of Natural Resources, Division of Lands and Soil

Soils surveyed by D. K. Musgrave, D. M. Holloran, J. P. Hahn, and T. D. Gerber, Ohio Department of Natural Resources, Division of Lands and Soil

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

CUYAHOGA COUNTY is adjacent to Lake Erie in northeastern Ohio. It is about 456 square miles, or 291,840 acres, in size (fig. 1). Cleveland, the county seat and largest city in Ohio, is centrally located along the lake shore. In July 1975, the total population of the county was estimated to be 1,598,400 by the U. S. Bureau of the Census.

Figure 1.—Location of Cuyahoga County in Ohio.

General nature of county

Cuyahoga County is among the most highly urbanized counties in Ohio. It is the central part of the expanding metropolitan area of northeastern Ohio. Housing developments, highways, shopping centers, factories, and other types of nonfarm development have steadily encroached into areas formerly used for farming.

Industrial and retail businesses have expanded rapidly from Cleveland into outlying parts of the county. Industries include the production of iron and steel, manufacture of machine tools and related industrial equipment, chemical and electrical products, and petroleum refining. Cuyahoga County is served by a number of railroads, airlines, foreign and domestic freight forwarders, intercity and suburban bus lines, and lake and ocean-going freighters.

Cuyahoga County also has an agricultural industry. It is an important center in northeastern Ohio for greenhouse vegetables. Tomatoes, radishes, cucumbers, and other vegetables are grown under glass, mostly in the central and western parts of the county. Sweet corn and other vegetables are grown on a limited acreage of soils suitable for this use. A few nurseries specializing in ornamental trees and shrubs and flowers are located on beach ridges in the northwestern part of the county.

Climate

Cuyahoga County is cold and snowy in winter and uncomfortably warm in summer. Northern areas nearest the lake are markedly colder than the rest of the county in summer. Precipitation is well distributed during the year and is adequate for most crops on most soils. From late fall through winter, snow squalls are frequent and total snowfall is normally heavy. In some years a single prolonged storm can produce more than 2 feet of snow on the ground, and strong winds create deep drifts.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Cleveland, Ohio, for the period 1951 to 1976. 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 29 degrees F, and the average daily minimum temperature is 22 degrees. The lowest temperature on record for the period, which occurred at Cleveland on January 24, 1963, is -19 degrees. In summer the average temperature is 70 degrees, and the average daily maximum temperature is 81 degrees. The highest recorded temperature, which occurred on September 1, 1953, is 101 degrees.

Growing degree days, shown in table 1, are equivalent to heat units. During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 20 inches, or 60 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 16 inches. The heaviest 1-day rainfall during the period of record was 3.36 inches in Cleveland on May 24, 1955. Thunderstorms occur on about 40 days each year, and most are in summer.

Average seasonal snowfall is 53 inches. The greatest snow depth at any one time during the period of record was 19 inches. On the average, 28 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The percentage of possible sunshine is 70 in summer and 30 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 do not blossom until 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.

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

Physiography, relief, and drainage

Cuyahoga County is in parts of two physiographic provinces: the glaciated Allegheny Plateau (Southern New York section) of the Appalachian Plateaus Province on the south and east and the Eastern Lake and Till Plains sections of the Central Lowland Province on the west and north (*4*). The line of demarcation between the two provinces is the Portage Escarpment, which crosses the county diagonally in approximately a northeast-southwest line.

Cuyahoga County lies entirely within the glaciated part of Ohio. The bedrock underlying the glacial deposits is sandstone and shale.

The entire county is drained principally by the Cuyahoga, the Chagrin, and the Rocky Rivers and their tributaries into Lake Erie. The valleys of the major streams are 100 to 150 feet below the level of the present land surface.

Most water supplies come from Lake Erie and the Cuyahoga River. Ground water supplies in the county are quite limited.

History and economic development

Cuyahoga County began to develop in 1796 when the town of Cleveland was founded and surveyed in the center of the Western Reserve Territory of Connecticut. The siting of the new town on the bluff above Lake Erie and the Cuyahoga River was strategic, dramatic, and convenient to water trade (*6*).

Today, Cleveland, the county seat, makes up a major part of the county. The original Cleveland plan was designed to serve a rural village of a few thousand people. The townspeople were mostly farmers and merchants who laboriously cleared the forest to build the village. From 1815 to 1830, when the roads and bridges were improved and steamcraft operated on the rivers and lake, the town began to evolve from a pioneer village to an open, well balanced New England-style town. Immigrants and goods arrived more freely, and the town began to prosper. The city expanded rapidly in the period of canal and lake transportation. Growing prosperity was based primarily on commerce and frontier trade. As time passed and Cleveland grew, commerce and then industry were superimposed on the inappropriate rural plan.

In 1885, the cultivated acreage was at its peak of 100,000 acres, or one-third of the county. Crops were wheat, oats, corn, apples, and grapes. Cheese, milk, and butter were also produced (*7*).

After the middle 19th Century, the impetus for growth was provided by industry and the railroad. The city and surrounding countryside experienced major growth in the latter part of the 19th Century, during its booming industrial period. Population grew from 17,000 people in 1850 to nearly 400,000 in 1900. The new residents were predominantly European immigrants and rural Americans. The city and county developed as a major manufacturing center and shipping point. Coal from Pennsylvania and iron from the Great Lakes ranges could easily meet here.

The Regional Planning Commission reports that about 90 percent of the population and retail facilities were concentrated within the present boundaries of Cleveland at the turn of the century. Most of the shift to the suburbs has taken place since the end of World War II.

Trolleys, railroads, and automobiles provided means for spreading of the city. Cuyahoga County had one of the first rapid rail transit systems in the country. As Cleveland spread out, several large corporations also relocated, and building slowed in the city during the 1940's and 1950's.

In Cuyahoga County the total acreage used for industry more than doubled during the 21-year period from 1948 to 1969. While the use of land for industrial purposes increased sharply throughout the county, the most dramatic growth was in the suburban communities. Cleveland's industrial land use almost doubled, but suburban industrial land use almost quadrupled. The most spectacular industrial growth during this post-World War II era has taken place in Brook Park, Bedford Heights, Brecksville, Brooklyn, Cuyahoga Heights, Euclid, Garfield Heights, Independence, Parma, Solon, and Strongsville (*9*).

Formerly, an important mineral resource in Cuyahoga County was sandstone quarried near the cities of Berea and Euclid. Currently, sand and gravel deposits are being mined, and deep wells and mines along and under Lake Erie are producing salt to control ice on highways and streets for cities in Ohio and surrounding states.

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 for broad land use planning" and "Soil maps for detailed planning."

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.

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.

General soil map for broad land-use planning

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

Descriptions of map units

Deep soils on uplands and the higher parts of lake plains

These soils make up about 53 percent of the county. The somewhat poorly drained to moderately well drained soils are nearly level to very steep. They formed in glacial till on uplands and lake plains. The landscape ranges from broad flats to dissected areas along drainageways. The soils are mainly used for urban development, parks, woodland, and open space; many areas are in brush. The major land-use limitations are slow or very slow permeability, seasonal wetness, and moderately steep to very steep slopes.

1. Urban land-Mahoning association

Urban land and undulating, somewhat poorly drained soils that formed in silty and loamy glacial till; on uplands and lake plains

This association is in urban areas. It consists of areas of Urban land and undulating soils. It is on till plains and the higher parts of lake plains.

This association makes up about 28 percent of the county. It is about 45 percent Urban land, 30 percent Mahoning soils, and 25 percent soils of minor extent.

Urban land is an area that is covered by streets, parking lots, buildings, and other structures that so obscure the soils that identification is not possible. Mahoning soils are nearly level and gently sloping, medium textured, and somewhat poorly drained. In the Mahoning soils, permeability is slow or very slow. A perched seasonal high water table is at a depth of 12 to 30 inches.

Minor soils in this association are the Ellsworth soils that are on side slopes along drainageways and on knolls. The Condit and the Miner soils are in depressions, and the Allis and the Mitiwanga soils, which have bedrock at a depth of 20 to 40 inches, are on broad flats and slight rises. In places the soils have been radically altered. Some low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed.

This association is used for buildings, streets, and parking lots as well as for parks, open space, lawns, and gardens. The soils have medium potential for lawns and landscaping and high potential for trees. In undrained areas, potential is low for building site development and sanitary facilities. The potential is medium or low for recreation uses.

Most areas have been artificially drained by sewer systems, gutters, and subsurface drains. Drained areas are well suited to lawns, flowers, vegetables, and shrubs. Perennial plants should be selected for tolerance to wetness. The Mahoning soils are severely limited as sites for buildings and most sanitary facilities by the seasonal high water table, low strength, and slow or very slow permeability. These soils are better suited to houses without basements than to houses with basements. Most sanitary facilities are connected to central sewer and treatment facilities. Drainage is needed for intensive recreational uses, such as ball diamonds and tennis courts.

2. Mahoning-Ellsworth association

Nearly level to very steep, somewhat poorly drained and moderately well drained soils that formed in silty and loamy glacial till; on uplands and lake plains

This association is on till plains and the higher parts of lake plains. Areas of the association are made up of nearly level to sloping soils and dissected, moderately steep to very steep soils along drainageways (fig. 2).

This association makes up about 20 percent of the county. It is about 50 percent Mahoning soils, 35 percent Ellsworth soils, and 15 percent soils of minor extent.

The Mahoning soils are on flats and low knolls, and the Ellsworth soils are on knolls and side slopes along drainageways. The Mahoning soils are somewhat poorly drained, nearly level, and gently sloping. They have a seasonal high water table at a depth of 12 to 30 inches.

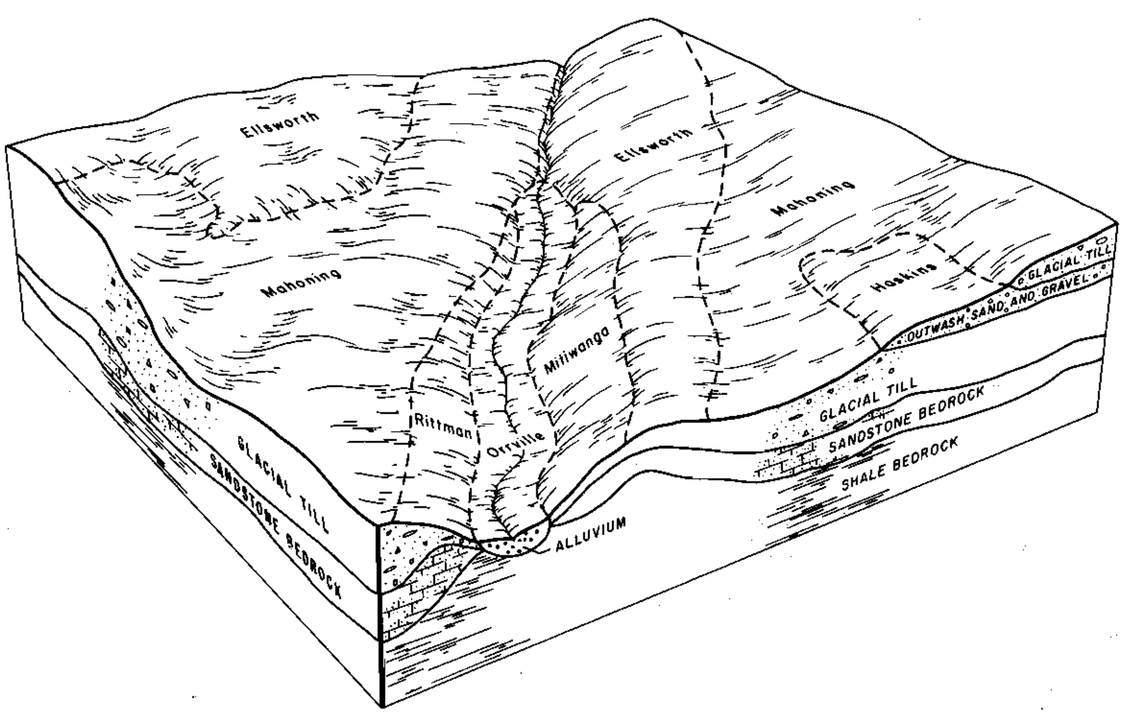

Figure 2.—Mahoning-Ellsworth association.

The Ellsworth soils are moderately well drained, are gently sloping to very steep, and have a seasonal high water table at a depth of 24 to 36 inches. Both soils have a medium textured surface layer, moderate available water capacity, and slow or very slow permeability.

Minor soils in this association are the Mitiwanga and the Loudonville soils that have bedrock at a depth of 20 to 40 inches. The Orrville soils are on flood plains along small streams. The Haskins and the Wadsworth soils are on flats and slightly convex parts of the landscape. Rittman soils are on knolls, side slopes, and ridgetops.

These soils are used mainly for woodland, open space, buildings, and parks. The trend of use is toward increased urbanization. The soils have low or medium potential for building site development, sanitary facilities, and recreational uses. The potential is high for trees and habitat for woodland wildlife. The gently sloping Ellsworth soils have better potential for lawns and gardens than other soils have.

The main land-use limitations are the slow or very slow permeability of both soils, the seasonal wetness of the Mahoning soils, and the moderately steep to very steep slopes of some of the Ellsworth soils. Ditches and subsurface drains are commonly used to improve drainage. The gently sloping and sloping Ellsworth soils are better suited as sites for buildings and most recreation than the other soils are. Footer drains and coatings on exterior basements walls are commonly used to help prevent wet basements. Sanitary facilities should be connected to central sewer and treatment facilities, if possible.

3. Wadsworth-Rittman association

Nearly level to sloping, somewhat poorly drained and moderately well drained soils that formed in silty and loamy glacial till; on uplands

This association is on uplands in areas that are dissected and along drainageways. The soils are mainly nearly level to sloping.

This association makes up about 5 percent of the county. It is about 50 percent Wadsworth soils, 20 percent Rittman soils, and 30 percent soils of minor extent (fig. 3).

The Wadsworth soils are on flats and low knolls, and the Rittman soils are on knolls, ridgetops, and side slopes. Wadsworth soils are somewhat poorly drained, nearly level and gently sloping and medium textured. They have a fragipan. Permeability is moderate or moderately slow above the fragipan and slow or very slow in the fragipan. A perched seasonal high water table is at a depth of 12 to 30 inches. Rittman soils are moderately well drained, gently sloping and sloping, and medium textured. They also have a fragipan. Permeability of the Rittman soils is moderate above the fragipan and slow in

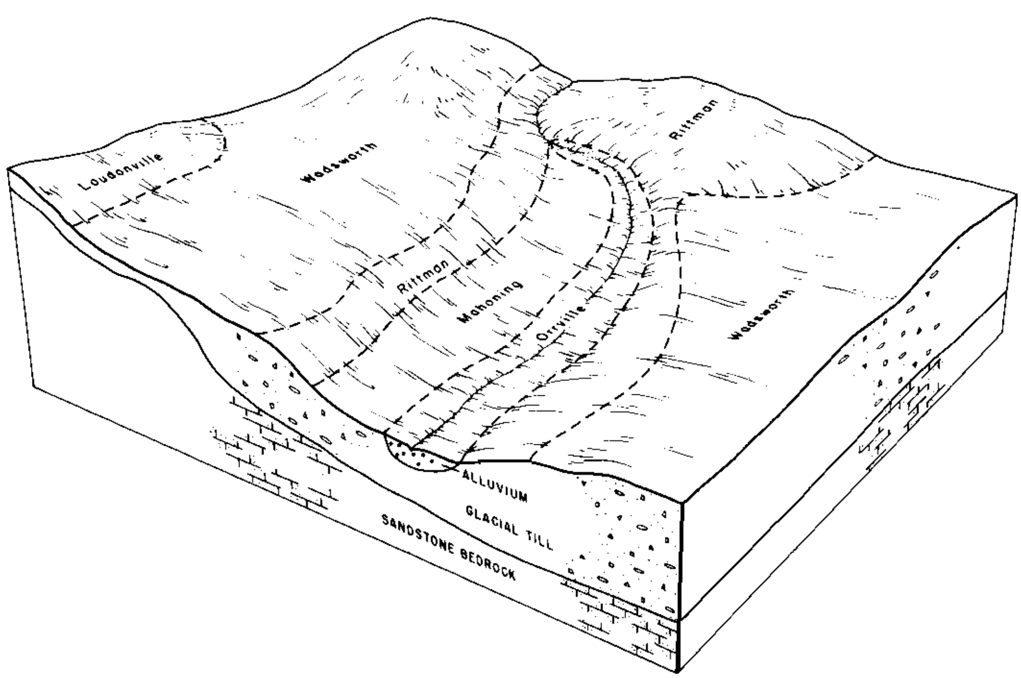

Figure 3.—Wadsworth-Rittman association.

the fragipan. A perched seasonal high water table is at a depth of 24 to 42 inches.

Minor soils in this association are the Mitiwanga and the Loudonville soils that have bedrock at a depth of 20 to 40 inches. In a few areas, there are the Mahoning and the Ellsworth soils that do not have a fragipan. The Orrville soils are on flood plains along small streams.

Most areas of these soils were farmed but are reverting to natural vegetation or used for buildings and recreation. The trend of use is toward increased urbanization. The Rittman soils have higher potential for most uses than the Wadsworth soils. The Rittman soils have medium potential for building site development and sanitary facilities, whereas the Wadsworth soils have low potential for these uses. The Rittman soils have medium or high potential for recreational uses, and the Wadsworth soils have medium or low potential. Both soils have high potential for trees, shrubs, hay, pasture, and habitat for openland and woodland wildlife.

The main land-use limitations are the seasonal wetness and the slow or very slow permeability. Ditches and subsurface drains are used to improve drainage in the Wadsworth soils. Both soils are better suited to houses without basements than to houses with basements. Sanitary facilities should be connected to central sewer and treatment facilities, if possible. The soils are well suited to pond reservoirs and sewage lagoons. Both soils are suited to hay, pasture, and trees.

Moderately deep soils on uplands and lake plains

These soils make up about 23 percent of the county. The poorly drained to well drained soils are nearly level to very steep. They formed in glacial till and residuum of bedrock. They are on lake plains, ridgetops, and knolls and in dissected areas of uplands. The soils are mainly used for buildings, streets, woodland, open space, parks, parking lots, lawns, and gardens. The main land-use limitations are seasonal wetness, slow or very slow permeability, steep and very steep slopes, and bedrock at a depth of 20 to 40 inches.

4. Urban land-Mitiwanga association

Urban land and moderately deep, nearly level and gently sloping, somewhat poorly drained soils that formed in loamy glacial till; on uplands and lake plains

This association is in urban areas. It consists of areas of Urban land and nearly level and gently sloping soils. It is on broad flats and undulating parts of the landscape on uplands.

This association makes up about 15 percent of the county. It is about 35 percent Urban land, 30 percent Mitiwanga soils, and 35 percent soils of minor extent.

Urban land consists of areas that are covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification is not feasible. The medium textured Mitiwanga soils are moderately deep, nearly level and gently sloping, and somewhat poorly drained. They have moderate permeability and a perched seasonal high water table, which is at a depth of 12 to 30 inches.

Minor soils in this association are the Dekalb, the Loudonville, and the Hornell soils, which are on breaks and in dissected areas along streams. The deep Darien and Mahoning soils are on flats and slight rises. In places the soils have been radically altered. Some low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed.

This association is used for parks, open space, buildings, streets, and, to a lesser extent, for lawns and gardens. The soils have medium potential for lawns and landscaping and high potential for trees. In undrained areas, potential is low for building and sanitary facilities. The potential is medium or low for recreation uses.

The main land-use limitations are the seasonal wetness and hard bedrock at a depth of 20 to 40 inches. Most areas have been artificially drained by sewer systems, gutters, and subsurface drains. Drained areas are well suited to lawns, flowers, vegetables, and shrubs, but perennial plants should be selected for tolerance of wetness. The soils are better suited to houses without basements than to houses with basements. Building sites should be landscaped and graded to keep surface water away from foundations. Central sewage systems are commonly used although the bedrock makes installation difficult.

5. Brecksville-Hornell association

Moderately deep, gently sloping to very steep, well drained and somewhat poorly drained soils that formed in silty and clayey glacial till and residuum from shale; on uplands

This association is in dissected areas of drainageways and narrow to broad ridgetops. The soils are gently sloping, sloping, steep, and very steep.

This association makes up about 5 percent of the county. It is about 55 percent Brecksville soils, 30 percent Hornell soils, and 15 percent soils of minor extent.

The Brecksville soils are on side slopes along drainageways, and the Hornell soils are on broad ridgetops and knolls. The moderately deep Brecksville soils are steep and very steep, medium textured, well drained, and slowly permeable. The moderately deep Hornell soils are somewhat poorly drained, gently sloping and sloping, and medium textured. They have slow or very slow permeability and a perched seasonal high water table at a depth of 12 to 30 inches.

Minor soils in this association are the Mahoning soils on broad flats and slight rises and the Ellsworth soils on knolls and ridges. The Dekalb and the Loudonville soils, which have bedrock at a depth of 20 to 40 inches, are on side slopes along streams.

These soils are used mainly for woodland, parks, and buildings. They have high potential for woodland and habitat for woodland wildlife. The potential is low for building site development and sanitary facilities. The Hornell soils have high potential for hay and pasture.

The main land-use limitations are the steep and very steep slopes of the Brecksville soils; the seasonal wetness and slow or very slow permeability of the Hornell soils; and bedrock at a depth of 20 to 40 inches in both soils. The Brecksville soils are suited to trees, habitat for woodland wildlife, and some recreation. Some areas of the Brecksville soils have potential for scenic recreational uses. The steep and very steep soils are unstable and subject to slippage. The Hornell soils are better suited to houses without basements than to houses with basements. Subsurface drains are commonly used to improve drainage. Sanitary facilities should be connected to central sewer and treatment facilities, if possible.

6. Allis-Urban land association

Urban land and moderately deep, nearly level, poorly drained soils that formed in silty and clayey glacial till derived mainly from shale; on lake plains

This association is in urban areas. It is on broad, slightly undulating flats on lake plains. This association makes up about 3 percent of the county. It is about 55 percent Allis soils, 25 percent Urban land, and 20 percent soils of minor extent.

The moderately deep Allis soils are nearly level, poorly drained, and medium textured. These soils have slow or very slow permeability. They have a perched seasonal high water table near the surface. Urban land consists of areas that are covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification is not feasible.

Minor soils in this association are the Hornell, the Haskins, and the Mahoning soils on low knolls and slight rises. Also, the Condit and the Miner soils are in low areas and depressions.

This association is used for buildings, recreation facilities, streets, parking lots, open space, lawns, and gardens. In undrained areas, potential is low for building site development, sanitary facilities, recreation, landscaping, and lawns. The soils have medium potential for trees and habitat for wetland and woodland wildlife.

The main land-use limitations are seasonal wetness, slow or very slow permeability, and shale bedrock at a depth of 20 to 40 inches. The soils are better suited to houses without basements than to houses with basements. The shale bedrock hinders excavation. Most areas are artificially drained by sewer systems, gutters, subsurface drains, and, to a lesser extent, surface ditches. Central sewage systems are commonly used. Perennial plants should be selected for tolerance to wetness.

Deep soils on beach ridges, outwash terraces, and lake plains

These soils make up about 14 percent of the county. The well drained to somewhat poorly drained, nearly level to very steep soils formed in glacial outwash, lacustrine sediments, and loamy and sandy, water-deposited materials. They are on broad flats, in undulating areas, and on the sides of deeply entrenched valleys and ravines. The soils are mainly used for buildings, woodland, parking lots, streets, parks, playgrounds, lawns, open space, greenhouses, and nurseries. The land-use limitations are moderately steep to very steep slopes, seasonal wetness, hillside slippage, very slow permeability, and droughtiness.

7. Oshtemo-Urban land-Chili association

Urban land and nearly level to very steep, well drained soils that formed in stratified, loamy and sandy glacial outwash; on outwash terraces and beach ridges

This association is mainly in urban areas. It consists of undulating and dissected areas on outwash terraces and beach ridges. The soils are nearly level to very steep.

This association makes up about 4 percent of the county. It is about 35 percent Oshtemo soils, 20 percent Urban land, 15 percent Chili soils, and 30 percent soils of minor extent.

The Oshtemo soils are nearly level, gently sloping, steep, and very steep. These moderately coarse textured soils are on outwash terraces and beach ridges. They have moderately rapid permeability in the subsoil and very rapid permeability in the substratum. Urban land consists of areas that are covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification is not feasible. Chili soils are well drained, medium textured, and nearly level to moderately steep. They are on outwash terraces. The Chili soils have moderately rapid permeability.

Minor soils in this association are the Stafford Variant and the Haskins soils which are adjacent to beach ridges, and the Bogart and the Jimtown soils that are on flats and terraces.

This association is used for buildings, open space, greenhouses, nurseries, and woodland. The nearly level and gently sloping soils have high potential for building site development, recreation, nurseries, lawns, flowers, vegetables, and trees. The steep and very steep soils have high potential for woodland and habitat for woodland wildlife. The soils have low potential for such sanitary facilities as sewage lagoons and sanitary landfills.

The nearly level and gently sloping soils are well suited as a site for buildings, local roads and streets, and most recreation. They are also well suited to lawns, flowers, vegetables, trees, shrubs, hay, and pasture. They warm and dry early in spring. On these less sloping soils, droughtiness is the main limitation. Erosion is a serious hazard on the moderately steep to very steep soils when vegetation is removed during construction. Cover should be maintained on the steeper soils as much as possible during construction to reduce the erosion hazard. On all of these soils, seepage from sanitary facilities is a possible pollution hazard to underground water supplies.

8. Geeburg-Mentor association

Steep and very steep, moderately well drained and well drained soils that formed in clayey and silty lacustrine sediments; on dissected parts of terraces

This association is on dissected parts of terraces in deeply entrenched valleys and V-shaped ravines. The soils are steep and very steep. Slippage is common on the lower parts of slopes, and most areas of the association are subject to hillside slippage.

This association makes up about 3 percent of the county. It has about 35 percent Geeburg soils, 20 percent Mentor soils, and 45 percent soils of minor extent.

The Geeburg soils are moderately well drained and very slowly permeable. They have a seasonal high water table at a depth of 24 to 42 inches. Mentor soils are well drained and moderately permeable. The seasonal high water table is at a depth of 48 to 72 inches. Both soils are steep and very steep. They have a medium textured surface layer.

Minor soils in this association are the Brecksville and the Oshtemo soils on side slopes of valleys. The Glenford soils are on foot slopes, and the Ellsworth soils are on breaks to the uplands. The Chagrin soils are on flood plains of small streams.

This association is mainly used for woodland. Most areas support native hardwoods. The soils have low potential for most uses other than woodland, habitat for woodland wildlife, and some recreation. In some areas, the soils have potential for scenic recreational uses.

These soils are suited to trees and habitat for woodland wildlife. Construction for urban and recreational uses is very difficult, and the hazard or erosion is very severe when vegetation is removed. Most slopes are unstable and subject to slippage. Trails in recreational areas should be protected against erosion and should cross the slope, if possible.

9. Urban land-Elnora-Jimtown association

Urban land and nearly level, moderately well drained and somewhat poorly drained soils that formed in sandy, water-deposited materials and in loamy glacial outwash; on lake plains, terraces, and beach ridges

This association is characterized by broad flats on lake plains, terraces, and beach ridges. The soils are nearly level, but there is some undulation.

This association makes up about 7 percent of the county. It is about 45 percent Urban land, 15 percent Elnora soils, 10 percent Jimtown soils, and 30 percent soils of minor extent.

Urban land consists of areas that are covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification is not feasible. Elnora soils are nearly level, moderately well drained, and coarse textured. They are on lake plains. Elnora soils have moderately rapid or rapid permeability. They have a seasonal high water table at a depth of 18 to 24 inches. Jimtown soils are nearly level, somewhat poorly drained, and medium textured. These soils are on terraces and beach ridges. They have moderate permeability and a seasonal high water table at a depth of 12 to 30 inches.

Minor soils in this association are the Chili and the Bogart soils on outwash and stream terraces. The Glenford and the Fitchville soils are on terraces and in basins of former glacial lakes. The Haskins soils are on terraces and beach ridges.

This association is used for buildings, parking lots, streets, parks, playgrounds, vacant lots, woodland, lawns, and greenhouses. The soils have medium or low potential for building site development and sanitary facilities. They have medium potential for lawns, vegetable and flower gardens, and recreation. These soils have medium or high potential for trees.

The main land-use limitations are the seasonal wetness, possible contamination of ground water supplies, and droughtiness in summer. Most areas have been drained by sewer systems, gutters, and subsurface drains. Subsurface drains are effective in lowering the seasonal high water table. Because of lateral movement of water in the substratum, the soils are better suited to houses without basements than to houses with basements. Sloughing is a hazard in excavations. Contamination of ground water by sanitary facilities is possible. Lawns on the Elnora soils dry up during periods without rain.

Deep soils on flood plains and low stream terraces

These soils make up about 5 percent of the county. The well drained and somewhat poorly drained, nearly level soils formed in alluvium on flood plains and in stratified deposits on low stream terraces. The landscape is characterized by narrow to relatively broad, flat valley floors that are bounded by sharp breaks to the uplands. The soils are mainly used for parks, golf courses, and woodland. Some areas are used for vegetables or a few buildings. The main land-use limitations are flooding, wetness, and moderately slow permeability.

10. Chagrin-Tioga-Euclid association

Nearly level, well drained and somewhat poorly drained soils that formed in loamy and sandy alluvium and in silty and loamy deposits; on flood plains and low stream terraces

This association is on flood plains and low stream terraces that are bounded by slope breaks to the uplands. The landscape is characterized by narrow to relatively broad, flat valley floors (fig. 4). The soils are subject to flooding.

This association makes up about 5 percent of the county. It is about 25 percent Chagrin soils, 15 percent Tioga soils, 10 percent Euclid soils, and 50 percent soils of minor extent.

The Chagrin and the Tioga soils are on flood plains, and the Euclid soils are at a slightly higher elevation on low stream terraces. The Chagrin soils are nearly level, well drained, and medium textured. These soils are subject to occasional flooding. They have moderate permeability and a seasonal high water table at a depth of 48 to 72 inches. Tioga soils are nearly level, well drained, and medium textured. They are subject to frequent flooding. They have moderate or moderately rapid permeability and a seasonal high water table at a depth of 36 to 72 inches. Euclid soils are nearly level, somewhat poorly drained, and medium textured. These soils are subject to rare flooding. The Euclid soils have moderately slow permeability. They have a seasonal high water table at a depth of 12 to 30 inches.

Minor soils in this association are the Orrville and the Holly soils on flood plains. These soils are in old meander channels and are near slope breaks to the stream terraces and the uplands. The Tioga Variant is on low stream terraces.

This association is mainly used for parks, golf courses, and woodland. Some areas are used for vegetables or a few buildings. The soils have high potential for woodland, cropland, pasture, and habitat for openland and woodland wildlife. They have low potential for building site development and sanitary facilities. The potential is medium or high for recreation.

The major land-use limitations are the wetness and the moderately slow permeability of the Euclid soils and the flooding of all three soils. The soils are better suited as a site for recreation, such as golf fairways and paths and trails, than to most other community development. Perennial plants should be selected for tolerance to brief flooding. In some places on the Euclid and Tioga soils, special measures are needed to control streambank erosion and to keep channels from cutting through the soils.

Urban land

Urban land makes up about 5 percent of the county. These areas have been altered and used for buildings, streets, parking lots, and other related works and structures. Most areas are nearly level and gently sloping, but sloping to steep areas are along streams. Onsite investigation is needed to determine the potential and limitations of these areas.

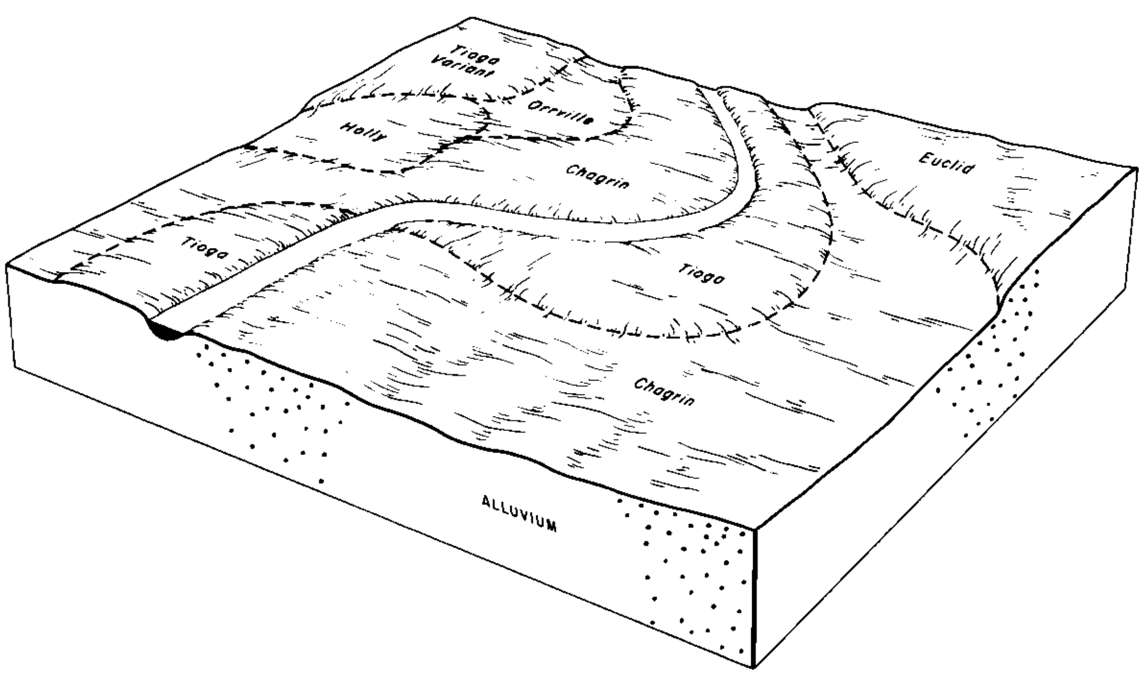

Figure 4.—Chagrin-Tioga-Euclid association.

11. Urban land

Nearly level and gently sloping areas that are predominantly covered by buildings, structures, concrete, asphalt, and other impervious surfaces

Urban land consists of nearly level and gently sloping areas that are covered by asphalt, concrete, buildings, and other impervious surfaces, such as parking lots, shopping and business centers, and industrial parks. It occurs mainly in the downtown business district and in corridors along main roads and streets.

This association makes up about 5 percent of the county. It is about 80 percent Urban land and 20 percent soils of minor extent.

Minor soils in these areas are the Mahoning, the Mitiwanga, the Elnora, the Oshtemo, and the Allis soils. Some areas contain miscellaneous materials, such as dredgings and industrial wastes. Sloping to steep areas are along the Cuyahoga River.

Onsite investigation is needed to determine the potential and limitations of urban areas.

Soil maps for detailed planning

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, a brief description of the soil profile, and a listing of the principal hazards and limitations to be considered in planning management.

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. Geeburg-Mentor silt loams, 25 to 70 percent slopes, is an example.

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

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

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

Soil descriptions

As—Allis silt loam. This moderately deep soil is nearly level and poorly drained. This soil is on uplands and lake plains. Slope is 0 to 2 percent. Most areas are irregularly shaped and 5 to over 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 3 inches thick. The subsoil is about 32 inches thick. The upper part is grayish brown, mottled, friable silt loam and firm and very firm silty clay; the lower part is grayish brown and dark brown, very firm shaly silty clay and silty clay loam. Dark gray, rippable, partly weathered shale bedrock is at a depth of about 35 inches. In some small areas, shale bedrock is at a depth of 40 to 60 inches. In some areas near beach ridges, this soil has a sandy loam or loam surface layer.

Included with this soil in mapping are areas of somewhat poorly drained Hornell soils on slight rises. This included soil makes up about 5 percent of most areas.

A perched seasonal high water table is near the surface in fall, winter, spring, and during extended wet periods. Permeability is slow or very slow. The root zone is mainly moderately deep to shale bedrock. The available water capacity is low. Runoff is slow, and some areas become ponded. The shrink-swell potential is moderate in the subsoil. Reaction is strongly acid to extremely acid in the surface layer and subsoil.

Most areas were once used for grapes but are presently used for parks or woodland. This soil has low potential for building site development, sanitary facilities, recreation, landscaping, and lawns. It has medium potential for hay, pasture, grapes, woodland, and as habitat for wetland and woodland wildlife.

This soil is severely limited for most uses by seasonal wetness, slow or very slow permeability, and shale bedrock at a depth of 20 to 40 inches. Surface and subsurface drains are needed to overcome wetness. Outlets for subsurface drains, however, are not available in many areas, and movement of water into these drains is slow. Raised beds can be used to elevate the upper part of the root zone above the seasonal high water table. Use of crop residue and cover crops improve the organic matter content and tilth and increase water infiltration. Perennial plants should be selected for tolerance to wetness and acid conditions. Periodic applications of lime are needed. If this soil is used for pasture, compaction can be avoided by grazing during periods when the surface layer is not soft and sticky.

This soil is better suited to houses without basements than to houses with basements because of wetness and depth to rock. The shale bedrock, however, is rippable. Foundations and footings should be designed to prevent structural damage caused by frost action and by shrinking and swelling of the soil. Landscaping and grading are needed on building sites to keep surface water away from the foundations. Surface drains and storm sewers can also be used to remove surface water. The soil is limited for local roads by wetness and low strength but can be improved for this use by installing artificial drainage and by replacing the subsoil with a suitable base material. Because of wetness, extensive drainage is needed for such intensive recreation uses as baseball diamonds and tennis courts, and play areas and walkways usually need special surfacing.

At—Allis-Urban land complex. This map unit consists of moderately deep, nearly level, poorly drained Allis soil and Urban land. Individual areas of this map unit are on smooth lake plains. Most areas contain about 55 percent Allis silt loam and 30 percent Urban land. The areas of Allis soil and the Urban land are so intricately mixed or so small in size that mapping them separately is not practical. Slope is 0 to 2 percent.

Typically, the Allis soil has a surface layer of dark grayish brown, friable silt loam about 7 inches thick. The subsoil is grayish brown, mottled, firm silty clay about 28 inches thick. Dark gray, rippable, partly weathered shale bedrock is at a depth of about 35 inches. In some places the soil has been radically altered. Some low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed.

The Urban land part of the unit is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification is not feasible.

Included with this complex in mapping are small areas of somewhat poorly drained Hornell soils on slight rises. This included soil makes up about 15 percent of the map unit.

Most areas of this map unit are artificially drained by sewer systems, gutters, subsurface drains, and, to a lesser extent, surface ditches. Areas of the Allis soil that are not drained have a perched seasonal high water table near the surface in fall, winter, spring, and during extended wet periods. Runoff is slow, and some low-lying areas are ponded by runoff from adjacent higher parts of the landscape. Permeability is slow or very slow. The root zone is mainly moderately deep to shale bedrock. The available water capacity is low. Reaction is strongly acid to extremely acid in the surface layer and the subsoil. The shrink-swell potential is moderate.

The Allis soil is used for parks, open space, building sites, lawns, and gardens. It has low potential for building site development, sanitary facilities, recreational uses, landscaping, and lawns. It has medium potential for woodland and as habitat for wetland wildlife.

This soil warms slowly and dries late in spring if undrained. Unless adequately drained, it is not well suited to lawns, flowers, vegetables, trees, and shrubs. Surface and subsurface drains are commonly used to improve drainage, but movement of water into subsurface drains is slow. Artificial drainage is difficult to establish in some areas because of the flat topography. Raised beds can be used to elevate the upper part of the root zone above the seasonal high water table. Perennial plants should be selected for tolerance to wetness and acid conditions. Applications of lime and fertilizer aid in establishing and maintaining lawns and gardens. Turf is easily damaged when the soil is saturated. The spots of cut and fill land are not well suited to lawns and gardens. Tilth is poor in exposed subsoil material, which is sticky when wet and hard when dry.

The Allis soil is severely limited as a site for buildings, sanitary facilities, and recreation by seasonal wetness, slow or very slow permeability, and shale bedrock at a depth of 20 to 40 inches. The shale bedrock hinders excavation but is rippable. This soil is better suited to houses without basements than to those with basements. Foundations and footings should be designed to prevent structural damage caused by frost action and shrinking and swelling of the soil. Building sites should be landscaped and graded to keep surface water away from foundations. The soil is limited for local roads and streets by wetness and low strength but can be improved for this use by installing artificial drainage and by replacing the subsoil with a suitable base material. Play areas and walkways usually need special surfacing because of wetness.

BgB—Bogart loam, 2 to 6 percent slopes. This deep soil is gently sloping and moderately well drained. This soil is on stream terraces. A few areas are on end moraines. Most areas are irregularly shaped and 4 to 50 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 10 inches thick. The subsoil is about 39 inches thick. It is yellowish brown, mottled, friable gravelly sandy loam, gravelly sandy clay loam, and gravelly clay loam. The substratum to a depth of about 60 inches is dark brown, mottled, very friable gravelly sandy loam. In some areas this soil has slopes of 0 to 2 percent.

Included with this soil in mapping are narrow areas of somewhat poorly drained Jimtown soils in drainageways and depressions. Also included are narrow strips of the Ellsworth and the Mahoning soils, which formed in glacial till. These inclusions make up about 15 percent of most areas.

A seasonal high water table is at a depth of 24 to 42 inches in winter, in spring, and during extended wet periods. Runoff is medium. Permeability is moderate or moderately rapid in the subsoil and rapid or very rapid in the substratum. The root zone is deep, and the available water capacity is moderate. The shrink-swell potential is low. Reaction of the subsoil is very strongly acid to slightly acid. The surface layer can be worked through a fairly wide range in moisture content.

Most areas were once farmed but are reverting to natural vegetation. This soil has medium potential for building site development and low potential for sanitary facilities. It has medium or high potential for recreation. This soil has high potential for lawns, landscaping, flowers, vegetables, hay, pasture, and trees.

This soil is well suited to lawns, flowers, vegetables, trees, shrubs, hay, and pasture. Additions of organic matter aid in establishing lawns, gardens, and seedings for hay and pasture. Irrigation is needed during extended dry periods. Subsurface drains are needed in the included wetter soils. Surface compaction, poor tilth, and reduced growth result from overgrazing or grazing when the soil is soft and sticky because of wetness. Tree seedlings grow well if competing vegetation is controlled or removed by cutting, spraying, girdling, or mowing.

This soil is limited as a site for buildings, sanitary facilities, and some recreational uses by the seasonal wetness, potential frost action, and seepage limit. It is better suited to houses without basements than to houses with basements. Building sites should be landscaped and graded to keep surface water away from the foundations. Sanitary facilities may possibly pollute local ground water because of the rapidly permeable or very rapidly permeable substratum. This soil is well suited to such recreational uses as paths and trails and golf fairways. Seasonal wetness limits the use of the soil for camp and picnic areas. This soil is limited for local roads by frost action, but it can be improved for this use of installing artificial drainage and by replacing the subsoil with a suitable base material.

BhB—Bogart-Urban land complex, undulating. This map unit consists of an undulating Bogart soil that is deep and moderately well drained and Urban land. Individual areas of this map unit are on stream terraces. Areas contain about 50 percent Bogart loam and 35 percent Urban land. Areas of the Bogart soil and Urban land are so intricately mixed or so small in size that mapping them separately is not practical. Slope ranges from 2 to 8 percent.

Typically, the Bogart soil has a surface layer of dark grayish brown, friable loam about 10 inches thick. The subsoil is about 39 inches thick. It is yellowish brown, mottled, friable gravelly sandy loam, gravelly sandy clay loam, and gravelly clay loam. In places the soil has been radically altered. Some low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed.

The Urban land part of the unit is covered by streets, parking lots, buildings, and other structures that obscure or alter the soils so that identification is not feasible.

Included with this complex in mapping are small areas of the well drained Chili soils on low knolls and the somewhat poorly drained Jimtown and Haskins soils in low-lying parts of the landscape. These inclusions make up 10 to 20 percent of most mapped areas.

Some areas are artificially drained by sewer systems, gutters, and subsurface drains. Bogart soils that are not drained have a seasonal high water table at a depth of 24 to 42 inches in winter and in spring and during extended wet periods. Runoff is medium. Permeability is moderate or moderately rapid in the subsoil and rapid or very rapid in the substratum. The root zone is deep, and the available water capacity is moderate. The shrink-swell potential is low. Reaction in the subsoil is very strongly acid to slightly acid.

The Bogart soil is used for parks, open space, building sites, lawns, and gardens. It has high potential for lawns, flower and vegetable gardens, trees, and shrubs. It has medium potential for building site development and low potential for sanitary facilities. This soil has medium or high potential for recreational uses.

The Bogart soil is well suited to grasses, flowers, vegetables, trees, and shrubs. Watering is needed during dry periods. Additions of organic-matter aid in establishing and maintaining lawns and gardens. Soil erosion generally is not a problem, unless the soil is disturbed and left bare and exposed. The spots of cut and fill are not well suited to lawns and gardens. Tilth is poor in exposed subsoil material, which is sticky when wet and hard when dry. Subsurface drains are used in the included wetter soils to lower the seasonal high water table.

The Bogart soil is limited as a site for buildings, sanitary facilities, and some recreational uses by the seasonal wetness, potential frost action, and seepage. It is better suited to houses without basements than to houses with basements. Building sites should be landscaped and graded to keep surface water away from the foundations. Sanitary facilities may possibly pollute local ground water because of the rapidly permeable or very rapidly permeable substratum. Perimeter drains increase the effectiveness of septic tank absorption fields. This soil is well suited to such recreational uses as paths and trails and golf fairways. It is limited for local roads by frost action, but it can be improved for this use by installing artificial drainage and by replacing the subsoil with a suitable base material.

BrF—Brecksville silt loam, 25 to 70 percent slopes. This moderately deep soil is steep and very steep and well drained. This soil is dissected and along drainageways on uplands. Most areas are long and narrow and range from 10 acres to over 100 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 2 inches thick. The subsoil is about 25 inches thick. The upper part is yellowish brown, friable and firm silt loam that is mottled below about 6 inches; the lower part is light olive brown, mottled, firm silty clay loam and shaly silty clay loam. The substratum, to a depth of about 30 inches, is light olive brown, mottled, firm shaly silty clay loam. Under this is olive brown, thin bedded, soft shale bedrock.

Included with this soil in mapping are narrow bands of the deep Glenford and Ellsworth soils on the upper parts of slopes. Narrow strips of the Holly soils are on flood plains. These inclusions make up about 15 percent of most areas.

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

Most of the acreage is scenic areas in parks and in woodland. This soil has low potential for building site development and sanitary facilities. It has high potential as habitat for woodland wildlife and medium potential for woodland.

This soil is suited to trees and ground cover. In most years seedlings are difficult to establish because of the low available water capacity. Erosion is a serious hazard if adequate vegetative cover is not maintained.

Construction for recreation and urban uses is very difficult because of the steep and very steep slopes. Low strength, hillside slippage, and soft shale bedrock at a depth of 20 to 40 inches also limit many uses. Most slopes are unstable and subject to slippage. Trails in recreational areas should be protected against erosion and should cross the slopes, if possible.

Ca—Canadice silty clay loam. This deep soil is nearly level and poorly drained. This soil is in basins of former glacial lakes. Some areas receive runoff from adjacent higher lying soils and are subject to ponding. Most areas are irregularly shaped and range from 5 to 50 acres in size. Slope is 0 to 2 percent.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 8 inches thick. The subsoil is about 35 inches thick. The upper part is grayish brown, mottled, friable and firm, silty clay loam; the lower part is dark gray and olive brown, firm silty clay that is mottled between 27 and 34 inches. The substratum to a depth of about 60 inches is olive brown, firm silty clay that is mottled in the lower 3 inches. In some areas in depressions this soil has a very dark gray surface layer.

Included with this soil in mapping are small areas of the somewhat poorly drained Caneadea soils on slight rises. In some included areas, gravelly sand is at a depth of 50 to 60 inches. These inclusions comprise about 15 percent of most areas.

A perched seasonal high water table is near the surface in winter, in spring, and during extended wet periods. Permeability is very slow. The root zone is deep, and available water capacity is moderate or high. The shrink-swell potential is moderate. Reaction is slightly acid to strongly acid in the surface layer and medium acid to neutral in the subsoil.

Most areas are in woodland or brush. This soil has low potential for building site development, sanitary facilities, and recreational development. It has medium potential for woodland and good potential as habitat for wetland wildlife.

Because of wetness, this soil is poorly suited to such intensive uses as flower and vegetable gardens. It warms slowly and dries late in spring if undrained. Drained areas are suited to hay, pasture, and lawns. Drainage by subsurface drains is slow, but surface drains help remove excess water. Subsurface drains are difficult to establish in some low areas of the landscape. Raised beds can be used to elevate the upper part of the root zone above the seasonal high water table. This soil is highly susceptible to surface crusting if cultivated. Its range of optimum moisture content for tillage is narrow. Perennial plants should be selected for tolerance to wetness.

This soil is severely limited as a site for buildings, recreation, and most sanitary facilities because of the wetness, very slow permeability, and amount of clay in the subsoil and substratum. For small buildings, spread footings and drainage help overcome the strength limitations. The soil is limited for local roads and streets by wetness and low strength, but it can be improved for this use by installing artificial drainage and by replacing the subsoil with a suitable base material. This soil is well suited to sewage lagoons; however, sanitary facilities should be connected to central sewer and treatment facilities. Play areas and walkways usually need special surfacing because of wetness.

CcA—Caneadea silt loam, 0 to 2 percent slopes. This deep soil is nearly level and somewhat poorly drained. This soil is on slight rises on lake plains. Most areas are irregularly shaped 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 40 inches thick. The upper part is grayish brown, mottled, firm silty clay loam; the middle and lower parts are olive brown, firm silty clay that is mottled between 12 and 27 inches. The substratum to a depth of about 60 inches is olive brown, firm silty clay. In some areas this soil has a silty clay loam surface layer.

Included with this soil in mapping are small areas of the poorly drained Canadice soils in shallow depressions and drainageways. Also included are areas where the silty clay loam or clay loam glacial till is in the substratum. The inclusions make up about 15 percent of most areas.

A perched seasonal high water table is at a depth of 12 to 30 inches in winter, in spring, and during extended wet periods. Permeability and runoff are slow. The root zone is deep, and 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.

Most areas are in woodland or brush. This soil has low potential for building site development and recreation. It has medium potential for woodland and high potential as habitat for openland and woodland wildlife. This soil has medium or low potential for recreation.

If drained, this soil is suited to lawns, flowers, vegetables, trees, shrubs, hay, and pasture. Planting is delayed if the soil is undrained. The slow internal water movement reduces the effectiveness of subsurface drains, so 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. Perennial plants should be selected for tolerance to wetness. Because tilling or grazing when the soil is soft and sticky causes it to compact, grazing should be controlled. Additions of organic matter aid in establishing and maintaining lawns and gardens. Lawns are easily damaged during wet periods. Undrained areas of this soil are suited to woodland; however, the use of planting and harvesting equipment is limited during wet seasons.

This soil is severely limited as a site for buildings and most sanitary facilities by the seasonal wetness, slow permeability, and high shrink-swell potential. Ditches, storm sewers, and subsurface drains are used to improve drainage. Building sites should be landscaped and graded to keep surface water away from foundations. Foundations and footings should be designed to prevent structural damage caused by the frost action and the shrinking and swelling of the soil. This soil is well suited to sewage lagoons; however, sanitary facilities should be connected to central sewer and treatment facilities. It is limited for local roads and intensive recreational facilities by wetness, low strength, and shrinking and swelling, but it can be improved for these uses by installing artificial drainage and by replacing the subsoil with a suitable base material. Most play areas and walkways need special surfacing because of wetness.

Cg—Carlisle silty clay loam. This deep soil is nearly level and very poorly drained. This soil is in low bogs and swales of uplands. It is subject to frequent flooding. Slope is 0 to 2 percent. Most areas are oval and range from 10 to 60 acres in size.

Typically, the surface layer is dark grayish brown and very dark gray, sticky silty clay loam about 10 inches thick. Below this to a depth of 60 inches are layers of very dark gray, dark brown, and dark olive, very friable muck. In some areas the soil does not have a mineral surface layer.

Included with this soil in mapping are narrow strips of the poorly drained Canadice soils that formed in lakebed sediments. These soils are commonly on the periphery of mapped areas. The inclusion makes up 15 percent of most areas.

Water is near the surface and ponds for long periods. Permeability ranges from moderately slow to moderately rapid. Runoff is very slow. The root zone is slightly acid or neutral, and the available water capacity is very high.

Most areas are in wetland vegetation and are used as habitat for wildlife. A few areas are being mined for peat moss. This soil has low potential for building site development and sanitary facilities. It has high potential as habitat for wetland wildlife and medium potential for vegetables.

This soil is severely limited for lawns, trees, shrubs, and as a site for buildings, sanitary facilities, and recreation by the flooding, extreme wetness, low strength, and seepage. The fluctuating water level limits the survival of most species of trees. Most areas are good habitat for duck, muskrat, and other wetland wildlife. This soil is a source of peat for lawns and landscaping.

Ch—Chagrin silt loam, occasionally flooded. This deep soil is nearly level and well drained. This soil is in the highest position on flood plains. It is occasionally flooded for brief periods in fall, winter, and spring. Slope is 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 8 inches thick. The subsoil is about 27 inches thick. It is dark yellowish brown, friable silt loam. The substratum to a depth of about 60 inches is dark brown and olive brown, friable silt loam. In some areas the soil has a very dark grayish brown surface layer.

Included with this soil in mapping are narrow strips of the somewhat poorly drained Orrville soils at a slightly lower elevation on flood plains. This inclusion makes up about 15 percent of most areas.

Permeability is moderate, and surface runoff is slow. The root zone is deep, and available water capacity is high. Reaction is slightly acid or neutral throughout the soil. The surface layer is easily tilled through a fairly wide range of moisture content.

The soil is used mostly for recreation and woodland. A few areas are used for sweet corn and sod production. This soil has high potential for cropland, pasture, and woodland. It has low potential for building site development and sanitary facilities. The potential is medium or high for recreation.

The main hazard for lawns, flowers, vegetables, trees, hay, pasture, and shrubs is flooding. Annual flowers and vegetables do well on this soil if they are planted after the major threat of flooding. Perennial plants should be selected for tolerance to brief flooding. Lawns are easy to establish when the soil is not flooded, but flooding of extended duration kills grasses. Planting cover crops protects the surface during floods. Tree seedlings grow well if competing vegetation is controlled or removed by such practices as spraying, mowing, or disking.

Flooding seriously limits this soil as a site for most buildings and sanitary facilities. Installing dikes to control flooding is difficult. Fill can elevate roads above normal flood levels. This soil is suited to extensive recreational uses, such as golf fairways, hiking trails, and picnic areas. Special measures are needed in some places to control streambank erosion and keep channels from cutting through the soil.

CnA—Chili loam, 0 to 2 percent slopes. This deep soil is nearly level and well drained. This soil is on outwash terraces. Most areas are irregularly shaped and range from 4 to 10 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 7 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown, friable gravelly sandy loam; the middle part is brown, firm gravelly loam; and the lower part is reddish brown, very friable gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, stratified loamy sand and very gravelly sand.

Included with this soil in mapping are small areas of the moderately well drained Bogart soils in shallow depressions and along drainageways. This inclusion makes up about 15 percent of most areas.

Permeability is moderately rapid. Runoff is slow. The root zone is mainly deep, and available water capacity is moderate or low. The shrink-swell potential is low. Reaction is strongly acid or medium acid in the subsoil. The surface layer can be worked through a fairly wide range of moisture content.

Most areas were once farmed but are reverting to natural vegetation or are used for recreation. This soil has high potential for building site development, recreation uses, flowers, vegetables, lawns, and trees. It has low potential for such sanitary facilities as sewage lagoons and sanitary landfills.

This soil is well suited to lawns, trees, shrubs, hay, and pasture. Droughtiness is the main limitation. The soil warms and dries early in spring and can be worked earlier than most soils. It is well suited to irrigation, which is needed during dry periods. Lawns should be seeded late in summer and mulched and watered. Additions of organic matter aid in establishing and maintaining lawns, gardens, and seedings for hay and pasture. This soil is well suited to grazing early in spring.

This soil is well suited as a site for buildings, local roads and streets, and most recreation uses. Even though the soil is well suited for local roads and streets, it can be improved for this use by replacing the surface layer and subsoil with a suitable base material. Sloughing is a hazard in excavation. This soil is a good source of gravel. It is limited for sanitary facilities, such as sewage lagoons and sanitary landfills, because of possible pollution of underground water supplies. The small stones in the surface layer interfere with intensive recreational uses, such as ball diamonds and play areas.

CnB—Chili loam, 2 to 6 percent slopes. This deep soil is gently sloping and well drained. This soil is on outwash terraces. Most areas are irregularly shaped and range from 4 to 10 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 7 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown, friable gravelly sandy loam; the middle part is brown, firm gravelly loam; and the lower part is reddish brown, very friable gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, stratified loamy sand and very gravelly sand. In some areas the surface layer is gravelly loam, which tends to be more droughty.

Included with this soil in mapping are small areas of the moderately well drained Bogart soils in shallow depressions and the moderately well drained Ellsworth soils that formed in glacial till on slope breaks to the uplands. These inclusions make up 15 percent of most areas.

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

Most areas were once farmed but are reverting to natural vegetation or are used for recreation. This soil has high potential for building site development, recreation, lawns, flowers, gardens, and trees. It has low potential for such sanitary facilities as sewage lagoons and sanitary landfills.

The main management concerns on this soil are droughtiness and controlling erosion. This soil is well suited to lawns, flowers, vegetables, trees, shrubs, hay, and pasture. It warms and dries early in spring and can be worked earlier than most soils. Irrigation is needed. Lawns should be seeded late in summer and should be mulched and watered. Additions of organic matter aid in establishing and maintaining lawns, gardens, and seedings for hay and pasture. The soil is well suited to grazing early in spring.

This soil is well suited as a site for buildings, local roads and streets, and most recreation. Even though the soil is well suited for local roads and streets, it can be improved for this use by replacing the surface layer and subsoil with a suitable base material. Sloughing is a hazard in excavations. This soil is a good source of gravel. Cover should be maintained on the site as much as possible during construction to reduce the erosion hazard. The soil is limited for sanitary facilities, such as sewage lagoons and sanitary landfills because of the possible pollution of underground water supplies. The small stones in the surface layer interfere with intensive recreational uses, such as ball diamonds and play areas.

CnC—Chili loam, 6 to 12 percent slopes. This deep soil is sloping and well drained. This soil is on outwash terraces. Most areas are irregularly shaped and range from 4 to 10 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 7 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown, friable gravelly sandy loam; the middle part is brown, friable and firm gravelly loam; and the lower part is reddish brown, very friable gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose stratified loamy sand and very gravelly sand. In some areas the surface layer is gravelly loam, which tends to be more droughty.

Included with this soil in mapping are small areas of the moderately well drained Bogart soils in drainageways. This inclusion makes up about 15 percent of most areas.

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

Most areas were once farmed but are reverting to natural vegetation or are used for recreation. This soil has medium potential for building site development, recreation, gardens, and lawns. It has low potential for such sanitary facilities as sewage lagoons and sanitary landfills. The potential for hay and pasture is high.

This soil is suited to hay, pasture, trees, and shrubs. The main hazards for vegetables, flowers, and cultivated crops are erosion and droughtiness. The slope also presents some difficulty in the use of equipment. During dry periods, this soil is droughty. Because of the limited available water capacity, it is better suited to early maturing crops than to crops that mature late in summer. Additions of organic matter to the soil aid in establishing and maintaining lawns and gardens. This soil is well suited to grazing early in spring. Seedlings of trees are difficult to establish during dry periods.

This soil is moderately well suited as a site for buildings, local roads and streets, and recreation. It is limited for these uses by slope, frost action, and soil strength. This soil can be improved for local roads by replacing the surface layer and subsoil with a suitable base material. Sloughing is a hazard in excavation. Cover should be maintained on the site as much as possible during construction to reduce soil loss by erosion. This soil is a good source of gravel. The small stones in the surface layer interfere with intensive recreational uses, such as ball diamonds and play areas. Trails in recreational areas should be protected against erosion and should cross the slope if possible. The soil is limited for sanitary facilities, such as sewage lagoons and sanitary landfills, by possible pollution of underground water supplies. This soil is droughty, which affects lawns during dry periods.

CoD—Chili gravelly loam, 12 to 18 percent slopes. This deep soil is moderately steep and well drained. This soil is on outwash terraces and end moraines. Most areas are irregularly shaped and range from 4 to 8 acres in size.

Typically, the surface layer is brown, friable gravelly loam about 5 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown, friable gravelly sandy loam; the middle part is brown, firm gravelly loam; and the lower part is reddish brown, very friable gravelly loam. The substratum to a depth of about 60 inches is yellowish brown, loose stratified loamy sand and very gravelly sand.

Included with this soil in mapping are small areas of the Ellsworth soils that formed in glacial till and are on slope breaks to the uplands. Also included are the Jimtown soils in seeps. These inclusions make up 10 to 15 percent of most areas.

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

Most areas are woodland. This soil has low potential for building site development, sanitary facilities, lawns, landscaping, and most recreation uses. The potential is high for woodland and habitat for woodland wildlife. This soil has medium potential for pasture.

The use of this soil is severely limited for lawns, flowers, and vegetables by the moderately steep slope, the erosion hazard, and the low or moderately low available water capacity. Erosion is a serious hazard when pastures are reseeded or when adequate vegetative cover is not maintained. Seeding pastures with the trash mulch or using no-till methods reduces the risk of erosion and conserves moisture. Seedings and seedlings are difficult to establish during dry periods. Vines, ground cover, and shrubs can be used in place of lawns as a vegetative cover.

This soil is suited to woodland and as habitat for woodland wildlife. The use of logging and planting equipment is limited by the slope. Logging roads and skid trails should be protected against erosion and should cross the slope, if possible.

The use of this soil is severely limited as a site for buildings, sanitary facilities, and most recreation by moderately steep slope and seepage. Development should be on the contour, if possible. Cover should be maintained on the site as much as possible during construction to reduce the erosion hazard. Sloughing is a hazard in excavations. The seepage from sanitary facilities is a possible pollution hazard to underground water supplies. Trails in recreation areas should be protected against erosion and should cross the slope, if possible. This soil is a good source of gravel.

Ct—Condit silty clay loam. This deep soil is nearly level and poorly drained. This soil is in low lying or depressional areas and at the heads of drainageways on ground moraines. Slope is 0 to 2 percent. The soil receives runoff from adjacent, higher lying soils and is subject to ponding. Most areas are long and narrow and range from 5 to 50 acres in size.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 7 inches thick. The subsoil is about 45 inches thick. It is gray and grayish brown, mottled, firm silty clay loam and silty clay. The substratum to a depth of about 60 inches is brown, mottled, firm silty clay loam. In some areas the surface layer is silt loam. In a few areas the soil has a very strongly acid subsoil and has shale bedrock at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Mahoning soils on slight rises. This inclusion is about 15 percent of most areas.

A seasonal high water table is at or near the surface in winter, in spring, and during extended wet periods. Permeability is slow. Runoff is very slow, or the soil is ponded. The soil puddles and clods easily. The root zone is deep, and available water capacity is moderate. The shrink-swell potential is moderate. Reaction is very strongly acid to medium acid in the upper part of the subsoil and medium acid to mildly alkaline in the lower part.

Most areas of this soil were once farmed but are reverting back to natural vegetation. Some areas are used as open space between houses. This soil has low potential for building site development, recreation, landscaping, and most sanitary facilities. It has medium potential for woodland and high potential as habitat for wetland wildlife.

If excess water is removed this soil is suited to lawns, flowers, vegetables, trees, and shrubs. It warms slowly and dries late in the spring in undrained areas. Surface and subsurface drainage are commonly used to remove excess water. Artificial drainage is difficult to establish in the lower positions in the landscape. Raised beds can be used to elevate the upper part of the root zone above the seasonal high water table. Perennial plants should be selected for tolerance to wetness.

This soil is severely limited as a site for buildings, recreation uses, and most sanitary facilities because of ponding, slow permeability, and low strength. It is better suited to houses without basements than to houses with basements. Foundation and footings should be designed to prevent structural damage caused by frost action, low strength, and shrinking and swelling of the soil. This soil is suited to sewage lagoons; however, sanitary facilities should be connected to central sewers and treatment facilities, if possible. The soil is limited for local roads and streets by ponding and low strength but can be improved for this use by installing artificial drainage and by replacing the subsoil with a suitable base material. Play areas and walkways usually need special surfacing.

Cu—Condit-Urban land complex. This map unit consists of a nearly level, poorly drained Condit silty clay loam and Urban land on ground moraines. Individual areas of this map unit receive runoff from adjacent, higher lying soils and are subject to ponding. Most areas contain about 50 percent Condit silty clay loam and about 35 percent Urban land. Areas of the Condit soil and Urban land are so intricately mixed or so small in size that mapping them separately is not practical. Slope is 0 to 2 percent.

Typically, the Condit soil has a surface layer of dark grayish brown, friable silty clay loam about 7 inches thick. The subsoil is about 45 inches thick. It is gray and grayish brown, mottled, firm silty clay loam. The substratum to a depth of about 60 inches is brown, mottled, firm silty clay loam. In some places, the soil has been radically altered. Some low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed.

The Urban land part of the unit is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification is not feasible.

Included with this complex in mapping are small areas of the somewhat poorly drained Mahoning soils on slight rises and the very poorly drained Miner soils in the lower parts of depressions. These inclusions make up 15 percent of most areas.

Most areas of this map unit are artificially drained by sewer systems, gutters, subsurface drains, and, to a lesser extent, surface ditches. Condit soils that are not drained have a water table near the surface in winter, in spring, and during extended wet periods. Permeability is slow. Runoff is very slow, or the soil is ponded. The root zone is deep, and available water capacity is moderate. Reaction is very strongly acid to medium acid in the surface layer and upper part of the subsoil and medium acid to mildly alkaline in the lower part. The soil puddles and clods if worked when wet. The shrink-swell potential is moderate.

The Condit soil is used for parks, open space, lawns, gardens, and building sites. It has low potential for building site development, recreation, landscaping, lawns, and most sanitary facilities. It has medium potential for woodland and high potential as habitat for wetland wildlife.

The Condit soil is suited to lawns, flowers, vegetables, trees, and shrubs if it is limed and excess water is removed. It warms slowly and dries late in spring in undrained areas. Perennial plants should be selected for tolerance to wetness and acid conditions. In most areas several methods of artificial drainage can be successfully used; onsite investigation is needed to determine the best method. In some areas artificial drainage is difficult to establish because of the lower position in the landscape. Raised beds can be used to elevate the upper part of the root zone above the seasonal high water table. Soil erosion generally is not a major problem unless the soil is disturbed and left bare and exposed for a considerable period of time or is used as a water course. Spots where included soils have been cut or filled are not well suited to lawns and gardens. Subsoil material that is exposed on the surface has very poor tilth; it is sticky when wet and hard when dry.

The Condit soil is severely limited as a site for buildings, recreational uses, and most sanitary facilities because of ponding, slow permeability and low strength. Areas used for these purposes need artificial drainage. The soil is better suited to dwellings and small buildings without basements than to those with basements. Foundations and footings should be designed to prevent structural damage caused by frost action, low strength, and shrinking and swelling of the soil. The upper layer of the Condit soil needs to be replaced or covered with a suitable base material to minimize maintenance of local roads and streets.

DaA—Darien silt loam, 0 to 2 percent slopes. This deep soil is nearly level and somewhat poorly drained. This soil is in broad areas on till plains. Most areas are irregularly shaped and 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 36 inches thick. The upper part is brown, mottled, friable silt loam and silty clay loam; the lower part is dark yellowish brown, mottled, firm silty clay loam. The substratum to a depth of about 60 inches is dark yellowish brown and yellowish brown, mottled, very firm channery silty clay loam.

Included with this soil in mapping are small areas of the Mahoning soils, which have more clay in the subsoil, and the moderately deep Mitiwanga soils. These soils are on positions in the landscape similar to that of the Darien soil and make up about 15 percent of most areas.

This soil has a perched seasonal high water table near the surface in winter, in spring, and during 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 medium acid or slightly acid in the upper part of the subsoil and slightly acid or neutral in the lower part. The shrink-swell potential is moderate in the subsoil and low in the substratum.

Most areas of this soil were once farmed but are now reverting to natural vegetation or are in recreational use. This soil has low potential for building site development and sanitary facilities. It has high potential for woodland and habitat for woodland wildlife. This soil has medium potential for landscaping and lawns.

If drained, this soil is suited to grasses, legumes, lawns, flowers, vegetables, and shrubs. A combination of surface and subsurface drainage is needed because the slow internal water movement reduces the effectiveness of subsurface drains used alone. Perennial plants should be selected for tolerance to wetness. Planting is delayed in undrained areas. The soil puddles and clods if worked when wet. Tilling or grazing when the soil is soft and sticky causes it to compact, and grazing should be controlled to prevent excessive compaction. Additions of organic matter aid in establishing and maintaining lawns and gardens. Lawns are easily damaged during wet periods. Undrained areas of this soil are suited to woodland; however, the use of planting and harvesting equipment is limited during wet seasons.

This soil is severely limited as a site for buildings, septic tank absorption fields, and sanitary landfills by the seasonal high water table and slow permeability. Ditches and subsurface drains are used to remove excess water. This soil is better suited to houses without basements than to houses with basements because of wetness. Building sites should be landscaped and graded to keep surface water away from foundations. Foundations and footings should be designed to prevent structural damage caused by frost action and the shrinking and swelling of the soil. This soil is well suited to sewage lagoons during the drier part of the year. Because of wetness, extensive drainage is needed for such intensive recreation uses as baseball diamonds and tennis courts, but this soil is well suited to hiking during drier periods.

DkF—Dekalb-Loudonville complex, 25 to 70 percent slopes. This map unit consists of moderately deep soils that are steep and very steep and are well drained. Areas of these soils are in narrow strips on hillsides. Most areas are long and narrow and 4 to 30 acres in size. They contain about 40 percent Dekalb channery sandy loam and 40 percent Loudonville silt loam. Areas of the Dekalb and the Loudonville soils are so intricately mixed or so small in size that mapping them separately is not practical.

Typically, the Dekalb soil has a very dark grayish brown, very friable channery sandy loam surface layer about 2 inches thick. The subsoil is about 17 inches thick. It is yellowish brown, very friable and friable channery sandy loam. The substratum is light yellowish brown, friable very flaggy sandy loam. Fractured sandstone bedrock is at a depth of about 31 inches.

Typically, the Loudonville soil has a dark grayish brown, friable silt loam surface layer about 4 inches thick. The yellowish brown, friable subsoil is about 19 inches thick. It is silt loam in the upper part, silty clay loam in the middle part, and channery silt loam in the lower part. Sandstone bedrock is at a depth of about 23 inches.

Included with these soils in mapping are small areas of rock outcroppings on the upper parts of slopes and narrow strips of the moderately well drained Ellsworth soils on the lower parts. Narrow strips of the Chagrin soils are along drainageways. These inclusions comprise about 20 percent of most areas.

Permeability is rapid in the Dekalb soil and moderate in the Loudonville soil. Both soils have a moderately deep root zone over sandstone bedrock. The available water capacity is very low or low in the Dekalb soil and low in the Loudonville soil. Runoff is very rapid. Reaction of the subsoil is very strongly acid or strongly acid in the Dekalb soil and very strongly acid to medium acid in the Loudonville soil.

Most of the acreage is woodland. These soils have low potential for building site development and sanitary facilities. They have medium to high potential for woodland and habitat for woodland wildlife.

These soils are best suited to woodland and to habitat for wildlife. During dry years, seedlings do not grow well and seedling mortality is a hazard. Trees, shrubs, and ground cover should be selected for tolerance to acid and dry conditions. The small stones in the surface layer and subsoil of the Dekalb soil interfere with planting trees. The hazard of erosion is very severe if vegetative cover is removed.

Construction for recreation and urban uses is very difficult. Trails in recreational areas should be protected against erosion and should cross the slope, if possible. Some areas of parks overlook scenic views (fig. 5).

Du—Dumps. This miscellaneous areas consists mostly of cement, bricks, cinders, home refuse, and other debris of industrial origin. Some areas are sanitary landfills containing mainly home refuse. Most areas are 20 to 200 acres in size. The depth of the fill material ranges from about 10 to 100 feet.

These areas commonly have poor physical characteristics for plant growth. Reaction is quite variable. Erosion of any existing fine soil material is a hazard, unless the area is adequately covered by a suitable soil layer and vegetation is established.

EIB—Ellsworth silt loam, 2 to 6 percent slopes. This deep soil is gently sloping and moderately well

Figure 5.—Some recreational areas of the Dekalb-Loudonville complex, 25 to 70 percent slopes, overlook scenic views.

drained. This soil is on knolls and side slopes at the heads of drainageways on ground moraines and end moraines. Most areas are irregularly shaped and 5 to 65 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 7 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown and brown, mottled, firm silty clay, and the middle and lower parts are dark yellowish brown, mottled, firm and very firm silty clay loam. The substratum to a depth of about 60 inches is olive brown and grayish brown, mottled, very firm silty clay loam. Some areas, mainly in the town of Gates Mills, are more acid in the surface layer and subsoil, contain less clay in the subsoil, and do not have free carbonates within a depth of 60 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Mahoning soils on more nearly flat positions in the landscape. This inclusion makes up about 15 percent of most areas.

A perched seasonal high water table is at a depth of 24 to 36 inches in winter, in spring, and during extended wet periods. Permeability is slow or very slow. Runoff is medium. The root zone is mainly moderately deep to compact glacial till. Available water capacity is moderate. Reaction ranges from very strongly acid to neutral in the surface layer, very strongly acid to medium acid in the upper part of the subsoil, and is neutral or mildly alkaline in the lower part. The shrink-swell potential is moderate.

Most areas of this soil were once farmed but are reverting to natural vegetation or are used for recreation. The soil has high potential for trees, lawns, and landscaping. The potential for building site development, sanitary facilities, and most recreation is medium.

Lawns, flowers, vegetables, trees, and shrubs grow well on this soil. The surface layer crusts after hard rains. Additions of organic matter to this soil aid in establishing and maintaining lawns and gardens. Soil erosion generally is not a problem unless the soil is disturbed and left bare and exposed.

This soil is moderately limited as a site for buildings and sanitary facilities by the seasonal wetness, slow or very slow permeability, and low strength. Because of wetness and low strength, the soil 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 and the shrinking and swelling of the soil. Building sites should be landscaped and graded to keep surface water away from the foundation. Footer drains and coatings on exterior walls of basements are commonly used to help prevent wet basements. Sanitary facilities should be connected to commercial sewers and treatment facilities, if possible. This soil is limited for local roads because of low strength and frost action potential. It can be improved for this use by installing artificial drainage and by replacing the subsoil with a suitable material. This soil is suited to such recreational uses as picnic areas and hiking trails. It is also suitable for pond embankments even though seasonal wetness and compaction limit this use.

EIC—Ellsworth silt loam, 6 to 12 percent slopes. This deep soil is sloping and moderately well drained. This soil is on ridgetops, on uneven shoulder slopes, and along well defined waterways. Most areas range from 5 to 40 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 7 inches thick. The subsoil is about 36 inches thick. The upper part is yellowish brown, firm silty clay loam; the lower part is dark brown and dark yellowish brown, mottled, very firm silty clay loam. The substratum to a depth of about 60 inches is olive brown and grayish brown, mottled, very 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 are small areas of the Mahoning soils along drainageways. This inclusion makes up about 10 percent of most areas.

The perched seasonal high water table is at a depth of 24 to 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. Available water capacity is moderate. The soil is droughty during extended dry periods because of water lost as runoff. Reaction ranges from very strongly acid to neutral in the surface layer, very strongly acid to medium acid in the upper part of the subsoil, and neutral or mildly alkaline in the lower part of the subsoil. The shrink-swell potential is moderate.

Most areas of this soil were once farmed but are reverting to natural vegetation or are used for recreation. The potential is medium for building site development and recreation. This soil has low or medium potential for sanitary facilities and high potential for woodland.

This soil is suitable for lawns, flowers, trees, and shrubs. Soil erosion is a hazard if this soil is disturbed and left bare and exposed. The surface layer crusts after hard rains. The addition of organic matter to this soil aids in establishing and maintaining lawns and gardens and reducing crusting and the risk of erosion.

This soil is limited as a site for buildings and sanitary facilities by slope, slow and very slow permeability, low strength, and seasonal wetness. It is suited to these uses if proper design and installation procedures are used. Because of wetness and low strength, it is better suited to houses without basements than to houses with basements. Footer drains and coatings on exterior walls of basements help keep basements dry. The soil is limited for local roads because of low strength and potential frost action, but it can be improved for this use by installing artificial drainage and replacing the surface layer and subsoil with a suitable base material. This soil is suitable for pond embankments even though seasonal wetness and compaction limit this use.

EID—Ellsworth silt loam, 12 to 18 percent slopes. This deep soil is moderately steep and moderately well drained. The soil is on convex ridgetops and along well defined drainageways. Most areas are long and narrow and range from 3 to 30 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 4 inches thick. The subsoil is about 36 inches thick. The upper part is yellowish brown, firm silty clay loam, and the lower part is dark brown and dark yellowish brown, mottled, very firm silty clay loam. The substratum to a depth of about 60 inches is olive brown and grayish brown, mottled, very firm silty clay loam. In some small areas the soil is eroded and has a yellowish brown silty clay loam or gravelly silt loam surface layer.

Included with this soil in mapping are narrow strips of the Brecksville soils near the base of slopes. This inclusion is about 10 percent of most areas.

The perched seasonal high water table is at a depth of 24 to 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. Available water capacity is moderate. Reaction ranges from very strongly acid to neutral in the surface layer, very strongly acid to medium acid in the upper part of the subsoil, and neutral or mildly alkaline in the lower part of the subsoil. The shrink-swell potential is moderate.

Most areas of this soil are woodland. This soil has low potential for sanitary facilities, building site development, and most recreation. It has high potential for woodland and habitat for woodland wildlife.

The moderately steep slope and erosion hazard limit the use of this soil for lawns, flowers, and vegetables. Vines, ground cover, and shrubs may be used in place of lawns as a vegetative cover. This soil is well suited to woodland, but the slope moderately limits the use of equipment. Logging roads and skid trails should be protected against erosion and should cross the slope, if possible.

This soil is severely limited as a site for buildings and sanitary facilities by slope, slow or very slow permeability, low strength, and seasonal wetness. If proper design and installation procedures are used, the limitation of slope can be partially overcome. 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.

EIF—Ellsworth silt loam, 25 to 70 percent slopes. This deep soil is steep and very steep and moderately well drained. This soil is on side slopes along drainageways. Most areas are long and narrow and range from 10 to 50 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 2 inches thick. The subsurface layer is yellowish brown, friable silt loam about 5 inches thick. The subsoil is about 27 inches thick. It is dark yellowish brown, firm silty clay loam that is mottled in the lower part. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm silty clay loam.

Included with this soil in mapping are narrow strips of the Brecksville soils on the lower parts of slopes. Also included are narrow strips of the Ellsworth soil that has slopes of 18 to 25 percent. These inclusions make up about 15 percent of most areas.

The perched seasonal high water table is at a depth of 24 to 36 inches during wet periods. Permeability is slow or very slow, and runoff is very rapid. The root zone is mainly moderately deep to compact glacial till, and the available water capacity is moderate. Reaction ranges from very strongly acid to neutral in the surface layer, very strongly acid to medium acid in the upper part of the subsoil, and neutral or mildly alkaline in the lower part.

Most areas are woodland. This soil has low potential for sanitary facilities, building site development, and most recreation. It has high potential for woodland and habitat for woodland wildlife.

This soil is suited to trees. Erosion is a serious hazard if adequate vegetative cover is not maintained. The slope severely limits the use of planting and harvesting equipment.

Construction for recreation and urban uses is very difficult, and the hazard of erosion is very severe when vegetation is removed. Most slopes are unstable and subject to slippage. Trails in recreation areas should be protected against erosion and should cross the slope, if possible.

EsC—Ellsworth-Urban land complex, rolling. This map unit consists of Urban land and a deep, moderately well drained Ellsworth soil. Areas of this map unit are on knolls, on ridgetops, and on side slopes that are at the heads of drainageways. Areas generally are 30 to 200 acres in size. They are about 55 percent Ellsworth silt loam and 30 percent Urban land. Areas of Ellsworth soil and the Urban land are so intricately mixed or are so small that mapping them separately is not practical. Slopes range from 6 to 18 percent.

Typically, the Ellsworth soil has a dark brown, friable silt loam surface layer about 7 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown, firm silty clay loam, and the lower part is dark brown and dark yellowish brown, mottled, very firm silty clay loam. The substratum to a depth of about 60 inches is olive brown and grayish brown, mottled, firm silty clay loam. In places, the soil has been radically altered. Some small areas have been cut, built up, or smoothed.

The Urban part of the unit is covered with streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification is not feasible.

Included with this complex in mapping are areas of the Rittman soils that have a fragipan and small areas of the somewhat poorly drained Mahoning soils. The Rittman and the Ellsworth soils are on similar parts of the landscape, and the Mahoning soils are in the flat areas. Also included are narrow strips of the somewhat poorly drained Orrville soils on narrow flood plains. These inclusions make up about 15 percent of most areas.

The perched seasonal high water table in the Ellsworth soil is at a depth of 24 to 36 inches in winter and in spring. Permeability is slow or very slow. Runoff is rapid or very rapid. The root zone is mainly moderately deep to compact glacial till. Available water capacity is moderate. Reaction ranges from very strongly acid to neutral in the surface layer, very strongly acid to medium acid in the upper part of the subsoil, and neutral or mildly alkaline in the lower part. The shrink-swell potential is moderate.

The Ellsworth soil is used for parks, open space, building sites, lawns, and gardens. It has high potential for lawns, vegetable and flower gardens, trees, and shrubs. It has medium potential for building site development and recreation. The potential is low or medium for sanitary facilities.

The Ellsworth soil is well suited to grasses, flowers, vegetables, trees, and shrubs. Erosion is a hazard if the soil is disturbed or the surface is bare. The surface layer crusts after hard rains. Regular additions of organic material increase the rate of water infiltration and reduce crusting and the risk of erosion. The spots of cut and fill are not well suited to lawns and gardens. Tilth is poor in exposed subsoil material, which is sticky when wet and hard when dry.

The Ellsworth soil is suited as a site for buildings, especially those without basements, if proper design and installation procedures are used. It is limited mainly by slope, slow or very slow permeability, low strength, and seasonal wetness. Maintaining as much plant cover as possible during construction reduces the risk of erosion. Foundations and footings of dwellings and small buildings should be designed to prevent the structural damage caused by the low strength and the moderate shrinking and swelling. Footer drains and exterior coatings of basement walls help keep basements dry. The soil is limited for local roads because of wetness and low strength, but it can be improved for this use by installing artificial drainage and by replacing the subsoil with a suitable base material. The Ellsworth soil is suitable for pond embankments even though seasonal wetness and compaction limit this use.

EuA—Euclid silt loam. This deep soil is nearly level and somewhat poorly drained. This soil is on broad, low stream terraces. It is subject to rare flooding. Slope is 0 to 2 percent. Most areas are long and broad or narrow and range from 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 31 inches thick. The upper part is yellowish brown, mottled, friable silt loam; the middle and lower parts are strong brown and yellowish brown, mottled, friable and 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 the well drained Tioga Variant on slight rises. This inclusion makes up about 15 percent of most areas.

The seasonal high water table is at a depth of 12 to 30 inches in winter, in spring, and during extended wet periods. Permeability is moderately slow, and runoff is slow. The root zone is deep, and available water capacity is high. The surface layer crusts after heavy rains. The surface layer and subsoil are very strongly acid to medium acid.

Most areas were once farmed but are presently used as parks or golf courses or are reverting to natural vegetation (fig. 6). This soil has high potential for lawns, landscaping, trees, hay, and pasture. It has low potential for building site development and sanitary facilities. The potential for recreation is medium.

This soil is suited to grasses, flowers, vegetables, shrubs, hay, and pasture if excess water is removed. Planting is delayed in undrained areas. Perennial plants should be selected for tolerance to wetness. Surface drains are used in some areas. Subsurface drains are commonly used to remove excess water from the root zone. Additions of organic matter aid in establishing and maintaining lawns, gardens, and seedings for hay and pasture. Lawns are easily damaged when the soil is wet. Undrained areas of this soil are suited to woodland; however, the use of planting and harvesting equipment is limited during wet seasons.

This soil is better suited as a site for recreation, such as golf fairways and paths and trails, than to most other community development. It is severely limited as a site for buildings and sanitary facilities by seasonal wetness, flooding, and moderately slow permeability. Drainage can be improved with subsurface drains, storm sewers, and open ditches. The soil is limited for local roads because of wetness and low strength, but it can be improved for this use by installing artificial drainage and by replacing the subsoil with a suitable base material. The soil is limited for excavation during winter and spring because of wetness. Sanitary facilities should be connected to central sewer and treatment facilities, if possible. Drainage is needed for intensive recreational uses, such as ball diamonds and tennis courts.

FcA—Fitchville silt loam, 0 to 2 percent slopes. This deep soil is nearly level and somewhat poorly drained. This soil is on terraces and in basins of former glacial lakes. Most areas are irregularly shaped and 5 to 40 acres in size.

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

Included with this soil in mapping are small areas of the moderately well drained Glenford soils on slight rises and the poorly drained Sebring soils in shallow depres-

Figure 6.—Tioga Variant and Euclid soils are used for recreation in Cuyahoga County. Tioga Variant loam is in the foreground, and the Euclid silt loam is in a slightly lower position in the background.

sions and along drainageways. These inclusions comprise about 15 percent of most areas.

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

Most of the acreage was once farmed but is reverting to natural vegetation or is in recreational use. This soil has high potential for lawns, landscaping, trees, hay, and pasture. It has low potential for building site development and sanitary facilities. The potential for recreation uses is medium.

This soil is suited to grasses, flowers, vegetables, trees, shrubs, hay, and pasture, if excess water is removed. Planting is delayed in undrained areas. Perennial plants should be selected for tolerance to wetness. Subsurface drains are commonly used to remove excess water from the root zone. Surface drains are used in some areas. The addition of organic matter aids in establishing and maintaining lawns, gardens, and seedings for hay or pasture. Lawns are easily damaged when the soil is wet. Undrained areas of this soil are suited to woodland; however, the use of planting and harvesting equipment is limited during wet seasons.

This soil is severely limited as a site for buildings and sanitary facilities and moderately limited for most recreation by seasonal wetness, moderately slow permeability, and low strength. Drainage can be improved with subsurface drains, storm sewers, and open ditches. Buildings should be located on the higher parts of the landscape. Building sites should be landscaped and graded to keep surface water away from foundations. Because of wetness and low strength, the soil is limited for local roads but can be improved for this use by installing artificial drainage and by replacing the subsoil with a suitable base material. Excavations are limited during winter and spring because of wetness. Sanitary facilities should be connected to central sewer and treatment facilities, if possible. Because of wetness, play areas and walkways need drainage and, in some cases, special surfacing.

FcB—Fitchville silt loam, 2 to 6 percent slopes. This deep soil is gently sloping and somewhat poorly drained. This soil is on slightly convex knolls in basins of former glacial lakes and on terraces. Most areas are irregularly shaped and 5 to 40 acres in size.

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

Included with this soil in mapping are small areas of the moderately well drained Glenford soils on higher, convex parts of the landscape and the poorly drained Sebring soils in shallow depressions and drainageways. These inclusions make up about 15 percent of most areas.

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

Most of the acreage was once farmed but is reverting to natural vegetation or is in recreation use. This soil has high potential for lawns, landscaping, trees, hay, and pasture. It has low potential for building site development and sanitary facilities. The potential for recreation is medium.

This soil is suited to grasses, flowers, vegetables, trees, shrubs, hay, and pasture, if excess water is removed. Planting is delayed in undrained areas. Perennial plants should be selected for tolerance to wetness. Subsurface drains are commonly used to remove excess water from the subsoil. Erosion is a hazard when the soil is disturbed and not reseeded or mulched. Additions of organic matter to this soil aid in establishing and maintaining lawns, gardens, and seedings for hay or pasture. Lawns are easily damaged when the soil is wet. Undrained areas of this soil are suited to woodland; however, the use of planting and harvesting equipment is limited during wet seasons.

This soil is severely limited as a site for buildings and sanitary facilities and moderately limited for most recreation by the seasonal wetness, moderately slow permeability, and low strength. Drainage can be improved with subsurface drains, storm sewers, and open ditches. Even though the slope provides some surface drainage, building sites should be landscaped and graded to keep surface water away from foundations. Cover should be maintained on the site as much as possible during construction to reduce soil loss by erosion. Excavating is limited during winter and spring because of wetness. Because of wetness and low strength, this soil is limited for local roads, but it can be improved for this use by installing artificial drainage and by replacing the subsoil with a suitable base material. Sanitary facilities should be connected to central sewer and treatment facilities, if possible. Because of wetness, play areas and walkways need drainage and, in some cases, special surfacing.

GeF—Geeburg-Mentor silt loams, 25 to 70 percent slopes. This map unit consists of a moderately well drained Geeburg soil and a well drained Mentor soil. These soils are on dissected parts of terraces. Seeps are common on the lower parts of slopes, and there is hillside slippage in most areas. These deep, steep and very steep soils are mainly in long and narrow areas that range from 50 to 150 acres in size. Individual areas are about 50 percent Geeburg silt loam and 35 percent Mentor silt loam. Areas of the Geeburg soil and the Mentor soil are so intricately mixed or are so small in size that mapping them separately is not practical.

Typically, the Geeburg soil has a surface layer of dark grayish brown, friable silt loam about 1 inch thick. The subsurface layer is brown and yellowish brown, friable silt loam about 4 inches thick. The subsoil is about 24 inches thick. The upper part is yellowish brown, friable silt loam; the middle part is dark yellowish brown, mottled, firm silty clay loam; and the lower part is dark brown, mottled, firm silty clay. The substratum to a depth of about 60 inches is dark brown and grayish brown, mottled, firm silty clay.

Typically, the Mentor soil has a surface layer of very dark grayish brown, friable silt loam about 4 inches thick. The subsurface layer is brown, friable silt loam about 3 inches thick. The subsoil is about 29 inches thick. It is dark yellowish brown and yellowish brown, friable and firm silt loam and silty clay loam. It is mottled in the lower 3 inches. The substratum to a depth of about 60 inches is yellowish brown and dark yellowish brown, mottled, friable and firm silt loam.

Included with these soils in mapping are narrow strips of the well drained Oshtemo soils that formed in stratified loamy and sandy material. Also included are areas of the Ellsworth soils that formed in glacial till and are on the upper parts of slopes and narrow strips of the Chagrin soils along drainageways. These inclusions comprise about 15 percent of most areas.

Permeability is very slow in the Geeburg soil and moderate in the Mentor soil. Runoff is very rapid. A seasonal high water table is at a depth of 24 and 42 inches in the Geeburg soil and at a depth of 48 to 72 inches in the Mentor soil. The Geeburg soil mainly has a moderately deep root zone over compact clayey materials and has a moderate available water capacity. The Mentor soil has a deep root zone and a high available water capacity. The Geeburg soil is strongly acid or very strongly acid in the upper part of the subsoil and medium acid to neutral in the lower part. The Mentor soil is very strongly acid to medium acid in the upper part of the subsoil and strongly acid to slightly acid in the lower part.

Most of the acreage is woodland. These soils have low potential for most uses other than woodland, habitat for woodland wildlife, and some recreational uses.

These soils are too steep for lawns and gardens. The hazard of erosion is very severe if the plant cover is removed. These soils are suited to trees and habitat for woodland wildlife. Most areas support native hardwoods. The slope severely limits the use of planting and logging equipment. Logging roads and skid trails should be protected against erosion.

Construction for recreational and urban uses is very difficult, and the hazard of erosion is very severe when vegetation is removed. Most slopes are unstable and subject to slippage because of lateral movement of water through the soils (fig. 7). These soils have potential for scenic recreational uses. Trails in recreational areas should be protected against erosion. They should cross the slope, if possible. Deep cuts across the slope are difficult to stabilize.

GfB—Glenford silt loam, 2 to 6 percent slopes. This deep soil is gently sloping and moderately well drained. It is on convex parts of knolls on lake plains and terraces. Most areas are long and narrow or irregularly shaped and are 5 to 25 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 3 inches thick. The subsurface layer is light yellowish brown, friable silt loam about 4 inches thick. The subsoil is about 38 inches thick. The upper part is yellowish brown, friable silt loam; the lower part is dark yellowish brown, firm silty clay loam that is mottled between 26 and 33 inches. The substratum to a depth of about 60 inches is yellowish brown and brown, firm silty clay loam. In some areas thin strata of fine sandy loam are in the substratum.

Included with this soil in mapping are small areas of the somewhat poorly drained Fitchville soils in shallow depressions and along drainageways. Also included are narrow strips of the well drained Mentor soils on convex slopes along drainageways. These inclusions comprise about 15 percent of most areas.

The perched seasonal high water table is at a depth of 24 to 36 inches in winter, in spring, and during extended wet periods. Permeability is moderately slow, and runoff is medium. The root zone is mainly deep, and the available water capacity is high. Reaction is very strongly acid to medium acid in the surface layer and upper part of the subsoil and medium acid to neutral in the lower part of the subsoil. The surface layer is easily tilled through a fairly wide range in moisture content.

Most areas are reverting to natural vegetation. A few areas are being used for sweet corn. This soil has high potential for lawns, landscaping, gardens, hay, pasture, sweet corn, and woodland. It has medium potential for sanitary facilities and building site development. The potential for recreation is medium or high.

This soil is well suited to lawns, flowers, vegetables, trees, shrubs, hay, and pasture. It crusts after heavy rains and is subject to erosion, especially in cultivated areas where slopes are 4 to 6 percent. Using minimum tillage, crop residue, and cover crops reduces erosion. Additions of organic matter aid in establishing and maintaining lawns and gardens. Surface compaction, poor tilth, and increased runoff result from overgrazing or grazing when the soil is soft and sticky as a result of wetness. Plant competition for tree seedlings can be reduced by spraying, mowing, or disking.

This soil is limited as a site for sanitary facilities, building site development, and recreation by seasonal wetness, moderately slow permeability, and moderate 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 caused by the frost action. Foundation drains and protective coatings on exterior walls help prevent wet basements. The soil can be improved for local roads by installing artificial drainage and by replacing the surface layer and subsoil with a suitable base material to reduce the risk of damage caused by frost action and low strength. The moderately slow permeability that limits the effectiveness of septic tank absorption fields can be partially overcome by increasing the size of the absorption area. This soil is well suited to paths and trails.

GfC—Glenford silt loam, 6 to 12 percent slopes. This deep soil is sloping and moderately well drained. This soil is on side slopes along drainageways. Most areas are long and narrow and range from 5 to 25 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 38 inches thick. The upper part is yellowish brown, friable silt loam; the lower part is dark yellowish brown, mottled, firm silty clay loam. The substratum to a depth

Figure 7.—Hillside slippage on Geeburg-Mentor silt loams, 25 to 70 percent slopes.

of about 60 inches is yellowish brown and brown, mottled, firm silty clay loam. In some areas the surface layer is yellowish brown silt loam where the upper part of the subsoil has been mixed with the surface layer by plowing. In some areas, thin strata of fine sandy loam are in the substratum.

Included with this soil in mapping are small areas of the well drained Mentor soils on convex slopes along drainageways. These included soils make up about 15 percent of most areas.

The perched seasonal high water table is at a depth of 24 to 36 inches in winter, in spring, and during extended wet periods. Permeability is moderately slow, and runoff is rapid. The root zone is mainly deep, and available water capacity is high. Reaction is very strongly acid to medium acid in the surface layer and upper part of the subsoil and medium acid to neutral in the lower part of the subsoil. The surface layer is easily tilled through a fairly wide range in moisture content.

Most areas are reverting to natural vegetation. This soil has high potential for trees, shrubs, hay, pasture, and as habitat for openland and woodland wildlife. It has medium or low potential for sanitary facilities and building site development. The potential for recreation is medium.

This soil is suited to trees, shrubs, hay, and pasture. In areas used for hay or pasture, an adequate plant cover must be maintained to control erosion. This soil is subject to surface crusting after hard rains. The slope limits the use of the soil for lawns and gardens. Additions of organic matter and fertilizer aid in the establishment and maintenance of lawns, gardens, and seedlings for hay and pasture. Reseeding can be done with a companion crop or by the no-till seeding method. Surface compaction, poor tilth, and increased runoff result from overgrazing or grazing when the soil is soft and sticky as a result of wetness. Plant competition can be reduced for tree seedings by spraying, mowing, or disking.

This soil is limited as a site for buildings, sanitary facilities, and recreation by slope, seasonal wetness, and moderately slow permeability. It is better suited to houses without basements than to houses with basements. Cover should be maintained on the site as much as possible during construction to reduce soil loss by erosion. Foundation drains and protective coatings on exterior walls help prevent wet basements. The distribution lines in septic tank absorption fields should cross the slope to reduce seepage of unfiltered effluent. The moderately slow permeability that limits the effectiveness of septic tank absorption fields can be partly overcome by increasing the size of the absorption area. The soil can be improved for local roads and streets by installing artificial drainage and by replacing the surface layer and subsoil with a suitable base material to reduce the risk of damage caused by frost action and low strength.

HaA—Haskins loam, 0 to 2 percent slopes. This deep soil is nearly level and somewhat poorly drained. This soil is on terraces and beach ridges. Most areas are irregularly shaped and 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 9 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown and dark yellowish brown, mottled, friable and firm sandy clay loam; the lower part is dark yellowish brown and yellowish brown, firm silty clay loam and gravelly clay loam that is mottled between 27 and 33 inches. The substratum to a depth of about 60 inches is dark yellowish brown, mottled, firm silty clay loam.

Included with this soil in mapping are small areas of the very poorly drained Mermill soils in drainageways. Also included are small areas of the Mahoning soils that formed in glacial till and the Jimtown soils that formed in glacial outwash. These inclusions comprise about 15 percent of most areas.

The seasonal high water table is at a depth of 12 to 30 inches in winter, in spring, and during extended wet periods. Permeability is moderate in the upper and middle parts of the subsoil and is slow or very slow in the lower part 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.

Most areas were once farmed but are reverting to natural vegetation. This soil has high potential for trees, hay, and pasture. It has low potential for building site development and sanitary facilities. The potential for most recreational uses and for lawns and landscaping is medium.

If drained, this soil is suited to lawns, gardens, shrubs, grasses, and legumes. Planting is delayed in undrained areas. Surface drains remove excess surface water. Subsurface drains are commonly used to lower the perched water table. These drains are more effective if placed on or above the slowly permeable or very slowly permeable glacial till or lacustrine material. Perennial plants should be selected for tolerance to wetness. Additions of organic matter to this soil aid in establishing and maintaining lawns, gardens, and seedings for hay and pasture. Grazing should be controlled, especially when the soil is soft and sticky to prevent excessive compaction. Undrained areas of this soil are suited to woodland; however, the use of planting and harvesting equipment is limited during wet seasons.

This soil is severely limited as a site for buildings and most sanitary facilities by high shrink-swell potential in the lower part of the subsoil and in the substratum, a seasonal high water table, slow or very slow permeability, and low strength. Drainage ditches, storm sewers, and subsurface drains improve drainage. Building sites should be landscaped and graded to keep surface water away from foundations. Foundation drains and protective coatings on exterior walls help prevent wet basements. Foundations and footings should be designed to prevent structural damage caused by frost action and by the shrinking and swelling of the lower part of the subsoil and the substratum. This soil is well suited to sewage lagoons; however, sanitary facilities should be connected to central sewers and treatment facilities, if possible. This soil is limited for local roads and tennis courts because of wetness and low strength, but it can be improved for these uses by installing artificial drainage and by replacing the surface layer and subsoil with a suitable base material.

HaB—Haskins loam, 2 to 6 percent slopes. This deep soil is gently sloping and somewhat poorly drained. This soil is on terraces and beach ridges. Most areas are irregularly shaped and 5 to 40 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 9 inches thick. The subsoil is about 33 inches thick. The upper and middle parts are yellowish brown and dark yellowish brown, mottled, friable and firm sandy clay loam and gravelly clay loam; the lower part is dark yellowish brown, mottled, firm silty clay loam. The substratum to a depth of about 60 inches is dark yellowish brown, mottled, firm silty clay loam.

Included with this soil in mapping are small areas of the Mahoning soils that formed in glacial till and the

Jimtown soils that formed in glacial outwash. These inclusions make up about 15 percent of most areas.

The perched seasonal high water table is at a depth of 12 to 30 inches in winter, in spring, and during extended wet periods. Permeability is moderate in the upper and middle parts of the subsoil and slow or very slow in the lower part 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. 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. The surface layer is easily tilled through a fairly wide range in moisture content.

Most areas were once farmed but are reverting to natural vegetation. This soil has high potential for hay, pasture, and trees. It has low potential for building site development and sanitary facilities. The potential for most recreation and for lawns and landscaping is medium.

If drained, this soil is suited to grasses, legumes, lawns, gardens, and shrubs, but planting is delayed in undrained areas. If this soil is cultivated, erosion is a hazard on long slopes. Subsurface drains are commonly used to lower the perched water table. These drains are more effective if placed on or above the slowly permeable or very slowly permeable glacial till or lacustrine material. Perennial plants should be selected for tolerance to wetness. Additions of organic matter to this soil aid in establishing and maintaining lawns, gardens, and seedings for hay and pasture. Grazing should be controlled, especially when the soil is soft and sticky, to prevent excessive compaction. Undrained areas of this soil are suited to woodland; however, the use of planting and harvesting equipment is limited during wet seasons.

This soil is severely limited as a site for buildings and most sanitary facilities by high shrink-swell potential in the lower part of the subsoil and in the substratum, a seasonal high water table, slow or very slow permeability, and low strength. Drainage ditches, storm sewers, and subsurface drains help remove excess water. Foundation drains and protective coatings on exterior walls help prevent wet basements. Foundations and footings should be designed to prevent structural damage caused by frost action and by the shrinking and swelling of the lower part of the subsoil and the substratum. This soil is well suited to sewage lagoons, but sanitary facilities should be connected to central sewers and treatment facilities, if possible. Because of wetness and low strength, this soil is limited for roads and tennis courts, but it can be improved for these uses by installing artificial drainage and by replacing the surface layer and subsoil with a suitable base material.

HbA—Haskins-Urban land complex, nearly level. This map unit consists of a deep Haskins soil that is nearly level and somewhat poorly drained and Urban land. Individual areas of this map unit are on terraces and beach ridges. They contain about 50 percent Haskins loam and 35 percent Urban land. Areas of the Haskins soil and the Urban land are so intricately mixed or so small in size that mapping them separately is not practical. Slope is 0 to 2 percent.

Typically, the Haskins soil has a surface layer of dark grayish brown, friable loam about 9 inches thick. The subsoil is about 33 inches thick. The upper and middle parts are yellowish brown and dark yellowish brown, mottled, friable and firm sandy clay loam and gravelly clay loam; the lower part is dark yellowish brown, mottled, firm silty clay loam. The substratum to a depth of about 60 inches is dark yellowish brown, mottled, firm silty clay loam. In places, the soil has been radically altered. Some low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed.

The Urban land part of the unit is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification is not feasible.

Included with this complex in mapping are small areas of the very poorly drained Mermill soils in drainageways. Also included are the Jimtown soils that formed in glacial outwash and the Mahoning soils that formed in glacial till. The Mahoning and Haskins soils are in similar positions on the landscape. These inclusions comprise about 15 percent of most areas.

Most areas are artificially drained by sewer systems, gutters, subsurface drains, and, to a lesser extent, surface ditches. Areas of the Haskins soil that are not drained have a perched seasonal high water table at a depth of 12 to 30 inches in winter, in spring, and during extended wet periods. Permeability is moderate in the upper and middle parts of the subsoil and slow or very slow in the lower part 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.

The Haskins soil is used for parks, open space, building sites, lawns, and gardens. It has medium potential for lawns, landscaping, and recreation. This soil has high potential for trees. The potential for building site development and sanitary facilities is low.

Lawns, flowers, vegetables, and shrubs grow well on the Haskins soil when it is drained. Planting is delayed in undrained areas. Drainage is more effective if subsurface drains are placed on or above the slowly permeable or very slowly permeable glacial till or lacustrine material. Perennial plants should be selected for tolerance to wetness. Additions of organic matter aid in establishing and maintaining lawns and gardens, increasing the rate of water infiltration, and in reducing crusting and the risk of erosion. The spots of cut and fill are not well suited to lawns and gardens. Tilth is poor in exposed subsoil material, which is sticky when wet and hard when dry.

This soil is severely limited for buildings and most sanitary facilities by high shrink-swell potential in the lower part of the subsoil and in the substratum, a seasonal high water table, slow or very slow permeability, and low strength. Drainage ditches, storm sewers, and subsurface drains help remove excess water. Foundation drains and protective coatings on exterior walls help prevent wet basements. Building sites should be landscaped and graded to keep surface water from foundations. Foundations and footings should be designed to prevent structural damage caused by frost action and by shrinking and swelling of the lower part of the subsoil and the substratum. Most sanitary facilities are connected to central sewer and treatment facilities. Because of wetness and low strength, this soil is limited for local roads and tennis courts, but it can be improved for these uses by installing artificial drainage and by replacing the surface layer and subsoil with a suitable base material.

Ho—Holly silt loam, frequently flooded. This deep soil is nearly level and poorly drained. This soil is on flood plains. Slope is 0 to 2 percent. The soil is frequently flooded for brief periods in fall, winter, and spring. Most areas are long and narrow and range from 5 to 30 acres in size.

Typically, the surface layer is dark grayish brown, mottled, friable silt loam about 8 inches thick. The subsoil is about 24 inches thick. It is gray and dark gray, mottled, friable silt loam and silty clay loam. The substratum to a depth of about 60 inches is grayish brown, mottled, friable clay loam and gravelly loam. In a few areas, bedrock is at a depth of 40 to 60 inches. These areas have flat stone fragments in the subsoil and substratum.

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

The seasonal high water table is near the surface in winter, in spring, and during extended wet periods. Permeability is moderate or moderately slow. Runoff is very slow, or the soil is ponded. The root zone is deep, and the available water capacity is high. Reaction is medium acid or slightly acid in the subsoil. The shrink-swell potential is low.

Most areas are in wetland vegetation or are woodland. This soil has low potential for lawns, landscaping, sanitary facilities, building site development, and recreation. It has high potential for woodland and habitat for wetland wildlife. This soil has potential for hay and pasture, if drained.

Flooding and wetness limit the use of this soil for lawns, flowers, vegetables, hay, pasture, and shrubs. Surface drains are commonly used to remove ponded water. Subsurface drains are used in areas where outlets are available. Perennial plants should be selected for tolerance to wetness. This soil is poorly suited to grazing early in spring. Overgrazing or grazing when the soil is soft and sticky as a result of wetness causes compaction and poor tilth.

This soil is suited to trees that are adapted to wet sites and is well suited to habitat for wetland wildlife. Planting is limited to the drier part of the year.

This soil is poorly suited as a site for buildings, sanitary facilities, and recreation because of frequent flooding, wetness, and moderate permeability or moderately slow permeability. This soil is also limited for sewage lagoons and sanitary landfills by the possible pollution of ground water. Installing dikes to control flooding is difficult. Because of flooding, wetness, and frost action, this soil is limited for local roads. These limitations can be partly overcome by installing artificial drainage and raising the area above flood levels with fill and by replacing the soil with a suitable base material from outside the area.

HrB—Hornell silt loam, 2 to 6 percent slopes. This moderately deep soil is gently sloping and somewhat poorly drained. This soil is on uplands. Most areas are long and narrow or irregularly shaped and 20 and 150 acres in size.

Typically, the surface layer is dark grayish brown and brown, friable silt loam about 6 inches thick. It is mottled in the lower part. The subsoil is about 20 inches thick. The upper part is yellowish brown, mottled, firm silty clay loam, and the middle and lower parts are yellowish brown and grayish brown, mottled, firm shaly silty clay loam and shaly silty clay. The substratum to a depth of about 34 inches is grayish brown, firm shaly silty clay loam. Under this is grayish brown, rippable, shale bedrock.

Included with this soil in mapping are small areas of the poorly drained Allis soils in flat positions of the landscape and the well drained Brecksville soils on the crests of rises. These inclusions make up about 15 percent of most areas.

A perched seasonal high water table is at a depth of 12 to 30 inches in winter, in spring, and during extended wet periods. Permeability is slow or very slow. Runoff is medium. The root zone is mainly moderately deep to shale bedrock. The available water capacity is low. The shrink-swell potential in the subsoil is moderate. Reaction is strongly acid to extremely acid in the surface layer and very strongly acid or strongly acid in the subsoil.

Most areas are woodland. This soil has medium potential for lawns and landscaping and high potential for woodland, hay, pasture, and habitat for woodland wildlife. The potential for sanitary facilities and building site development is low. This soil has medium or low potential for recreation.

If drained this soil is suited to trees, lawns, flowers, vegetables, hay, and pasture. Planting is delayed in undrained areas. Perennial plants should be selected for tolerance to wetness and acid conditions. Subsurface drains are commonly used to help remove excess water. The soil puddles and clods if worked when soft and sticky because of wetness. Applications of lime, fertilizer, and organic matter aid in establishing and maintaining seedings, increasing the rate of water infiltration, and in reducing crusting. Plant competition for tree seedlings can be reduced by spraying, mowing, or disking.

This soil is severely limited as a site for buildings and sanitary facilities by wetness, slow or very slow permeability, and shale bedrock at a depth of 20 to 40 inches. Erosion is a hazard if the soil is disturbed and left unprotected. The soil is better suited to houses without basements than to houses with basements. Storm sewers and surface and subsurface drains are commonly used to help remove excess water. Footer drains and coatings on exterior basement walls help keep basements dry. Foundations and footings should be designed to prevent structural damage caused by the shrinking and swelling of the soil. Because of wetness and low strength, this soil is limited for local roads and streets. It can be improved for this use by installing artificial drainage and by replacing the surface layer and subsoil with a suitable base material. This soil is suited to such recreational uses as picnic areas and paths and trails during the drier part of the year.

HrC—Hornell silt loam, 6 to 12 percent slopes. This moderately deep soil is sloping and somewhat poorly drained. This soil is on ridgetops, uneven side slopes that are above steeper slopes, and along well defined drainageways. Most areas are long and narrow or irregularly shaped and 20 to 100 acres in size.

Typically, the surface layer is dark brown and brown, friable silt loam about 6 inches thick. The subsoil is about 20 inches thick. It is yellowish brown and grayish brown, mottled, firm silty clay loam and shaly silty clay. The substratum, to a depth of about 34 inches, is grayish brown, firm shaly silty clay loam. Below this is grayish brown, rippable, shale bedrock.

Included with this soil in mapping are small areas of the well drained, more sloping Brecksville soils on the upper parts of slopes. This inclusion makes up about 15 percent of most areas.

A perched seasonal high water table is at a depth of 12 to 30 inches in winter, in spring, and during extended wet periods. Permeability is slow or very slow. Runoff is rapid. The root zone is mainly moderately deep to shale bedrock. The available water capacity is low. The shrink-swell potential in the subsoil is moderate. Reaction is strongly acid or very strongly acid in the subsoil.

Most areas are woodland. This soil has medium potential for gardens, lawns, and shrubs and high potential for woodland, hay, pasture, and habitat for woodland wildlife. It has low potential for sanitary facilities and building site development and medium or low potential for recreation.

The main concerns are seasonal wetness, slope, and erosion hazard when the soil is used for cultivated crops, flowers, and vegetables. Undrained areas are suited to hay, pasture, trees, and shrubs. Drained areas are suited to lawns, flowers, and vegetables. The soil puddles and clods if worked when soft and sticky. Perennial plants should be selected for tolerance to wetness and acid conditions. Applications of lime, fertilizer, and organic matter aid in establishing and maintaining seedings, increasing the rate of water infiltration, and in reducing crusting. Plant competition for tree seedlings can be reduced by spraying, mowing, or disking.

This soil is severely limited as a site for buildings and sanitary facilities by wetness, slopes, slow or very slow permeability, and shale bedrock at a depth of 20 to 40 inches. Cover should be maintained on the site as much as possible during construction to reduce soil loss by erosion. This soil is better suited to houses without basements than to houses with basements. Storm sewers and surface drains are commonly used to improve drainage. Footer drains and coatings on exterior basement walls help keep basements dry. Foundations and footings should be designed to prevent structural damage caused by the shrinking and swelling of the soil. Because of wetness and low strength, this soil is limited for local roads and streets, but it can be improved for this use by installing artificial drainage and by replacing the surface layer and subsoil with a suitable base material. Trails in recreational areas should be protected against erosion and should cross the slope, if possible.

HrD—Hornell silt loam, 12 to 18 percent slopes. This moderately deep soil is somewhat poorly drained and moderately steep. This soil is on convex ridgetops and along well defined drainageways. Most areas are long and narrow and 5 to 60 acres in size.

Typically, the surface layer is dark grayish brown and brown, friable silt loam about 6 inches thick. It is mottled in the lower part. The subsoil is yellowish brown and grayish brown, mottled, firm silty clay loam and silty clay about 20 inches thick. The substratum to a depth of about 34 inches is grayish brown, firm shaly silty clay loam. Under this is grayish brown, rippable, shale bedrock.

Included with this soil in mapping are small areas of the well drained Brecksville soils that are more sloping than this Hornell soil. This inclusion makes up about 15 percent of most areas.

A perched seasonal high water table is at a depth of 12 to 30 inches in winter, in spring, and during extended wet periods. Permeability is slow or very slow. Runoff is very rapid. The root zone is mainly moderately deep to shale bedrock. The available water capacity is low. The shrink-swell potential in the subsoil is moderate. Reaction is strongly acid to extremely acid in the surface layer and very strongly acid or strongly acid in the subsoil.

Most areas are woodland. This soil has low potential for sanitary facilities, building site development, lawns, landscaping, and most recreation. It has high potential for woodland and habitat for woodland wildlife and medium potential for pasture.

This soil is limited for pasture, lawns, flowers, and vegetables by moderately steep slope, low available water capacity, seasonal wetness, and erosion hazard. Vines, ground cover, trees, and shrubs tolerant of acid conditions are suited to this soil. Mowing lawns is difficult. Proper stocking rates, plant selection, and pasture rotation; timely deferment of grazing; and a good fertilization program help keep the pasture and soil in good condition. Using a cover crop or reseeding by the no-till method reduces the risk of erosion. Vegetation that competes with tree seedlings can be reduced by spraying, mowing, or disking.

This soil is severely limited as a site for buildings, sanitary facilities, and most recreation by slope, slow or very slow permeability, shale bedrock at a depth of 20 to 40 inches, and seasonal wetness. With special design and installation procedures, these limitations can be partly overcome. Cover should be maintained on the site as much as possible during construction to reduce soil loss by erosion. Footer drains and exterior coatings on basement walls help keep basements dry. Trails in recreational areas should be protected against erosion and should cross the slope, if possible.

HsC—Hornell-Urban land complex, rolling. This map unit consists of a rolling Hornell soil that is moderately deep and somewhat poorly drained and Urban land. Individual areas of this map unit are on uplands. Most areas contain about 55 percent Hornell silt loam and 35 percent Urban land. Areas of the Hornell soil and Urban land are so intricately mixed or so small in size that mapping them separately is not practical. Slopes range from 6 to 18 percent.

Typically, the Hornell soil has a surface layer of dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 20 inches thick. It is yellowish brown and grayish brown, mottled, firm silty clay loam and silty clay. The substratum to a depth of about 34 inches is grayish brown, firm shaly silty clay. Under this is grayish brown, rippable shale bedrock. In some places the soil has been radically altered. Some areas have been filled or leveled during construction, and other areas have been cut, built up, or smoothed.

The Urban land part of the unit is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification is not feasible.

Included with this unit in mapping are small areas of the poorly drained Allis soils on toe slopes and flat parts of the landscape. This inclusion makes up about 10 percent of most areas.

Most areas of this map unit are artificially drained through sewer systems, gutters, and subsurface drains. Areas of the Hornell soil that are not drained have a perched seasonal high water table at a depth of 12 to 30 inches in winter, in spring, and during extended wet periods. Permeability is slow or very slow. Runoff is rapid or very rapid. The root zone is mainly moderately deep to shale bedrock. The available water capacity is low. The shrink-swell potential in the subsoil is moderate. Reaction is strongly acid or very strongly acid in the subsoil.

The Hornell soil is used for parks, open space, lawns, gardens, and building sites. It has medium to low potential for gardens and lawns. This soil has high potential for trees and shrubs. It has low potential for sanitary facilities and building site development and medium to low potential for recreation.

The use of the Hornell soil for lawns and gardens is limited by slope, seasonal wetness, and acidity. Perennial plants should be selected for tolerance to wetness and acid conditions. Applications of lime, fertilizer, and organic matter aid in establishing and maintaining lawns and gardens and increasing the rate of water infiltration. The spots of cut and fill are not well suited to lawns and gardens. Tilth is poor in exposed subsoil material, which is sticky when wet and hard when dry.

The Hornell soil is severely limited as a site for buildings and sanitary facilities by seasonal wetness, slopes, slow or very slow permeability, and shale bedrock at a depth of 20 to 40 inches. With special design and installation procedures, these limitations can be partly overcome. Cover should be maintained on the site as much as possible during construction to reduce soil loss by erosion. Because of wetness and low strength, this soil is better suited to houses without basements than to houses with basements. Footer drains and exterior coatings on basement walls help keep basements dry. Foundations and footings should be designed to prevent structural damage caused by the shrinking and swelling of the soil. Because of wetness and low strength, this soil is limited for roads and streets, but it can be improved for this use by installing artificial drainage and by replacing the surface layer and subsoil with a suitable base material. Trails in recreational areas should be protected against erosion and should cross the slope, if possible.

JtA—Jimtown loam, 0 to 3 percent slopes. This deep soil is nearly level and somewhat poorly drained. This soil is on terraces. Most areas are broad and irregularly shaped and range from 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 9 inches thick. The subsoil is about 39 inches thick. The upper and middle parts are dark yellowish brown, mottled, firm clay loam and sandy clay loam; the lower part is dark brown, mottled, firm gravelly sandy clay loam. The substratum to a depth of about 60 inches is dark yellowish brown, friable gravelly sandy loam.

Included with this soil in mapping are small areas of the Haskins soils that formed in glacial outwash over glacial till or lacustrine materials. This inclusion is about 15 percent of most areas.

A seasonal high water table is at a depth of 12 to 30 inches in winter, in spring, and during extended wet periods. Permeability is moderate. Runoff is slow. 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.

Most areas were once farmed but are reverting to natural vegetation. This soil has high potential for trees, hay, pasture, and habitat for openland and woodland wildlife. It has low potential for building site development and sanitary facilities. The potential for most recreation and for lawns and landscaping is medium.

If drained, this soil is suited to lawns, gardens, shrubs, grasses, and legumes. Planting is delayed in undrained areas. Surface drains remove excess surface water. Subsurface drains are used to lower the seasonal high water table. Perennial plants should be selected for tolerance to wetness. Additions of organic matter to this soil aid in establishing and maintaining lawns, gardens, and seeding for hay and pasture. Grazing should be controlled to prevent excessive compaction, especially when the soil is soft and sticky.

Undrained areas of this soil are suited to woodland and habitat for openland and woodland wildlife. The use of planting and harvesting equipment is limited during wet seasons.

This soil is limited as a site for buildings and sanitary facilities by wetness and possible contamination of ground water supplies. The soil is better suited to such recreational uses as picnic areas and golf fairways than to these uses. Drainage can be improved by subsurface drains, storm sewers, and open ditches. Because of wetness, the soil is better suited to houses without basements than to houses with basements. Buildings should be located on the higher areas and landscaped and graded to keep water away from foundations. Because of potential frost action, this soil is limited for local roads, but it can be improved for this use by installing artificial drainage and by replacing the subsoil with a suitable base material. Excavating is limited during winter and spring because of wetness and sloughing. Sanitary facilities should be connected to central sewers and treatment facilities, if possible.

JuA—Jimtown-Urban land complex, nearly level. This map unit consists of a deep Jimtown soil that is nearly level and somewhat poorly drained and Urban land. Individual areas of this map unit are on terraces and beach ridges. They contain about 40 percent Jimtown loam and 30 percent Urban land. Areas of the Jimtown soil and Urban land are so intricately mixed or so small in size that mapping them separately is not practical. Slope is 0 to 2 percent.

Typically, the Jimtown soil has a surface layer of dark grayish brown, friable loam about 9 inches thick. The subsoil is about 39 inches thick. It is dark yellowish brown and dark brown, mottled, firm clay loam, sandy clay loam, and gravelly sandy clay loam. The substratum to a depth of about 60 inches is dark yellowish brown, friable gravelly sandy loam. In places, the soil has been radically altered. Some low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed.

The Urban land part of the unit is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification is not feasible.

Included with this complex in mapping are small areas of the Haskins soils that formed in glacial outwash over glacial till or lacustrine materials and the moderately well drained Bogart soils. The Haskins and Jimtown soils are on similar landscapes, and the Bogart soils are on low knolls. These inclusions make up about 15 percent of most areas.

Some areas of this map unit are artificially drained by sewer systems, gutters, and subsurface drains. Areas of the Jimtown soil that are not drained have a seasonal high water table at a depth of 12 to 30 inches in winter, in spring, and during extended wet periods. Permeability is moderate. Runoff is slow. The surface layer and subsoil are very strongly acid to slightly acid. The shrink-swell potential is low.

The Jimtown soil is used for parks, open space, building sites, lawns, and gardens. It has medium potential for lawns, vegetable and flower gardens, and recreation. This soil has low potential for building site development and sanitary facilities. It has high potential for trees and habitat for woodland wildlife.

If drained, the Jimtown soil is suited to lawns, flowers, vegetables, and shrubs. Planting is delayed in undrained areas. Perennial plants should be selected for tolerance to wetness. Additions of organic matter aid in establishing and maintaining lawns and gardens, in increasing the rate of water infiltration, and in reducing crusting. The spots of cut and fill are not well suited to lawns and gardens. Tilth is poor in exposed subsoil material, which is sticky when wet and hard when dry.

This soil is better suited to recreational uses, such as picnic areas and golf fairways, than to playgrounds. It is limited as a site for buildings and sanitary facilities not connected to central sewage disposal systems by wetness and by possible contamination of ground water supplies. Subsurface drains are very effective in lowering the seasonal high water table. Because of wetness, the soil is better suited to houses without basements than to houses with basements. Building sites should be landscaped and graded to keep surface water away from foundations. Because of potential frost action, this soil is limited for local roads, but it can be improved for this use by installing artificial drainage and by replacing the subsoil with a suitable base material. Sanitary facilities should be connected to central sewers and treatment facilities, if possible.

LoB—Loudonville silt loam, 2 to 6 precent slopes. This moderately deep soil is gently sloping and well drained. This soil is on side slopes and ridgetops. Most areas are long and narrow or irregularly shaped and 5 to 40 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 19 inches thick. The upper part is yellowish brown and dark yellowish brown friable silt loam and silty clay loam; the lower part is yellowish brown, friable channery silt loam. Sandstone bedrock is at a depth of about 25 inches. In some areas the surface layer is channery silt loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Mitiwanga soils on flat parts of the landscape. Also included are small areas of the moderately well drained Ellsworth soils that are deeper than 40 inches to bedrock. .

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

Most areas were once farmed but are presently woodland or are reverting back to natural vegatation. This soil has high potential for woodland, recreation, and habitat for woodland wildlife. The potential for lawns and landscaping is medium, and the potential for sanitary facilities and building site development is low.

Even though this soil is droughty for lawns and gardens during dry periods, it is suited to lawns, flowers, vegetables, trees, shrubs, pasture, and hay. Additions of organic matter aid in establishing and maintaining lawns, gardens, pasture, and hay. If the soil is used for cultivated crops, there is a hazard of erosion. The surface layer crusts and puddles after hard rains. Plant competition in areas of woodland seedlings can be reduced by spraying, mowing, or disking.

This soil is severely limited as a site for sanitary facilities and some building by sandstone bedrock at a depth of 20 to 40 inches. It is better suited to dwellings and small buildings without basements than to those with basements because blasting of bedrock is generally necessary to construct basements. Sanitary facilities should be connected to central sewers and treatment facilities, if possible. Because of low strength, this soil is limited for local roads and streets, but it can be improved for this use by replacing the surface layer and subsoil with a suitable base material. This soil is well suited to recreational uses, such as campsites and paths and trails.

LoC—Loudonville silt loam, 6 to 12 percent slopes. This moderately deep soil is sloping and well drained. This soil is on side slopes and ridgetops. Most areas are long and narrow and range from 5 to 50 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 19 inches thick. The upper and middle parts are yellowish brown, friable silt loam and silty clay loam; the lower part is yellowish brown, friable channery silt loam. Sandstone is at a depth of about 25 inches. In some areas the surface layer is a channery silt loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Mitiwanga soils in seeps and the deep, moderately well drained Ellsworth soils on the lower parts of slopes. These inclusions make up about 15 percent of most areas.

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

Most areas were once farmed but are presently woodland or are reverting to natural vegetation. This soil has high potential for woodland and habitat for woodland wildlife. The potential for lawns and landscaping is medium, and the potential for sanitary facilities and building site development is low. This soil has medium potential for recreation.

Even though this soil is droughty during dry periods, it is suited to lawns, flowers, vegetables, trees, shrubs, hay, and pasture. It warms and dries early in spring and is especially well suited to pasture for early grazing. If the soil is used for cultivated crops, erosion is a hazard. The erosion hazard limits irrigation in clean tillage areas and is a major concern on long slopes. Additions of organic matter aid in establishing and maintaining lawns, gardens, pastures, and meadows. Plant competition in areas of woodland seedlings can be reduced by spraying, mowing, and disking.

This soil is limited as a site for buildings, sanitary facilities, and recreation by slope and by sandstone bedrock, which is at a depth of 20 to 40 inches. Cover should be maintained on the site as much as possible during construction to reduce erosion. The soil is better suited to dwellings and small buildings without basements than to those with basements because blasting of bedrock is generally necessary to construct basements. If proper design and installation procedures are used, the limitation imposed by slope can be partly overcome. Sanitary facilities should be connected to central sewer and treatment facilities, if possible. Because of low strength, this soil is limited for local roads and streets, but it can be improved for this use by replacing the surface layer and subsoil with a suitable base material. Trails in recreational areas should be protected against erosion and should cross the slope, if possible.

LoD—Loudonville silt loam, 12 to 18 percent slopes. This moderately deep soil is moderately steep and well drained. This soil is on hillsides and slopes adjacent to drainageways on uplands. Most areas are long and narrow and 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The dark brown, friable subsoil is about 19 inches thick. The upper part is loam, and the lower part is channery loam. Sandstone bedrock is at a depth of about 25 inches. In some areas, many flat stone fragments are in the subsoil.

Included with this soil in mapping are narrow strips of the deep, moderately well drained Ellsworth soils on the lower parts of slopes. This inclusion makes up about 15 percent of most areas.

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

Most areas are woodland. This soil has high potential for woodland and habitat for woodland wildlife. The potential for lawns, landscaping, sanitary facilities, building site development, and most recreation is low.

This soil is well suited to trees, shrubs, and ground cover, and many areas are in native hardwoods. The soil dries early in spring and is droughty during dry periods. The slope is a moderate limitation for the use of equipment. Seedling growth is improved if competing vegetation is controlled or removed by cutting, spraying, girdling, or mowing.

This soil is limited as a site for buildings, sanitary facilities, and most recreation uses by slope and by sandstone bedrock, which is at a depth of 20 to 40 inches (fig. 8). Erosion is a serious hazard if adequate vegetative cover is not maintained. Cover should be maintained on the site as much as possible during construction to reduce the erosion hazard. If proper design and installation precedures are used, the limitation imposed by slope can be partly overcome. Trails in recreational areas should be protected against erosion and should cross the slope, if possible.

Figure 8.—The slope of the Loudonville silt loam, 12 to 18 percent slopes, is a severe limitation for buildings and sanitary facilities.

LuC—Loudonville-Urban land complex, rolling. This map unit consists of a moderately deep, well drained Loudonville soil and Urban land. Individual areas of this map unit are on side slopes and ridgetops. They contain about 50 percent Loudonville silt loam and 35 percent Urban land. Areas of the Loudonville soil and Urban land are so intricately mixed or so small in size that mapping them separately is not practical.

Typically, the Loudonville soil has a surface layer of dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 19 inches thick. The upper and middle parts are yellowish brown, friable silt loam and silty clay loam; the lower part is dark yellowish brown and yellowish brown, friable channery silt loam. Sandstone bedrock is at a depth of about 25 inches. In places, the soil has been radically altered. Some low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed.

The Urban land part of the unit is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification is not feasible.

Included with this complex in mapping are small areas of the somewhat poorly drained Mitiwanga soils in seeps and the deep, moderately well drained Ellsworth soils on the lower parts of slopes. These inclusions make up about 15 percent of most areas.

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

The Loudonville soil is used for parks, open space, building sites, lawns, and gardens. It has high potential for trees and habitat for woodland wildlife. The potential for lawns, landscaping, and recreation is medium or low. This soil has low potential for sanitary facilities and building site development.

The Loudonville soil is suited to trees and shrubs and moderately well suited to poorly suited to vegetable and flower gardens. It is droughty, and the erosion hazard is severe if vegetative cover is not maintained. Watering is needed during dry periods. Additions of organic matter aid in establishing and maintaining lawns and gardens. The spots of cut and fill land are not well suited to lawns and gardens. Tilth is very poor in exposed subsoil material, which is sticky when wet and hard when dry.

The Loudonville soil is limited as a site for buildings, sanitary facilities, and recreation by slope and by bedrock, which is at a depth of 20 to 40 inches. Areas where the soil has slopes of 6 to 12 percent are better suited to these uses than those where slopes are 12 to 18 percent. Cover should be maintained on the site as much as possible during construction to reduce erosion. The soil is also better suited to dwellings and small buildings without basements, because blasting of bedrock is generally necessary for basements. Central sewage systems are commonly used although the bedrock makes installation difficult. Because of low strength, this soil is limited for local roads, but it can be improved for this use by replacing the surface layer and subsoil with a suitable base material. Trails in recreational areas should be protected against erosion and should cross the slope, if possible.

MgA—Mahoning silt loam, 0 to 2 percent slopes. This deep soil is nearly level and somewhat poorly drained. This soil is in broad areas on till plains and higher parts of lake plains. Most areas are irregularly shaped and 4 acres to 100 acres or more in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is mottled, friable and firm silty clay loam about 32 inches thick. It is yellowish brown, dark yellowish brown, and olive brown. The substratum to a depth of about 60 inches is olive brown, firm silty clay loam and clay loam that is mottled in the lower part.

Included with this soil in mapping are small areas of the poorly drained Condit soils in depressions. Also included are small areas of the Haskins soils that formed in glacial outwash over glacial till or lakebed sediments and the Mitiwanga soils which have sandstone bedrock at a depth of 20 to 40 inches. These inclusions make up about 15 percent of most areas.

This soil has a perched seasonal high water table at a depth of 12 to 30 inches in winter, in spring, and during extended wet perods. 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 moderately deep to compact glacial till. The available water capacity is moderate. Where the soil is unlimed, it is strongly acid or very strongly acid in the surface layer and upper part of the subsoil. The shrink-swell potential is moderate.

Most areas were farmed but are reverting to natural vegetation or are used as sites for buildings or recreation. This soil has medium potential for landscaping and lawns and high potential for trees (fig. 9). The potential for building site development and sanitary facilities is low. This soil has medium or low potential for recreational uses.

Grasses, legumes, lawns, flowers, vegetables, and shrubs grow well on this soil in drained areas. Planting is delayed in undrained areas. Perennial plants should be selected for tolerance to wetness. This soil puddles and clods if worked when wet. The addition of organic matter to this soil aids in establishing and maintaining lawns and gardens. Undrained areas of this soil are suited to woodland; however, the use of planting and harvesting equipment is limited during wet seasons.

This soil is severely limited for most sanitary facilities and as a site for buildings by a seasonal high water table, low strength, and slow or very slow permeability. Ditches and subsurface drains are used to remove excess water. Subsurface drains must be closely spaced to give uniform drainage. Building sites should be landscaped and graded to keep surface water away from foundations. Because of wetness, this soil 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 and by the shrinking and swelling of the soil. Sanitary facilities should be connected to central sewers and treatment facilities, if possible. Because of wetness and low strength, this soil is limited for local roads, but it can be improved for this use by installing artificial drainage and replacing the surface layer and subsoil with a suitable base material. Drainage is needed for intensive recreation, such as ball diamonds and tennis courts.

MgB—Mahoning silt loam, 2 to 6 percent slopes. This deep soil is gently sloping and somewhat poorly drained. This soil is in broad areas on till plains. Most areas are irregularly shaped and 4 acres to 100 acres or more in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 32 inches thick. It is yellowish brown, dark yellowish brown, and olive brown silty clay loam that is mottled and firm. The substratum to a depth of about 60 inches is olive brown, firm silty clay loam and clay loam.

Included with this soil in mapping are small areas of the moderately well drained Ellsworth soils on slight rises. Also included are small areas of the Haskins soils that formed in glacial outwash over glacial till or lakebed sediments. These inclusions make up about 15 percent of most areas.

This soil has a perched seasonal high water table at a depth of 12 to 30 inches in winter, in spring, and during 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 moderately deep to compact glacial till. The available water capacity is moderate. Where this soil is unlimed, it is strongly acid or very strongly acid in the surface layer and upper part of the subsoil. The shrink-swell potential is moderate.

Most areas were once farmed but are reverting to natural vegetation or are used for recreation. This soil has medium potential for lawns and landscaping and high potential for trees. The potential for building site development and sanitary facilities is low. This soil has medium or low potential for recreational uses.

Lawns, flowers, vegetables, and shrubs grow well on this soil in drained areas. Planting is delayed in undrained areas. Perennial plants should be selected for tolerance to wetness. This soil puddles and clods if worked when wet. The addition of organic matter to this soil aids in establishing and maintaining lawns and gardens. Undrained areas of this soil are suited to woodland; however, the use of planting and harvesting equip-

Figure 9.—Most areas of Mahoning silt loam, 0 to 2 percent slopes, were farmed but are reverting to natural vegetation or are used as sites for buildings or recreation.

ment is limited during wet seasons. Erosion is a hazard where the soil is disturbed and left bare of vegetation.

This soil is severely limited for most sanitary facilities and as a site for buildings by a seasonal high water table, low strength, and slow or very slow permeability. Ditches and subsurface drainage are used to remove excess water. Subsurface drains must be closely spaced to give uniform drainage. Building sites should be landscaped and graded to keep surface water away from foundations. Because of wetness, this soil 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 and by the shrinking and swelling of the soil. Footer drains and coatings on exterior basement walls are used to help prevent wet basements. Sanitary facilities should be connected to central sewers and treatment facilities. Because of wetness and low strength, this soil is limited for local roads, but it can be improved for this use by installing artificial drainage and by replacing the subsoil with a suitable base material. Drainage is needed for intensive recreation, such as ball diamonds and tennis courts.

MmB—Mahoning-Urban land complex, undulating. This map unit consists of a deep, somewhat poorly drained Mahoning soil and Urban land in broad, undulating areas on till plains and on the higher parts of lake plains. Areas range from 30 to over 500 acres in size and contain about 55 percent Mahoning silt loam and 30 percent Urban land. Areas of the Mahoning soil and Urban land are so intricately mixed or so small in size that mapping them separately is not practical. Slopes ranges from 0 to 6 percent.

Typically, the Mahoning soil has a surface layer of dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 32 inches thick. It is yellowish brown, dark yellowish brown, and olive brown silty clay loam that is mottled and firm. The substratum to a depth of about 60 inches is olive brown, mottled, firm silty clay loam and clay loam. In places the soil has been radically altered. Some of the low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed.

The Urban land part of the unit is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification is not feasible.

Included with this unit in mapping are small areas of the poorly drained Condit soils along drainageways and in depressions and the moderately well drained Ellsworth soils on rises. These inclusions make up about 15 percent of most areas.

Most areas are artificially drained by sewer systems, gutters, subsurface drains, and, to a lesser extent, surface ditches. Areas of the Mahoning soil that are not drained have a perched seasonal high water table at a depth of 12 to 30 inches. Permeability is slow or very slow. The Mahoning soil warms and dries late in spring, even if it is artificially drained. The root zone is mainly moderately deep to compact glacial till. Runoff is slow and medium. Where this soil is unlimed, it is strongly acid or very strongly acid in the surface layer and upper part of the subsoil. The shrink- swell potential is moderate.

The Mahoning soil is used for parks, open space, building sites, lawns, and gardens. It has medium potential for lawns and landscaping and high potential for trees. The potential for building site development and sanitary facilities is low. This soil has medium or low potential for recreation.

Lawns, flowers, vegetables, and shrubs grow well on the Mahoning soil when it is drained. Perennial plants should be selected for tolerance to wetness. This soil puddles and clods if worked when wet. The addition of organic matter aids in establishing and maintaining lawns and gardens, increasing the rate of water infiltration, in reducing crusting and the risk of erosion. The spots of cut and fill are not well suited to lawns and gardens. Tilth is poor in exposed subsoil material, which is sticky when wet and hard when dry.

The Mahoning soil is severely limited as a site for buildings and most sanitary facilities by a seasonal high water table, low strength, and slow or very slow permeability. Building sites are commonly landscaped and graded to keep surface water away from foundations. The soil 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 and by shrinking and swelling of the soil. Footer drains and coatings on exterior basement walls help keep basements dry. Most sanitary facilities are connected to central sewers and treatment facilities. Because of wetness and low strength, this soil is limited for local roads, but it can be improved for this use by installing artificial drainage and by replacing the subsoil with a suitable base material. Drainage is needed for intensive recreational uses, such as ball diamonds and tennis courts.

Mo—Mermill loam. This deep soil is nearly level and very poorly drained. The soil is in low-lying or depressional areas on lake plains. It is subject to ponding in the lower parts of depressions by runoff from adjacent, higher lying soils. Slope is 0 to 2 percent. Most areas are irregularly shaped and range from 4 to 50 acres in size.

Typically, the surface layer is very dark gray, friable loam about 8 inches thick. The subsoil is about 28 inches thick. The upper part is dark grayish brown, mottled, friable loam and clay loam; the lower part is dark grayish brown, mottled, firm silty clay loam. The substratum to a depth of about 60 inches is dark gray, mottled, firm silty clay loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Haskins soils on slight rises and small areas of the Miner soils that formed in glacial till. These inclusions make up about 15 percent of most areas.

A perched seasonal high water table is at or near the surface in winter, in spring, and during extended wet periods. Permeability is moderate in the upper part of the subsoil and slow or very slow in the lower part and in the substratum. Runoff is very slow or the soil is ponded. The root zone is moderately deep to compact glacial till. The available water capacity is moderate. Reaction is medium acid to neutral in the upper part of the subsoil and neutral or mildly alkaline in the lower part.

Most areas were once farmed but are reverting to natural vegetation. This soil has low potential for building site development, recreation, and most sanitary facilities. It has medium potential for lawns and landscaping and high potential for woodland, hay, pasture, and as habitat for wetland wildlife.

Drained areas of this soil are suited to lawns, flowers, vegetables, shrubs, hay, and pasture. Surface and subsurface drains are commonly used to remove excess water. Suitable outlets for subsurface drains are difficult to establish in some areas. These drains are more effective if placed on or above the slowly or very slowly permeable glacial till. Raised beds can be used to elevate the upper part of the root zone above the seasonal high water table. Perennial plants should be selected for tolerance to wetness.

This soil is poorly suited to grazing early in spring. Even with drainage, controlled grazing is a good practice. If this soil is grazed when wet, the soft, sticky surface layer compacts easily.

This soil is severely limited as a site for buildings, recreation, and most sanitary facilities by slow permeability or very slow permeability, ponding, and the high shrink-swell potential in the lower part of the subsoil and in the substratum. Surface drains, storm sewers, and subsurface drains are used to remove excess water. Because of low strength, this soil is limited for local roads, but it can also be improved for this use by replacing the surface layer and subsoil with a suitable base material and by installing an artificial drainage system. Foundations and footings should be designed to prevent structural damage caused by frost action and the shrinking and swelling of the soil. Sanitary facilities should be connected to central sewer and treatment facilities. This soil is well suited to sewage lagoons.

Mr—Miner silty clay loam. This deep soil is nearly level and very poorly drained. This soil is in low-lying or depressional areas on the lake plains and till plains. Slope is 0 to 2 percent. It is subject to ponding in the lower part of depressions by runoff from adjacent, higher lying soils. Most areas are long and narrow or irregularly shaped and range from 5 to 100 acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 7 inches thick. The subsoil is about 35 inches thick. It is gray, mottled, firm clay. The substratum to a depth of about 60 inches is gray and dark grayish brown, mottled, firm silty clay and shaly clay loam. In a few areas, shale or sandstone bedrock is at a depth of 40 to 60 inches. In some areas adjacent to beach ridges, the surface layer is loam.

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

Most areas were farmed but are reverting to natural vegetation. This soil has high potential as habitat for wetland wildlife, open space, woodland, and pond reservoirs. It has low potential for lawns, landscaping, building site development, sanitary facilities, and recreation.

This soil warms slowly and dries late in spring in undrained areas. Drained areas are suited to lawns, shrubs, trees, flowers, and vegetables. Surface and subsurface drains are commonly used to remove excess water, but movement of watei into subsurface drains is slow. Artificial drainage is difficult to establish in many areas because of the low position in the landscape. Raised beds can be used to elevate the upper part of the root zone above the seasonal high water table. Surface water can also be drained by parallel furrows and raised beds. Perennial plants should be selected for tolerance to wetness.

This soil is well suited as open space. It is severely limited as a site for buildings, sanitary facilities, and recreation because of ponding, slow permeability, and low strength. Foundations and footings should be designed to prevent structural damage caused by frost action, low strength, and shrinking and swelling of the soil. Sanitary facilities should be connected to central sewer and treatment facilities. Because of ponding and low strength, this soil is limited for roads and streets but can be improved for this use by installing artificial drainage and by replacing the subsoil with a suitable base material. Play areas and walkways usually need special surfacing.

MtA—Mitiwanga silt loam, 0 to 2 percent slopes. This moderately deep soil is nearly level and somewhat poorly drained. This soil is on lake plains. Most areas are irregularly shaped and 5 to 50 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsurface layer is light brownish gray, mottled, friable silt loam about 3 inches thick. The subsoil is yellowish brown, mottled, friable silty clay loam about 11 inches thick. The substratum, to a depth of about 29 inches, is yellowish brown, mottled, friable flaggy loam. Under this is sandstone bedrock.

Included with this soil in mapping are a few areas of the deep Darien soils on the lower part of slopes. This inclusion makes up about 15 percent of most areas.

This soil has a perched seasonal high water table at a depth of 12 to 30 inches in winter, in spring, and during extended wet periods. It 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 and low in the substratum. Reaction is very strongly acid to medium acid in the surface layer and extremely acid to strongly acid in the subsoil.

Most areas were once farmed but are reverting to natural vegetation or are used for recreation. This soil has medium potential for lawns and landscaping and low potential for building site development and sanitary facilities. It has high potential for woodland, natural shrubs, and as habitat for openland and woodland wildlife.

Drained areas of this soil are suited to grasses, legumes, lawns, flowers, vegetables, and shrubs. Unless artificially drained, this soil is poorly suited to intensive uses. Wetness delays planting and limits the choice of crops. Undrained areas 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 subsurface drains, and outlets are not available in most areas. Perennial plants should be selected for tolerance to wetness. Additions of lime, fertilizer, and organic matter, such as crop residue, aid in the establishment and maintenance of lawns and gardens. This soil is subject to surface crusting, compaction, and hard clodding if tillage is performed when the soil is soft and sticky. It is not suited to grazing early in spring, and turf is easily damaged during wet periods. Undrained areas are suited to trees that are tolerant of wetness.

This soil is severely limited for building sites, sanitary facilities, and some recreational uses by seasonal wetness and hard bedrock, which is at a depth of 20 to 40 inches. Surface drains and storm sewers can be used to remove excess water. Building sites should be landscaped and graded to keep surface water away from the foundations and septic tank absorption fields. Because of potential frost action and low strength, this soil is limited for local roads but can be improved for this use by installing artificial drainage and by replacing the surface layer and subsoil with a suitable base material. Sanitary facilities should be connected to central sewer and treatment facilities, if possible. The soil is better suited to picnic areas and paths and trails than to most other recreational uses.

MtB—Mitiwanga silt loam, 2 to 6 percent slopes. This moderately deep soil is gently sloping and somewhat poorly drained. This soil is on till plains. Most areas are irregularly shaped and range from 5 to 25 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 13 inches thick. It is yellowish brown, mottled silty clay loam that is friable. The substratum to a depth of about 29 inches, is yellowish brown, mottled, friable flaggy loam. Under this is sandstone bedrock.

Included with this soil in mapping are small areas of the deep Darien soils on the lower part of slopes and the well drained Loudonville soils on rises. These inclusions make up about 15 percent of most areas.

The soil has a perched seasonal high water table at a depth of 12 to 30 inches in winter, in spring, and during extended wet periods. Permeability is moderate. Runoff is medium. The available water capacity is low. The shrink-swell potential is low in the subsoil and moderate in the substratum. Reaction is very strongly acid to medium acid in the surface layer and extremely acid to strongly acid in the subsoil.

Most areas were once farmed but are reverting to natural vegetation or are used for recreation. This soil has medium potential for lawns and landscaping and low potential for building site development and sanitary facilities. It has high potential for woodland, natural shrubs, and as habitat for openland and woodland wildlife.

If drained, this soil is suited to grasses, legumes, lawns, flowers, vegetables, and shrubs. Unless artificially drained, this soil is poorly suited to intensive uses. Wetness delays planting and limits the choice of crops. Undrained areas 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 subsurface drains, and outlets are not available in most areas. Perennial plants should be selected for tolerance to wetness. Erosion is a hazard on long slopes. Additions of lime, fertilizer, and organic matter, such as crop residue, reduce erosion and aid in the establishment and maintenance of lawns and gardens.

This soil is subject to surface crusting, compaction, and hard clodding if tillage is performed when the soil is soft and sticky. It is not suited to grazing early in spring, and turf is easily damaged during wet periods. Undrained areas are suited to woodland species that are tolerant of wetness. Competing vegetation can be controlled or removed by cutting, spraying, girdling, or mowing.

This soil is severely limited for building sites, sanitary facilities, and some recreational uses by seasonal wetness and hard bedrock, which is at a depth of 20 to 40 inches. Surface drains and storm sewers can be used to remove surface water. Building sites should be landscaped and graded to keep surface water away from foundations and septic tank absorption fields. Because of potential frost action and low strength, this soil is limited for local roads but can be improved for this use by installing artificial drainage and by replacing the surface layer and subsoil with a suitable base material. Runoff and erosion increase during construction if cover is not maintained on the site. Sanitary facilities should be connected to central sewer and treatment facilities, if possible. The soil is better suited to picnic areas and paths and trails than to most other recreational uses.

MxB—Mitiwanga-Urban land complex, undulating. This map unit consists of a moderately deep, somewhat poorly drained Mitiwanga soil and Urban land. Individual areas of this map unit are on till plains. They range from 20 acres to 100 acres in size and contain about 45 percent Mitiwanga silt loam and 35 percent Urban land. Areas of the Mitiwanga soil and Urban land are so intricately mixed or so small in size that mapping them separately is not practical. Slopes range from 0 to 6 percent.

Typically, the Mitiwanga soil has a surface layer of dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 13 inches thick. It is yellowish brown, mottled, silty clay loam that is friable. The substratum, to a depth of about 29 inches, is yellowish brown, mottled, friable flaggy loam. Under this is sandstone bedrock. In some places the soil has been radically altered. Some low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed.

The Urban land part of the unit is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soil that identification is not feasible.

Included in mapping are small areas of the deep Darien soils on the lower part of slopes and the well drained Loudonville soils on rises. These inclusions make up about 20 percent of most areas.

Most areas of this map unit are artificially drained by sewer systems, gutters, subsurface drains, and, to a lesser extent, surface ditches. Areas of the Mitiwanga soil that are not drained have a perched seasonal high water table at a depth of 12 to 30 inches during the wet season, and some low-lying areas are ponded by runoff from adjacent higher soils. Runoff is slow and medium. Permeability is moderate. Reaction is very strongly acid to medium acid in the surface layer and extremely acid to strongly acid in the subsoil. The shrink-swell potential is moderate in the subsoil and low in the substratum.

The Mitiwanga soil is used for parks, open space, building sites, lawns, and gardens. It has low potential for building site development and sanitary facilities. This soil has medium potential for lawns and landscaping and high potential for open space and trees. This soil has medium or low potential for recreational uses.

Lawns, flowers, vegetables, trees, and shrubs grow well on the Mitiwanga soil when it is drained. Perennial plants should be selected for tolerance to wetness. This soil puddles and clods if worked when soft and sticky. Additions of lime, fertilizer, and organic matter aid in the establishment and maintenance of lawns and gardens, in increasing the rate of water infiltration, and in reducing crusting and the risk of erosion. Turf is easily damaged when the soil is saturated. The spots of cut and fill are not well suited to lawns and gardens. Tilth is poor in exposed subsoil material, which is sticky when wet and hard when dry.

The Mitiwanga soil is severely limited for building sites, sanitary facilities, and some recreational uses by seasonal wetness and hard bedrock, which is at a depth of 20 to 40 inches. Cover should be maintained on the site as much as possible during construction to reduce soil loss by erosion. Surface drains and storm sewers are used to remove surface water. Building sites should be landscaped and graded to keep surface water away from the foundations. The Mitiwanga soil 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 and by shrinking and swelling of the soil. Footer drains and coatings on exterior basement walls help keep basements dry. Most sanitary facilities are connected to central sewer and treatment facilities. Because of potential frost action and low strength, this soil is limited for local roads and streets but can be improved for this use by installing artificial drainage and by replacing the surface layer and subsoil with a suitable base material.

Or—Orrville silt loam, frequently flooded. This deep soil is nearly level and somewhat poorly drained. This soil is on flood plains. Slope is 0 to 2 percent. It is frequently flooded for brief periods in fall, winter, and spring. Most areas are long and narrow and range from 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 32 inches thick. It is yellowish brown, light brownish gray, and grayish brown silt loam that is mottled and friable. The substratum to a depth of about 60 inches is grayish brown and dark grayish brown, mottled, loose stratified sandy loam and loamy sand.

Included with this soil in mapping are narrow strips of the Holly soils in slight depressions and old meander channels and the Chagrin and the Tioga soils on slight rises. These inclusions make up about 15 percent of most areas.

The seasonal high water table is at a depth of 12 to 30 inches in winter, in spring, and during extended wet periods. Permeability is moderate, and 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. The shrink-swell potential is low.

Most areas were once farmed but are reverting to natural vegetation. This soil has low potential for building site development and sanitary facilities. It has high potential for woodland, pasture, and habitat for woodland wildlife. The potential is medium or low for recreation.

Flooding and wetness are limitations of this soil for lawns, flowers, vegetables, shrubs, hay, and pasture. They delay planting in most years. Subsurface drainage is needed, but suitable outlets are not available in some areas. Planting cover crops or seeding permanent grasses and legumes increases water intake and protects the surface in areas that are subject to scouring. Overgrazing or grazing when the soil is soft and sticky as a result of wetness causes compaction and poor tilth. Grasses and legumes should be selected for tolerance to wetness.

This soil is suited to trees and shrubs. Seedlings grow well if competing vegetation is controlled or removed by such practices as spraying, mowing, or disking.

This soil is seriously limited as a site for buildings and sanitary facilities by the flood hazard and the seasonal wetness. Sewage lagoons and sanitary landfills are also limited by the possible pollution of ground water. Sloughing is a hazard in excavation. This soil has potential for such recreational uses as hiking during the drier part of the year. Installing dikes to control flooding is difficult. Because of flooding and potential frost action, this soil is limited for local roads and streets. These limitations can be improved by raising the area above flood levels with fill and by replacing the surface layer and subsoil with a suitable base material.

OsA—Oshtemo sandy loam, 0 to 2 percent slopes. This deep soil is nearly level and well drained. The soil is on outwash terraces. Most areas are long and narrow or irregularly shaped and range from 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown, very friable sandy loam about 8 inches thick. The subsurface layer is yellowish brown, very friable loamy sand about 8 inches thick. The subsoil is about 37 inches thick. The upper part is brown, very friable sandy loam; the lower part is brown, loose loamy sand and brown, very friable sandy loam. The substratum to a depth of about 60 inches is brown, loose sand.

Included with this soil in mapping are small areas of the Chili soils that formed in stratified outwash deposits and contain more gravel than the Oshtemo soil. Also included are the Mentor soils that formed in silty sediments. Included soils make up about 15 percent of most areas.

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

Most areas were once farmed, but are reverting to natural vegetation. Some areas are used for greenhouses. This soil has high potential for lawns, landscaping, vegetables, greenhouses, hay, pasture, trees, building site development, and recreational uses. It has low potential for water impoundment because of the very rapidly permeable substratum.

This soil is well suited to lawns, vegetables, flowers, trees, shrubs, hay, and pasture. It is especially well suited to deep rooted plants. It warms and dries early in spring and can be worked earlier than most soils. Even though soil blowing is a hazard, this soil is well suited to irrigation if ample water is available for irrigation. If irrigated, this soil is well suited to such specialty crops as nursery stock and fruit trees. Growth of pasture is slow in summer because the soil is droughty. This soil is well suited to grazing early in spring. Lawns should be seeded late in summer and mulched and watered. Additions of organic matter aid in establishing and maintaining lawns, gardens, and seedings for hay and pasture. Because nutrients are moderately rapidly leached, this soil generally responds better to smaller but more frequent or timely applications of fertilizer than to one large application.

This soil is well suited as a site for buildings, local roads and streets, and most recreation. It is poorly suited to sanitary facilities, especially sewage lagoons and sanitary landfills, because of the possible contamination of ground water from seepage. Sloughing is a hazard in excavations. This soil is a good source of sand.

OsB—Oshtemo sandy loam, 2 to 6 percent slopes. This deep soil is gently sloping and well drained. This soil is on beach ridges and outwash terraces (fig. 10). Most areas are long and narrow or irregularly shaped and range from 20 to 50 acres in size.

Typically, the surface layer is dark grayish brown, very friable sandy loam about 8 inches thick. The subsurface layer is yellowish brown, very friable loamy sand about 8 inches thick. The subsoil is about 37 inches thick. The upper part is brown, very friable sandy loam; the lower part is brown, loose loamy sand and brown, very friable sandy loam. The substratum to a depth of about 60 inches is brown, loose sand.

Included with this soil in mapping are small areas of the Chili soils that formed in stratified outwash deposits and contain more gravel than the Oshtemo soil. Also

Figure 10.—Oshtemo sandy loam, 2 to 6 percent slopes, is on the beach ridge in the background. This soil is well suited as a site for buildings, local roads and streets, and most recreation.

included are the Mentor soils that formed in silty sediments. Included soils make up about 15 percent of most areas.

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

Most areas were once farmed but are reverting to natural vegetation. Some areas are used for greenhouses. This soil has high potential for lawns, landscaping, vegetables, greenhouses, hay, pasture, trees, building site development, and recreation. It has low potential for water impoundment because of the very rapidly permeable substratum.

This soil is well suited to lawns, vegetables, flowers, trees, shrubs, hay, and pasture. It is especially well suited to deep rooted plants. It warms and dries early in spring and can be worked earlier than most soils.

Even though soil blowing and erosion are hazards, this soil is well suited to irrigation if ample water is available for irrigation. If irrigated, this soil is well suited to such specialty crops as nursery stock and fruit trees. Growth of pasture is slow in summer because the soil is droughty. This soil is well suited to grazing early in spring. Lawns should be seeded late in summer and should be mulched and watered. Additions of organic matter aid in establishing and maintaining lawns, gardens, and seedings for hay and pasture. Because nutrients are moderately rapidly leached, this soil generally responds better to smaller but more frequent or timely applications of fertilizer than to one large application.

This soil is well suited as a site for buildings, local roads and streets, and most recreation. It is poorly suited to sanitary facilities, especially sewage lagoons and sanitary landfills, because of the possible contamination of ground water from seepage. Sloughing is a hazard in excavations. This soil is a good source of sand.

OsF—Oshtemo sandy loam, 25 to 55 percent slopes. This deep, steep and very steep soil is well drained. This soil is on dissected parts of terraces. Most areas are long and narrow and range from 5 to 50 acres in size.

Typically, the surface layer is dark grayish brown, very friable sandy loam about 6 inches thick. The subsurface layer is yellowish brown, very friable loamy sand about 6 inches thick. The subsoil is about 32 inches thick. It is dark yellowish brown and yellowish brown, loose gravelly sandy loam and gravelly loamy sand. The substratum to a depth of about 60 inches is yellowish brown, loose sand.

Included with this soil in mapping are a few small areas of the Mentor soils that formed in silty sediments. Also included are small areas of the Ellsworth soils that formed in glacial till and are on the upper parts of slopes. These inclusions make up about 15 percent of most areas.

Permeability is moderately rapid in the subsoil and very rapid in the substratum. Runoff is rapid. The root zone is deep, and the available water capacity is low. Reaction in the surface layer and subsoil is strongly acid or medium acid. The shrink-swell potential is low.

Slope controls the use of this soil. Most areas are woodland and in wildlife habitat. This soil has high potential for woodland and habitat for woodland wildlife. It has low potential for building site development, sanitary facilities, lawns, landscaping, and most recreation.

This soil is suited to trees. Most trees common to the area are adapted to this soil. Seedlings are difficult to establish in most years because of drought. The hazard of erosion is very severe if plant cover is removed. Slope severely limits the use of equipment.

Construction for recreation and urban uses is difficult, and the hazard of erosion is very severe when vegetation is removed. Hillside slippage also limits these uses. Trails in recreational areas should be protected from erosion and should cross the slope, where possible. Sloughing is a hazard in excavations.

OtB—Oshtemo-Urban land complex, undulating. This map unit consists of a deep, well drained Oshtemo soil and Urban land. Individual areas of this map unit are on beach ridges and terraces. They contain about 45 percent Oshtemo sandy loam and 40 percent Urban land. Areas of the Oshtemo soil and Urban land are so intricately mixed or so small in size that mapping them separately is not practical. Slopes range from 2 to 8 percent.

Typically, the Oshtemo soil has a surface layer of dark grayish brown, very friable sandy loam about 8 inches thick. The subsurface layer is yellowish brown, very friable loamy sand about 8 inches thick. The subsoil is about 37 inches thick. The upper part is brown, very friable sandy loam; the lower part is brown, loose loamy sand and very friable sandy loam. The substratum to a depth of about 60 inches is brown, loose sand. In some places the soil has been radically altered. Some low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed.

The Urban land part of the unit is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification is not feasible.

Included with this complex in mapping are small areas of the Mentor soils that formed in silty sediments and the Chili soils that formed in outwash deposits and contain more gravel than the Oshtemo soil. The inclusions make up about 15 percent of most areas.

The Oshtemo soil has moderately rapid permeability in the subsoil and very rapid permeability in the substratum. The root zone is deep, and the available water capacity is low or moderate. Reaction of the surface layer and subsoil are strongly acid or medium acid. The shrink-swell potential is low.

The Oshtemo soil is used for parks, open space, building sites, lawns, and gardens. It has high potential for lawns, vegetable and flower gardens, trees, shrubs, building site development, and recreation. It has low potential for water impoundment because of the very rapidly permeable substratum.

The Oshtemo soil is well suited to grasses, legumes, flowers, vegetables, trees, and shrubs. It is especially well suited to deep rooted plants. Erosion generally is not a major problem, unless the soil is disturbed and left unprotected. This soil warms and dries early in spring and is droughty during dry periods. During dry periods, supplemental irrigation is needed to promote good growth. Lawns should be seeded late in summer and should be mulched and watered. Additions of organic matter aid in establishing and maintaining lawns and gardens. The spots of cut and fill are not well suited to lawns and gardens.

This soil is a good site for buildings, local roads and streets, and most recreation. It is poorly suited to sanitary facilities, especially sewage lagoons and sanitary landfills, because of the possible contamination of ground water from seepage. Sewage should be centrally treated, if possible. Sloughing is a hazard in excavations.

Pg—Pits, gravel. Gravel pits consist of surface-mined areas from which aggregate material has been removed for construction. Gravel pits are on outwash terraces. Typically, they are associated with Oshtemo, Chili, and other soils that are underlain by gravel and sand outwash. Most pits range from 5 to 50 acres in size. Actively mined pits are continually 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 poorly suited to plants. The organic matter content and available water capacity are low. Most unused gravel pits can be developed as wildlife habitat or as recreational areas. Pits excavated to or below water table level can be developed as habitat for wetland wildlife.

Pt—Pits, quarry. Pits, quarry, consist of surface-mined areas from which sandstone bedrock has been removed for construction. They are mainly in areas where sandstone bedrock is close to the surface. Typically, they are adjacent to areas of the Loudonville, the Dekalb, and the Mitiwanga soils. Most quarries range from 5 to 50 acres in size. Actively mined quarries are continually being enlarged. Most pits characteristically have a high wall on one or more sides.

The material that was mined consists of ripple-marked and cross-bedded, medium to coarse-grained porous sandstone that is moderately hard and light gray to light tan. The sandstone is of varying thickness and orientation. Selectivity in mining is commonly feasible.

The material remaining after mining is poorly suited to plant growth. The organic matter content and available water capacity are very low. Most quarries contain water and are used for fishing, swimming, and other aquatic recreation. The areas surrounding most quarries have been leveled and planted to shrubs and grass.

RsB—Rittman silt loam, 2 to 6 percent slopes. This deep soil is gently sloping and moderately well drained. This soil is on knolls and side slopes at the heads of drainageways on till plains. Most areas are long and narrow or irregularly shaped and 20 to 100 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 7 inches thick. The subsoil is about 37 inches thick. The upper part is yellowish brown, mottled, friable and firm silty clay loam; the lower part is a dense fragipan of dark yellowish brown, mottled, very firm silty clay loam. The substratum to a depth of about 60 inches is dark brown, mottled, firm silty clay loam. The upper part of the subsoil is silt loam in the northeast part of the county.

Included with this soil in mapping are small areas of the somewhat poorly drained Wadsworth soils on foot slopes and toe slopes and small areas of the Ellsworth soils, which do not have a fragipan. These inclusions make up about 15 percent of most areas.

A perched seasonal high water table is at a depth of 24 to 42 inches in winter, in spring, and during 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 moderately deep zone above the fragipan. The available water capacity is moderate. Where this soil is unlimed, reaction is very strongly acid or strongly acid in the root zone. The shrink-swell potential is moderate in the upper part of the subsoil and low in the lower part.

Most areas were once farmed but are reverting to natural vegetation or used for recreational purposes. This soil has high potential for trees, lawns, landscaping, pasture, hay, and as habitat for openland and woodland wildlife. It has medium potential for building site development and sanitary facilities. The potential is high for most recreational uses.

This soil is well suited to hay, pasture, trees, shrubs, and vegetable and flower gardens. In areas used for hay or pasture, an adequate plant cover must be maintained for the control of erosion. Subsurface drains are needed in the included wetter soils. This soil is subject to surface crusting after hard rains. Soil compaction is a problem if the soil is tilled when it is soft and sticky as a result of wetness. Additions of organic matter, fertilizer, and lime aid in the establishment and maintenance of lawns and gardens. Grasses and legumes that can withstand some wetness should be grown on this soil. Plants that compete with tree seedlings can be reduced by spraying, mowing, or disking.

This soil is limited as a site for buildings and sanitary facilities by seasonal wetness, slow permeability, and shrink-swell potential. Because of wetness, it is better suited to houses without basements than to houses with basements. Foundation drains and protective coatings on exterior walls help prevent wet basements. Because of potential frost action, this soil is limited for local roads and streets but can be improved for this use by installing artificial drainage and by replacing the surface layer and subsoil with a suitable base material. Sanitary facilities should be connected to central sewer and treatment facilities, if possible. This soil is well suited to such recreational uses as golf fairways and paths and trails. It is also well suited to pond reservoirs.

RsC—Rittman silt loam, 6 to 12 percent slopes. This deep soil is sloping and moderately well drained. The soil is on ridgetops and on side slopes along well defined drainageways. Most areas are long and narrow or irregularly shaped and 20 to 150 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 5 inches thick. The subsoil is about 37 inches thick. The upper part is yellowish brown, mottled, friable and firm silty clay loam; the lower part is a dense fragipan of dark yellowish brown, mottled, very firm silty clay loam. The substratum to a depth of about 60 inches is dark brown, mottled, firm silty clay loam.

Included with this soil in mapping are small areas of the Ellsworth soils, which do not have a fragipan, and eroded soils that have a surface layer of yellowish brown silty clay loam. These eroded soils are on the steeper parts of the slope and have fair tilth. These inclusions make up 15 percent of most areas.

A perched seasonal high water table is at a depth of 24 to 42 inches in winter, in spring, and during extended wet periods. Permeability is moderate above the fragipan and slow in the fragipan. Runoff is rapid. The root zone is mainly restricted to the moderately deep zone above the dense fragipan. The available water capacity is moderate. Where this soil is unlimed, reaction is very strongly acid or strongly acid in the root zone. The shrink-swell potential is moderate in the upper part of the subsoil and low in the lower part.

Most areas were once farmed but are reverting to natural vegetation or used for recreation purposes. This soil has high potential for trees, shrubs, hay, pasture, and as habitat for openland and woodland wildlife. It has medium potential for lawns, landscaping, building site development, sanitary facilities, and recreation.

This soil is suited to hay, pasture, trees, and shrubs. In areas used for hay or pasture, an adequate plant cover must be maintained for the control of erosion. This soil is subject to surface crusting after hard rains. The slope limits the use of this soil for lawns and gardens. Additions of organic matter, lime, and fertilizer aid in the establishment and maintenance of lawns, gardens, hay, and pasture. Reseeding can be done by using the no-till seeding methods or a companion crop. Surface compaction, poor tilth, and increased runoff result from overgrazing or grazing when the soil is soft and sticky as a result of wetness. Plant competition for tree seedlings can be reduced by spraying, mowing, or disking.

This soil is limited as a site for buildings and sanitary facilities by slope, seasonal wetness, and slow permeability. Cover should be maintained on the site as much as possible during construction to reduce soil loss by erosion. Because of wetness, this soil is better suited to houses without basements than to houses with basements. Foundation drains and protective coatings on exterior walls help prevent wet basements. The distribution lines in septic tank absorption fields should cross the slope to prevent seepage. Sanitary facilities should be connected to central sewer and treatment facilities, if possible. Because of potential frost action, this soil is limited for local roads and streets but can be improved for this use by installing artificial drainage and by replacing the subsoil with a suitable base material. Areas of this soil that are on both sides of small, natural drainageways are good sites for ponds. This soil is well suited to paths and trails.

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

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsurface layer is gray, mottled, friable silt loam about 4 inches thick. The subsoil is about 31 inches thick. It is light brownish gray, grayish brown, and gray silt loam and silty clay loam that is mottled and friable or firm. The substratum to a depth of about 60 inches is gray, mottled, firm silty clay loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Fitchville soils on slight rises and the more clayey Canadice soils. The Canadice and the Sebring soils are on similar parts of the landscape. These inclusions make up about 15 percent of most areas.

A perched seasonal high water table is at or near the surface in winter, in spring, and during extended wet periods. Permeability is moderately slow. The root zone is deep, and the available water capacity is high. Runoff is very slow, or the soil is ponded. The shrink-swell potential is moderate in the subsoil and substratum. Reaction in the subsoil is medium acid to very strongly acid in the upper part and medium acid to mildly alkaline in the lower part.

Most areas were once farmed but are reverting to natural vegetation or are used for recreation. This soil has low potential for building site development, sanitary facilities, recreational uses, landscaping, and lawns. It has high potential for woodland and habitat for wetland wildlife.

Wetness is the main limitation. Drained areas are suited to lawns, vegetables, hay, pasture, trees, and shrubs. Surface drains are commonly used to remove excess surface water. Subsurface drains are used to lower the seasonal high water table but establishing this type of drainage is difficult because of the low position in the landscape. Raised beds can be used to elevate the upper part of the root zone above the seasonal high water table. Perennial plants should be tolerant of wetness. This soil is poorly suited to grazing early in spring. Surface compaction, reduced growth, poor tilth, and decreased water infiltration rates result from overgrazing or grazing when the soil is soft and sticky because of wetness. Undrained areas are suited to woodland and habitat for wetland wildlife. Wetness limits the use of equipment for planting trees.

This soil is severely limited as a site for buildings, sanitary facilities, and recreation because of moderately slow permeability, ponding, and low strength. Artificial drains are somewhat effective in reducing the wetness. Because of ponding and low strength, this soil is limited for local roads but can be improved for this use by replacing the subsoil with a suitable base material and by installing artificial drainage. Building sites should be landscaped and graded to keep surface water away from foundations. Sanitary facilities should be connected to central sewer and treatment facilities, if possible. Most play areas and walkways need special surfacing.

St—Stafford Variant sandy loam. This deep soil is nearly level and somewhat poorly drained. This soil is on lake plains adjacent to beach ridges. Slope is 0 to 2 percent. Most areas are long and narrow and 5 to 50 acres in size.

Typically, the surface layer is dark grayish brown, friable sandy loam about 4 inches thick. The grayish brown, mottled subsoil is about 20 inches thick. The upper part is loose loamy sand; the middle part is very friable sandy loam; and the lower part is firm sandy clay loam. The substratum to a depth of about 60 inches is dark gray, mottled, loose loamy sand.

Included with this soil in mapping are small areas of the Haskins soils that formed in glacial outwash over glacial till or lacustrine material. This inclusion makes up about 15 percent of most areas.

A seasonal high water table is at a depth of 12 to 30 inches in winter, in spring, and during extended wet periods. Permeability is moderately rapid. Runoff is slow. The root zone is deep, and the available water capacity is low. The subsoil is strongly acid to slightly acid. The shrink-swell potential is low.

Most areas were once farmed but are reverting to natural vegetation. A few areas are used for vegetables and nurseries. This soil has medium potential for lawns, landscaping, and most recreation. It has low potential for building site development and sanitary facilities. This soil has high potential for trees, hay, pasture, and habitat for openland and woodland wildlife.

Drained areas of this soil are suited to lawns, gardens, shrubs, grasses, and legumes. Planting is delayed in undrained areas. Surface drains remove excess surface water. Subsurface drains are used to lower the seasonal high water table. Some areas are difficult to drain. When the sandy material in the substratum is saturated, it tends to flow into and plug subsurface drains. Perennial plants should be selected for tolerance to wetness. Additions of organic matter to this soil aid in establishing and maintaining lawns, gardens, and seedings for hay and pasture. This soil is poorly suited to grazing early in spring. Grazing should be controlled, especially during wet periods, to prevent excessive compaction.

Undrained areas of this soil are suited to trees and habitat for openland and woodland wildlife. The use of planting equipment is limited during wet seasons.

This soil is limited as a site for buildings and sanitary facilities by seasonal wetness and possible contamination of ground water supplies. The soil is better suited to such recreational uses as picnic areas and golf fairways than to buildings or sanitary facilities. Because of lateral movement of water in the subsoil and substratum, this soil is better suited to houses without basements than to houses with basements. Excavation is limited during winter and spring by the high water table and caving banks. Because of wetness and potential frost action, this soil is limited for local roads but can be improved for this use by installing artificial drainage and by replacing the subsoil with a suitable base material.

Tg—Tioga loam, frequently flooded. This deep soil is nearly level and well drained. This soil is on the highest parts of flood plains. Slope is 0 to 2 percent. It is frequently flooded for brief periods in the fall, winter, and spring. Most areas are long and narrow and range from 10 to 100 acres in size.

Typically, the surface layer is dark brown, very friable loam about 8 inches thick. The subsoil is about 21 inches thick. It is dark yellowish brown, very friable loam and fine sandy loam. The substratum to a depth of about 60 inches is brown and yellowish brown, stratified, loose loamy sand and gravelly loamy sand and thin layers of loose coarse sand and very friable sandy loam. In a few areas the substratum is channery or stony where a stream runs on bedrock.

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

Permeability is moderate or moderately rapid. Runoff is slow. The root zone is deep, and the available water capacity is moderate. A seasonal high water table is at a depth of 36 to 72 inches during wet periods. The surface layer and subsoil are strongly acid to neutral.

This soil is used mostly for recreational uses and woodland. It has high potential for woodland, pasture, and habitat for openland and woodland wildlife. This soil has low potential for building site development and sanitary facilities. It has medium potential for recreation.

Flooding is the main hazard for lawns, flowers, vegetables, trees, shrubs, hay, and pasture. If planted after the major threat of flooding, annual flowers and vegetables do well on this soil. Perennial plants should be selected for tolerance to brief flooding. Lawns are easy to establish during the nonflooding periods, but flooding of extended duration kills grasses. The surface layer is easily tilled through a fairly wide range of moisture content. Planting cover crops protects the surface during floods. Tree seedlings that are not damaged by floodwaters grow well if competing vegetation is controlled or removed by such practices as spraying, mowing, or disking.

This soil is seriously limited as a site for most buildings and sanitary facilities by flooding. Using dikes to control flooding is difficult. Fill can be used to elevate roads above normal flood levels. This soil is suited to extensive recreational uses, such as golf fairways, hiking trails, and picnic areas. In some places special measures are needed to control erosion and keep channels from cutting through soils.

Th—Tioga Variant loam. This deep soil is nearly level and well drained. This soil is on low stream terraces. Slope is 0 to 2 percent. It is at slightly higher positions on the landscape than the adjacent soils on first bottoms and is subject to flooding on rare occasions. Most areas are long and narrow and range from 5 to 20 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is about 25 inches thick. The upper part is yellowish brown, friable silt loam; the lower part is yellowish brown and dark yellowish brown, mottled, friable fine sandy loam and sandy loam. The substratum to a depth of about 60 inches is dark yellowish brown, friable loam and yellowish brown, loose loamy sand and gravelly loamy sand. A few areas have slopes of 3 or 4 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Euclid soils in slight depressions and seeps near breaks to the uplands. These inclusions make up about 15 percent of most areas.

Permeability is moderate or moderately rapid in the subsoil and rapid in the substratum. A seasonal high water table is at a depth of 36 to 72 inches in winter, in spring, and during extended wet periods. Runoff is slow. The root zone is deep, and the available water capacity is high. Reaction in the surface layer and subsoil is very strongly acid to medium acid.

Most areas were once farmed but are reverting to natural vegetation or are in recreational use. A few are used for pasture. This soil has a high potential for lawns, landscaping, flower and vegetable gardens, woodland, hay, pasture, and recreational uses. It has low potential for sanitary facilities and building site development.

This soil is well suited to lawns, flowers, vegetables, trees, shrubs, hay, and pasture. Flooding generally does not damage the plants. Additions of lime and organic matter aid in establishing and maintaining lawns and gardens, and seeding for hay and pasture. The surface layer is easily tilled through a fairly wide range of moisture content. Tree seedlings grow well if competing vegetation is controlled or removed by such practices as spraying, mowing, or disking.

This soil is well suited to such recreational uses as picnic areas, playgrounds, and golf fairways. The soil is flooded mainly during the period when it is not used. The flooding hazard seriously limits the use of this soil as a site for buildings. Buildings in recreational areas should be constructed with foundations and footings designed to prevent structural damage caused by flooding and frost action. Even though the soil is well suited to local roads and streets, they can be improved by replacing the surface layer and subsoil with a suitable base material. Sloughing is a hazard in excavations. Sanitary facilities are limited by wetness and the possible pollution of underground water supplies.

Ua—Udorthents, loamy. These soils are in areas of cut or fill. In areas that have been cut, the remaining soil material typically is similar to the subsoil or substratum of adjacent soils. In fill or disposal areas, the characteristics of the soil material are more varied; this soil material generally is the subsoil and substratum of nearby soils. Slope ranges from 0 to 6 percent.

Typically, the upper 60 inches is silty clay loam, clay loam, or silt loam. The surface layer is commonly littered with shale fragments and is firm and dense. Available water capacity is variable but dominantly low or very low in the root zone. Internal water movement and runoff are variable. Tilth is poor. Hard rains tend to seal the surface in poorly vegetated areas, thus reducing the infiltration rate and restricting the emergence and growth of plants. A seasonal high water table is evident in some areas, particularly where the soil is graded and depressed or bowl-shaped. The root zone is medium acid to mildly alkaline. Included with this soil in mapping are small areas where slopes are 6 to 15 percent.

In most areas, construction has taken place. About one-half of the areas have no vegetative cover. In areas where the surface is bare, the erosion hazard is severe. Suitable plant cover is needed to control erosion.

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

Ub—Urban land. Urban land is areas where more than about 80 percent of the surface is covered by asphalt, concrete, buildings, or other manmade surfaces. Examples are parking lots, shopping and business centers, and industrial parks. Areas are 10 acres or more in size and are nearly level and gently sloping.

Included in mapping are large areas that are mostly miscellaneous materials placed in fills and almost totally covered with roads, buildings, and other structures. The fill along the shore of Lake Erie consists of dredgings from Lake Erie and Cuyahoga River. Areas along the Cuyahoga River contain waste material from steel mills.

Examination and identification of soils or soil-like materials in this unit are impractical. Onsite investigation is needed to determine the potential and limitation for any proposed use.

Uc—Urban land-Allis complex. This map unit consists of areas of Urban land and a moderately deep, nearly level and gently sloping, poorly drained Allis soil. Most areas of this map unit are broad and irregularly shaped and range from 25 to 100 acres in size. They contain about 70 percent Urban land and 20 percent Allis silt loam. Areas of the Urban land and the Allis soil are so intricately mixed or so small in size that mapping them separately is not practical. Slopes range from 0 to 4 percent.

The Urban land part of the unit is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification is not feasible.

Typically, the Allis soil has a surface layer of dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 27 inches thick. It is grayish brown, mottled, very firm silty clay. The substratum is dark gray, rippable, partly weathered shale bedrock. In some places the soil has been radically altered. Some of the low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed.

Included with this complex in mapping are small areas of the somewhat poorly drained Mitiwanga soils that are on similar positions of the landscape to those of the Allis soil. Also included are small areas of the somewhat poorly drained Hornell soil that is on slight rises. These inclusions make up about 10 percent of most areas.

Most areas of this map unit are artificially drained through sewer systems, gutters, and subsurface drains. Undrained areas of Allis soil have a perched seasonal high water table near the surface in fall, winter, spring, and during extended wet periods. Permeability is slow or very slow, and runoff is slow. The root zone is mainly moderately deep to shale bedrock, and the available water capacity is low. The subsoil is extremely acid to strongly acid. The shrink-swell potential is moderate.

The Allis soil is used for parks, open space, or building sites. It has low potential for building site development, sanitary facilities, recreation, landscaping, and lawns. It has medium potential for trees and as habitat for wetland wildlife.

Drained areas of the Allis soil are suited to lawns, trees, and shrubs and moderately well suited to flowers and vegetables. Undrained areas are poorly suited to lawns, flowers, and vegetables. Perennial plants should be selected for tolerance to wetness and acid conditions. Raised beds can be used to elevate the upper part of the root zone above the seasonal high water table. Applications of lime, fertilizer, and organic matter aid in the establishment and maintenance of lawns and gardens. The spots of cut and fill are not well suited to lawns and gardens. Tilth is poor in exposed subsoil material, which is sticky when wet and hard when dry.

The Allis soil is severely limited as sites for buildings, sanitary facilities, and recreation by wetness, slow or very slow permeability, and shale bedrock at a depth of 20 to 40 inches. Central sewage systems are commonly used, although the bedrock hinders installation. Building sites should be landscaped and graded to keep surface water away from the foundations. Foundations and footings should be designed to prevent structural damage caused by frost action and by shrinking and swelling of the soil. Footer drains and coatings on exterior basement walls help keep basements dry. Because of wetness and low strength, this soil is limited for local roads. It can be improved for this use by replacing the surface layer and subsoil with a suitable base material and by installing artificial drainage.

UeA—Urban land-Elnora complex, nearly level. This map unit consists of areas of Urban land and a deep, nearly level, moderately well drained Elnora soil. Individual areas of this map unit are on low ridges on the lake plains. Most are 50 to 500 acres in size and contain about 70 percent Urban land and 20 percent Elnora loamy fine sand. Areas of the Urban land and the Elnora soil are so intricately mixed or are so small that mapping them separately is not practical. Slopes range from 0 to 3 percent.

The Urban land part of the unit is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification is not feasible.

Typically, the Elnora soil has a surface layer of very dark grayish brown, very friable loamy fine sand about 9 inches thick. The subsoil is about 23 inches thick. It is yellowish brown, very friable loamy fine sand that is mottled in the lower part. The substratum to a depth of about 60 inches is grayish brown, brown, and yellowish brown stratified, loose fine sand and loamy fine sand. In places, the soil has been radically altered. Some low areas have been filled or leveled during construction, and other areas have been cut, built up, or smoothed.

Included with this complex in mapping are small areas of the well drained Oshtemo soils on higher convex parts of the landscape and the somewhat poorly drained Fitchville, Jimtown, and Haskins soils and the Stafford Variant on flats. These inclusions make up about 10 percent of most areas.

Most areas of this map unit are artificially drained by sewer systems and gutters. Areas of Elnora soil that are not drained have a seasonal high water table at a depth of 18 to 24 inches in late winter, in spring, and during extended wet periods. Permeability is moderately rapid or rapid. Runoff is slow. The root zone is deep, and the available water capacity is low. The subsoil is strongly acid or medium acid.

The Elnora soil is used for parks, open space, building sites, lawns, and gardens. It has medium potential for lawns, vegetable and flower gardens, trees, shrubs, and recreational uses. This soil has medium or low potential for building site development.

The Elnora soil is suited to grasses, flowers, vegetables, trees, and shrubs. Wetness early in spring and droughtiness in summer are major limitations. Watering is needed during dry periods. Additions of organic matter aid in the establishment and growth of flowers and vegetables. Seeding should be done late in summer, and plants should be mulched and watered.

This soil is limited as a site for buildings by seasonal wetness. Because of lateral movement of water in the substratum, the soil is better suited to houses without basements than to houses with basements. Sloughing is a hazard in excavation. Most of the sewage is centrally treated. Because of seepage, contamination of ground water by sanitary facilities is possible. The sandy surface layer limits recreational use of this soil.

UmB—Urban land-Mahoning complex, undulating. This map unit consists of Urban land and of a deep, somewhat poorly drained, undulating Mahoning soil. Individual areas of this map unit are on till plains and the higher parts of lake plains. They are broad and irregularly shaped and range from 30 to over 500 acres in size. They contain about 70 percent Urban land and 20 percent Mahoning silt loam. Areas of the Urban land and the Mahoning soil are so intricately mixed or so small in size that mapping them separately is not practical. Slopes range from 0 to 6 percent.

The Urban land part of the unit is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification is not feasible.

Typically, the Mahoning soil has a surface layer of dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 32 inches thick. It is yellowish brown, dark yellowish brown, and olive brown silty clay loam that is mottled and firm. The substratum to a depth of about 60 inches is olive brown, mottled, firm silty clay loam and clay loam. In places the soil has been radically altered. Some low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed.

Included with this soil in mapping are small areas of the moderately well drained Ellsworth soils on rises and the poorly drained Condit soils in depressions. Inclusions make up about 10 percent of most areas.

Most areas of this map unit are artificially drained by sewer systems, gutters, and subsurface drains. Undrained areas of the Mahoning soil have a perched seasonal high water table at a depth of 12 to 30 inches. Permeability is slow or very slow. Where this soil is unlimed, reaction is strongly acid or very strongly acid in the surface layer and upper part of the subsoil. The shrink-swell potential is moderate. Runoff from the Mahoning soil is slow and medium.

The Mahoning soil is used for parks, open space, building sites, and, to a lesser extent, for lawns and gardens. It has medium potential for lawns and landscaping and high potential for trees. The potential for building site development and sanitary facilities is low. This soil has medium or low potential for recreation uses.

Lawns, flowers, vegetables, and shrubs grow well on the Mahoning soil when it is drained. Subsurface drains must be closely spaced to remove excess water uniformly. Perennial plants should be selected for tolerance to wetness. The additions of organic matter to this soil aid in establishing and maintaining lawns and gardens and in increasing the rate of water infiltration. The spots of cut and fill are not well suited to lawns and gardens. Tilth is poor in exposed subsoil material, which is sticky when wet and hard when dry.

The Mahoning soil is severely limited as a site for buildings and most sanitary facilities by a seasonal high water table, low strength, and slow or very slow permeability. These limitations can be partly or fully overcome by specially designed facilities. Building sites should be landscaped and graded to keep surface water away from foundations. Footer drains and coatings on exterior basement walls help keep basements dry. Foundations and footings should be designed to prevent structural damage caused by frost action and by shrinking and swelling of the soil. Because of wetness and low strength, this soil is limited for local roads. It can be improved by installing artificial drainage and by replacing the surface layer and subsoil with a suitable base material. Most sanitary facilities are connected to central sewers and treatment facilities. Runoff and erosion increase during construction. These can be reduced by maintaining soil cover, wherever possible.

UnB—Urban land-Mitiwanga complex, undulating. This map unit consists of Urban land and a moderately deep, somewhat poorly drained, undulating Mitiwanga soil. Individual areas of this map unit are on till plains. Most are broad and irregularly shaped and range from 20 to 100 acres in size. They contain about 70 percent Urban land and about 20 percent Mitiwanga silt loam. Areas of the Urban land and the Mitiwanga soil are so intricately mixed or so small in size that mapping them separately is not practical. Slopes range from 0 to 6 percent.

The Urban land part of the unit is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification is not feasible.

Typically, the Mitiwanga soil has a surface layer of dark grayish brown, friable silt loam about 11 inches thick. The subsoil is yellowish brown, mottled, friable silty clay loam about 11 inches thick. The substratum, to a depth of about 28 inches, is yellowish brown, mottled, friable flaggy loam. Under this is sandstone bedrock. In some places the soil has been radically altered. Some low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed.

Included with the complex in mapping and on similar positions of the landscape as those of the Mitiwanga soil, are small areas of the deep Darien soils and of the moderately deep Allis soils that are underlain by rippable shale bedrock. Also included are small areas of the moderately deep Hornell and Loudonville soils on rises. These inclusions comprise about 10 percent of most areas.

Most areas of this map unit are artificially drained by sewer systems, gutters, and subsurface drains. Undrained areas of the Mitiwanga soil have a perched seasonal high water table at a depth of 12 to 30 inches. Permeability is moderate. Reaction is very strongly acid to medium acid in the surface layer and extremely acid to strongly acid in the subsoil. The shrink-swell potential is moderate in the subsoil and low in the substratum.

The Mitiwanga soil is used for parks, open space, building sites, and, to a lesser extent, for lawns and gardens. It has low potential for building site development and sanitary facilities. This soil has medium potential for lawns and landscaping and high potential for open space and trees. This soil has medium to low potential for recreation uses.

Lawns, flowers, vegetables, and shrubs grow well if the Mitiwanga soil is drained. Perennial plants should be selected for tolerance to wetness. This soil puddles and clods if worked when soft and sticky. Additions of lime, fertilizer, and organic matter aid in establishing and maintaining lawns and gardens, in increasing the rate of water infiltration, and in reducing crusting. The spots of cut and fill are not well suited to lawns and gardens. Tilth is poor in exposed subsoil material, which is sticky when wet and hard when dry.

The Mitiwanga soil is severely limited for building sites, sanitary facilities, and some recreational uses by seasonal wetness and hard bedrock, which is at a depth of 20 to 40 inches. Blasting bedrock is generally necessary to construct basements. Building sites should be landscaped and graded to keep surface water away from the foundations. Foundations and footings should be designed to prevent structural damage caused by frost action and by shrinking and swelling of the soil. Footer drains and coatings on exterior basement walls help keep basements dry. Because of potential frost action and low strength, this soil is limited for local roads, but can be improved for this use by installing artificial drainage and replacing the surface layer and subsoil with a suitable base material. Central sewage systems are commonly used, although the bedrock makes their installation difficult.

UoB—Urban land-Oshtemo complex, undulating. This map unit consists of Urban land and a deep, well drained Oshtemo soil. Individual areas of this map unit are on beach ridges. They are long and narrow and contain about 70 percent Urban land and about 20 percent Oshtemo sandy loam. Areas of the Urban land and Oshtemo soil are so intricately mixed or so small that mapping them separately is not practical. Slopes range from 2 to 8 percent.

The Urban land part of the unit is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification is not feasible.

Typically, the Oshtemo soil has a surface layer of dark grayish brown, very friable sandy loam about 8 inches thick. The subsurface layer is yellowish brown, very friable sandy loam about 6 inches thick. The subsoil is about 37 inches thick. The upper part is brown, very friable sandy loam; the lower part is brown, loose and very friable loamy sand. The substratum to a depth of about 60 inches is brown, loose sand. In places the soil has been radically altered. Some low areas have been filled or leveled during construction, and other areas have been cut, built up, or smoothed.

Included with this complex in mapping are small areas of the Mentor soils that formed in silty sediments and the Chili soils that formed in outwash deposits containing more gravel. These inclusions make up about 10 percent of most areas.

The Oshtemo soil has moderately rapid permeability in the subsoil and very rapid permeability in the substratum. The root zone is deep, and the available water capacity is low or moderate. Reaction of the surface layer and subsoil are strongly acid or medium acid. The shrink-swell potential is low.

The Oshtemo soil is used for parks, open space, building sites, and, to a lesser extent, for lawns and gardens. It has high potential for building site development, recreation uses, lawns, flower gardens, trees, and shrubs.

The Oshtemo soil is well suited to grasses, flowers, vegetables, trees, and shrubs. It is especially well suited to deep rooted plants. This soil warms and dries early in spring and is droughty during dry periods. It is suited to irrigation. Erosion is generally not a major problem unless the soil is disturbed and left unprotected. Lawns should be seeded late in summer and should be mulched and watered. Additions of organic matter aid in establishing and maintaining lawns and gardens. The spots of cut and fill are not well suited to lawns and gardens.

This soil is a good site for buildings, local roads and streets, and most recreation. Most sewage is centrally treated. Sloughing is a hazard in excavations.

WaA—Wadsworth silt loam, 0 to 2 percent slopes. This deep soil is nearly level and somewhat poorly drained. This soil is on uplands. Most areas are broad, long and narrow, or irregularly shaped and range from 5 to 175 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 40 inches thick. The upper part is yellowish brown, mottled, friable to very firm silt loam and silty clay loam; the middle part is a dense fragipan of yellowish brown and dark brown, mottled, very firm silty clay loam and silt loam; and the lower part is dark brown, mottled firm silty clay loam. The substratum to a depth of about 60 inches is dark brown, mottled, firm silty clay loam.

Included with this soil in mapping are small areas of the Mahoning soils, which do not have a fragipan. The Wadsworth and the Mahoning soils are on similar parts of the landscape. This inclusion makes up about 15 percent of most areas.

Permeability is moderately slow or moderate above the fragipan and slow or very slow in the fragipan. Runoff is slow. The root zone is moderately deep to the fragipan. The available water capacity is moderate. A perched seasonal high water table is at a depth of 12 to 30 inches in winter and in spring and during extended wet periods. Where this soil is unlimed, it is very strongly acid to medium acid in the root zone.

Most areas were once farmed but are reverting to natural vegetation or used for recreational purposes. This soil has medium potential for landscaping and lawns. It has high potential for trees, shrubs, hay, and pasture. It has low potential for building site development and sanitary facilities. The potential for recreation is medium or low.

If drained, this soil is suited to grasses, legumes, lawns, flowers, vegetables, and shrubs. Planting is delayed in undrained areas. A combination of surface and subsurface drains is commonly used to improve drainage. Subsurface drains must be closely spaced to give uniform drainage. This soil puddles and clods if worked when it is soft and sticky as the result of wetness. Additions of organic matter aid in establishing lawns and gardens. Perennial plants should be selected for tolerance to wetness. Grazing should be controlled to prevent excessive compaction. Undrained areas of this soil are suited to woodland; however, the use of planting and harvesting equipment is limited during wet seasons.

This soil is severely limited as a site for buildings and most sanitary facilities by seasonal wetness and slow or very slow permeability. Ditches and subsurface drains are used to remove excess water. Building sites should be landscaped and graded to keep surface water away from foundations. Because of wetness, this soil 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. Because of potential frost action and low strength, this soil is limited for local roads but can be improved for this use by installing artificial drainage and by replacing the surface layer and subsoil with a suitable base material. This soil is well suited to pond reservoirs and sewage lagoons; however, sanitary facilities should be connected to central sewers and treatment facilities, if possible. Drainage is needed for intensive recreation uses, such as ball diamonds and tennis courts.

WaB—Wadsworth silt loam, 2 to 6 percent slopes. This deep soil is gently sloping and somewhat poorly drained. This soil is on low knolls on uplands. Most areas are broad or irregularly shaped and 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 40 inches thick. The upper part is yellowish brown, mottled, friable and firm silt loam and silty clay loam; the middle part is a dense fragipan of yellowish brown and dark brown, mottled, very firm silty clay loam; and the lower part is dark brown, mottled, firm silty clay loam. The substratum to a depth of about 60 inches is dark brown, mottled, firm silty clay loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Fitchville and the Mahoning soils, which do not have a fragipan. The Wadsworth, the Fitchville, and the Mahoning soils are on similar parts of the landscape. Small areas of the moderately well drained Rittman soils are on some of the higher knolls. The inclusions comprise about 15 percent of most areas.

Permeability is moderately slow or moderate above the fragipan and slow or very slow in the fragipan. Runoff is medium. The root zone is moderately deep to the fragipan. The available water capacity is moderate. A perched seasonal high water table is at a depth of 12 to 30 inches in winter and in spring and during extended wet periods. Where this soil is unlimed, it is very strongly acid to medium acid in the root zone.

Most areas were once farmed but are reverting to natural vegetation or are used for parks. This soil has medium potential for lawns and landscaping. It has high potential for trees, shrubs, hay, and pasture. It has low potential for building site development and sanitary facilities. The potential for recreation is medium or low.

If drained, this soil is suited to grasses, legumes, lawns, flowers, vegetables, and shrubs. Planting is delayed and lawns remain wet later in spring in undrained areas. The soil warms and dries slowly in spring, even if it is artificially drained. Subsurface drains are commonly used to improve drainage; however, they must be closely spaced to give uniform drainage. This soil puddles and clods if it is worked when soft and sticky as the result of wetness. Erosion is a hazard where the soil is disturbed and not reseeded or mulched. Additions of organic matter aid in establishing lawns and gardens and reduce crusting. Perennial plants should be selected for tolerance to wetness. Grazing should be controlled to prevent excessive compaction. Undrained areas of this soil are suited to woodland; however, the use of planting and harvesting equipment is limited during wet seasons.

This soil is severely limited as a site for buildings and most sanitary facilities by seasonal wetness and slow or very slow permeability. Ditches and subsurface drains are used to improve drainage. Even though the slope provides some surface drainage, building sites should be landscaped and graded to keep surface water away from foundations. Foundations and footings should be designed to prevent structural damage caused by frost action. Because of potential frost action and low strength, this soil is limited for local roads but can be improved for this use by installing artificial drainage and by replacing the surface layer and subsoil with a suitable base material. This soil is well suited to pond reservoirs and moderately well suited to sewage lagoons, but sanitary facilities should be connected to central sewers and treatment facilities. Drainage is needed for intensive recreation, such as ball diamonds and tennis courts.

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

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.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Soil maps for detailed planning." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

More than 16,000 acres in the survey area was used for cropland and pasture in 1967, according to the Conservation Needs Inventory (*8*). Of this total, 1,000 acres was used for permanent pasture; 2,349 acres for row crops; 770 acres for close-grown crops; 1,468 acres for hayland; 400 acres for orchards, vineyards, and bush fruit; the rest was open land that was formerly cropped.

Soil drainage is the major management need on more than three-fourths of the acreage used for crops and pasture in the survey area. Unless artificially drained, the poorly drained, somewhat poorly drained, and very poorly drained soils are so wet that crops are damaged during most years. In this category are the Allis, the Canadice, the Caneadea, the Carlisle, the Condit, the Darien, the Euclid, the Fitchville, the Haskins, the Holly, the Hornell, the Jimtown, the Mahoning, the Mermill, the Miner, the Mitiwanga, the Orrville, the Sebring, the Wadsworth soils and the Stafford Variant.

The Bogart, the Ellsworth, the Glenford, and the Rittman soils have good natural drainage most of the year, but they tend to dry slowly after rains. These moderately well drained soils, especially those that have slopes of 2 to 6 percent, contain small areas of wetter soils along drainageways and in swales. Artificial drainage is needed in some of these wetter soils.

The design of both surface and subsurface drainage systems varies with the kind of soil. A combination of surface and subsurface drainage is needed in most areas of poorly drained and very poorly drained soils used for intensive row cropping. Drains have to be more closely spaced in soils with slow permeability or very slow permeability than in the more permeable soils. Soils such as the Stafford Variant are difficult to drain because when the sandy material in the substratum is saturated it tends to flow and plug the subsurface drains. Finding adequate outlets for subsurface drainage systems is difficult in many areas of the Carlisle, the Canadice, the Condit, the Holly, the Mermill, the Miner, and the Sebring soils. Information about the design of drainage systems for each kind of soil is contained in the Technical Guide, available in the local office of the Soil Conservation Service.

Soil erosion is a major problem on slightly less than 20 percent of the acreage used for cropland and pasture in Cuyahoga County. If the slope is more than 2 percent, erosion is a hazard. The most common soils used for cropland that generally require erosion control are the Ellsworth, the Glenford, the Loudonville, the Mahoning, the Rittman, and the Wadsworth soils. Some of the sandier soils, such as the Oshtemo and the Stafford Variant, are subject to soil blowing when used for cropland. Common erosion control practices used in the county are grassed waterways, diversions, contour tillage, using crop residues and cover crops, and maintaining close-growing crops for cover.

Information about the design of erosion control practices for each kind of soil is contained in the Technical Guide, available in the local office of the Soil Conservation Service.

Soil fertility is naturally low and the surface is strongly acid or very strongly acid in most unlimed soils in the survey area. Some soils are difficult to lime adequately because of the high content of free aluminum. The soils that have a coarser textured subsoil, such as the Bogart, the Chile, and the Oshtemo soils and the Stafford Variant, hold and retain smaller amounts of plant nutrients. Smaller but more frequent applications of lime and fertilizer are needed. 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 that are used for crops have a silt loam surface layer that is light in color and is moderate or moderately low in organic matter. Intense rainfall causes the formation of crust on the surface. When the soil is dry, the crust is hard and nearly impervious to water. Once the crust forms, it reduces the infiltration and increases runoff. Regular additions of crop residues and other organic material can improve soil structure and reduce the likelihood of crusting.

The surface layer of the Canadice and the Condit soils contains more clay than that of other soils in the survey area. Poor tilth can be a problem, because these soils stay wet until late spring.

The soils that have a loam and sandy loam surface layer, such as the Chili and the Oshtemo soils, have good tilth. They can be worked through a fairly wide range of moisture content.

Pasture is a minor land use in Cuyahoga County. Most areas used for pasture are on soils that have potential for cropland. Some of the soils used for pasture are subject to erosion, have low fertility, and commonly have poor tilth. Soils that require drainage for maximum growth of row crops also require drainage for maximum growth of pasture plants. Important in managing pasture are erosion control, drainage, additions of lime and fertilizer, keeping compaction to a minimum, and controlling weeds and brush. The latest information about seeding mixtures, herbicide treatment, and other management for specific soils can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Special crops are grown for commercial use in Cuyahoga County. They include nursery stock, vegetables, grapes, and fruit from orchards. No attempt will be made in this section to give specific practices, fertilizer rates, or seed varieties for these crops. A high level of management is needed to successfully produce these crops. The latest information about grazing special crops can be obtained from the local offices of the Cooperative Extension Service and the Soil Conservation Service.

Use of the soils for landscaping and gardening

Alexander Ritchie, Jr., soil survey coordinator, Ohio Division of Lands and Soil, prepared this section.

Table 5 lists examples of vines, ground covers, shrubs, trees, grasses, and legumes that are suitable for the soil in the county. Users of table 5 should consult local nurserymen, horticulturists, landscape designers, extension agents, or horticultural references for many additional species that can be used on the named soils. The 1972 U.S. Department of Agriculture Yearbook, "Landscape for Living," covers many aspects of landscaping in urban areas, especially effects of heat from pavements, salts, shade, and microclimates of individual yards (*13*).

Many of the soils in Cuyahoga County have been disturbed to some degree during excavation for utilities and foundations for buildings and during construction of roads and walks. This is especially true of soils in Urban land-soil or soil-Urban land complexes and soils that have been cut and filled. The species of plants in table 5 ordinarily do well on the specified soils unless the soil has been severely altered physically or chemically. The soils close to construction are most likely to be radically altered.

The following factors, in addition to those already mentioned, need to be considered before plants for landscaping in Cuyahoga County are selected.

Shade. Any map unit that is dominated by Urban land has a high density of buildings. As a result, the soil that is available between or around the buildings may be in shade much of the day. Although broadleaf evergreens generally do well in these shaded locations, most of the common flowers and vegetables do poorly. In the Urban land complexes, careful observation of shade patterns are needed before plants are chosen.

Wetness. Some plants do not thrive in wet soils, such as the Allis or the Sebring soils. Plants tolerant of wetness should be selected. Some things can be done to overcome the wetness. One is to install surface drainage, if the soil is permeable enough for excess water to move through the soil to the drain line. Another approach is to bring in new soil and use raised beds to drain the area and to attain a satisfactory rooting zone. In other places, the problem may be runoff from adjacent slopes accumulating as ponded water on low-lying plantings. In urban areas, alleviating wetness is sometimes difficult because of property line restrictions that limit the alternatives.

Restricted root zone. Generally, soils that have a restricted root zone do not hold enough moisture for plants throughout the growing season. If the Allis, the Hornell, the Loudonville, the Mitiwanga, the Rittman, or the Wadsworth soils have been severely graded during construction, the underlying bedrock or the dense compact layers in the subsoil may be exposed or left within a few inches of the surface. Trees, shrubs, lawns, and gardens planted under these conditions are likely to do poorly. Roots are restricted by the bedrock or dense layers; therefore, plants have a very limited amount of available water during dry seasons and are susceptible to frost heave during freezing and thawing. Slopes of these soils may contribute runoff or seepage to driveways and walks, causing wet, messy conditions in warm weather and ice hazards in winter.

Where root-restricted layers are near the surface, the root zone can be thickened by adding topsoil and by mixing as much organic matter as possible into the overlying soil. This also increases the available water capacity of the soil.

Use of the soils for flower and vegetable gardens

Alexander Ritchie, Jr., soil survey coordinator, Ohio Division of Lands and Soil, prepared this section.

Flowers and vegetables suitable for the soils in the county are not included in table 5, because the list of adapted flowers and vegetables is extensive and many flowers and vegetables have about the same soil requirements. Rather than attempt to provide a list of species suitable for each kind of soil, this section describes the characteristics for a good garden soil, the soils in Cuyahoga County that have the most favorable soil characteristics for gardening, and the soil features that restrict the use of some soils.

The most favorable soil for a garden is nearly level or gently sloping, loamy, and permeable. The soil is adequately aerated but has moderate or high available water capacity. The pH value should be generally between 6.0 and 7.0. Most soils in Cuyohoga County are naturally very strongly acid to medium acid and require liming. The amount of lime to be added should be determined by soil tests. Many soils in Cuyahoga County have a moderate or moderately low organic matter content in the surface layer. Regardless of the kind of soil indicated by the soil map, additions of peat moss, humus, or compost in the surface layer benefit flowers and vegetables.

The soils in Cuyahoga County that are well suited to flower and vegetable gardens, are the nearly level Tioga Variant and the gently sloping Glenford soils, if they are undisturbed or only slightly disturbed. These soils are deep, well drained or moderately well drained, and easily tilled, also, they have a moderate or high available water capacity.

The Bogart and the Elnora soils, the nearly level and the gently sloping phases of the Chili and the Oshtemo soils, and the gently sloping phase of Loudonville soils are not desirable for flowers and vegetable gardens because the available water capacity is less than is needed for optimum plant growth or the soils contain many fine to coarse stones that interfere with tillage. Although they are the earliest to warm in spring, they do not hold enough water to carry flowers and vegetables through the normal growing season without irrigation.

The Ellsworth and the Rittman soils are moderately well drained. Planting in spring is usually delayed because of wetness.

The Chagrin and the Tioga soils are well drained but are subject to flooding in most places, which limits gardening in most years.

The Caneadea, the Darien, the Euclid, the Fitchville, the Haskins, the Hornell, the Jimtown, the Mahoning, the Mitiwanga, the Orrville, the Wadsworth soils and the Stafford Variant are limited for most flowers and vegetables because of wetness. Wetness may delay planting in spring 2 to 4 weeks after the frost-free dates. Tillage is a little more difficult on the Mahoning, the Caneadea, and the Hornell soils because the surface layer contains slightly more clay than the other soils. Orrville soils are subject to flooding, which limits gardening in most years.

Unless drained, the Allis, the Canadice, the Carlisle, the Condit, the Holly, the Mermill, the Miner, and the Sebring soils are too wet for most flowers and vegetables. Most of these soils are in low positions in the landscape where crops can be damaged by frost.

The Dekalb, the Geeburg, the Brecksville, the Mentor, and the steeper phases of the Ellsworth and the Loudonville soils are very poorly suited to gardens because of the slope.

Recreation

Cuyahoga County is quite fortunate in having many recreational areas where activities are varied. The Cleveland Metropolitan Park District has over 17,500 acres surrounding Cleveland like an emerald necklace. Most municipalities have various recreational areas, and the Cuyahoga Valley National Historical Park and Recreational Area is partly in Cuyahoga County. Because the northern edge of the county borders Lake Erie, numerous public and private recreational facilities provide for fishing, swimming, and boating. About 30 private and publicly owned golf courses are in the county.

The major parks are along the major rivers in the county. They include the flood plains and steep and very steep valley side slopes. They have great scenic value but are severely limited for urban development.

The soils of the survey area are rated in table 6 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 by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 6, 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 6 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 9 and interpretations for dwellings without basements and for local roads and streets in table 8.

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 7, 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 bluegrass.

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, hackberry, and black walnut. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are shrub honeysuckle, autumn-olive, and crabapple.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, hemlock, 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, slope, and surface stoniness. Examples of wetland plants are duckweed, wild millet, willows, 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 ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy, shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, 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 8 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 9 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 9 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 plastic tubing. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 9 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 9 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 10 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, 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. Table 12 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 used in great quantities in many kinds of construction. The ratings in table 10 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 12.

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 11 gives information on the soil properties and site features that affect water management. The kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. This table also gives for each soil the restrictive features that affect drainage, irrigation, 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.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

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 properties and classification

Table 12 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 morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*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 of the soils

Table 13 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 13, 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 14 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 14 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered is local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 14 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 14.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

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

Eight soils in Cuyahoga County were sampled and laboratory data were determined by the Soil Characterization Laboratory, Department of Agronomy, Ohio State University, Columbus, Ohio. The physical and chemical data obtained on most samples 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 evaluating their behavior under various land uses. The data from these eight profiles were selected as representative for the respective series and are described in this survey. These soil series and their laboratory identification numbers are: Mitiwanga (CY-1), Condit (CY-2), Brecksville (CY-3), Chagrin (CY-4), Hornell (CY-5), Ellsworth (CY-6), Allis (CY-7), and Mahoning (CY-8).

In addition to the data on soils of Cuyahoga County, laboratory data are also available for many of the same soils from nearby counties in northeastern Ohio. These data and the Cuyahoga County data are on file at the Department of Agronomy, 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 these data have been published as a part of special studies of soils in Ohio (*10*).

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*14*). 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 15, 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 Aqualfs (*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 thought to be 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 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 (*12*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*14*). 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 "Soil maps for detailed planning."

Allis series

The Allis series consists of moderately deep soils that are poorly drained and slowly or very slowly permeable. These soils are on lake plains. They formed in glacial till derived mainly from shale. Slope is 0 to 2 percent.

Allis soils are commonly adjacent to the Hornell, the Mahoning, and the Miner soils and are similar to the Condit and the Hornell soils. The Hornell and the Mahoning soils are better drained than the Allis soils and are less gray in the subsoil. The Mahoning, the Condit, and the Miner soils are less acid, are deep to bedrock, and have an argillic horizon. Miner soils are also wetter than the Allis soils and have a darker colored surface layer.

Typical pedon of Allis silt loam, in Bay Village, Huntington Park, 2,625 feet west of the intersection of Wolf Road and Cahoon Road along Wolf Road, then 187 feet north.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine granular structure; friable; common roots; 2 percent coarse fragments; strongly acid; clear smooth boundary.

B1g—3 to 7 inches; grayish brown (10YR 5/2) silt loam; few fine prominent brownish yellow (10YR 6/8) mottles; moderate medium and fine subangular blocky structure; friable; common roots; very strongly acid; clear smooth boundary.

B21g—7 to 15 inches; grayish brown (2.5Y 5/2) silty clay; common medium prominent strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; few roots; grayish brown (2.5Y 5/2) coatings on faces of peds; extremely acid; clear smooth boundary.

B22g—15 to 22 inches; grayish brown (2.5Y 5/2) silty clay; many medium prominent strong brown (7.5YR 5/6) mottles, moderate coarse prismatic structure; very firm; few roots; grayish brown (2.5Y 5/2) coatings on faces of peds; 2 percent shale fragments; extremely acid; clear smooth boundary.

B31g—22 to 28 inches; grayish brown (2.5Y 5/2) shaly silty clay; many medium prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; very firm; few roots; grayish brown (2.5Y 5/2) coatings on faces of peds; 20 percent shale fragments; extremely acid; abrupt smooth boundary.

B32g—28 to 35 inches; dark brown (10YR 3/3) silty clay loam; few fine distinct grayish brown (2.5Y 5/2) and many medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; very firm; few roots; grayish brown (2.5Y 5/2) coatings on faces of peds; 5 percent shale fragments; extremely acid; abrupt smooth boundary.

Cr—35 inches; dark gray (10YR 4/1) partly weathered rippable shale bedrock; extremely acid.

The thickness of the solum and depth to shale bedrock are 20 to 40 inches. Coarse fragments range from 2 to 25 percent in the solum. The solum ranges from extremely acid to strongly acid throughout.

The Ap and A1 horizons have hue of 10YR and value and chroma of 2 to 4. The B2 horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 0 to 4. It is silty clay loam, silty clay, or clay, or their shaly analogs. In some pedons, there is a C horizon, 2 to 6 inches thick.

Bogart series

The Bogart series consists of deep soils that are moderately well drained. These soils are on stream terraces. A few areas of the soils are on end moraines. These soils formed in stratified deposits of glacial outwash. Permeability is moderate or moderately rapid in the solum and rapid or very rapid in the underlying material. Slope ranges from 2 to 6 percent.

Bogart soils are commonly adjacent to the Chili, the Glenford, and the Jimtown soils. The Chili soils are better drained than the Bogart soils and do not have mottles in the subsoil. Glenford soils formed in lacustrine deposits. The Jimtown soils are wetter than the Bogart soils and have lower chroma in the subsoil.

Typical pedon of Bogart loam, 2 to 6 percent slopes, in Glenwillow, 3,300 feet west of the intersection of Pettibone Road and State Route 91 along Pettibone Road, then 132 feet south.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) loam; moderate medium and fine granular structure;

friable; many roots; 5 percent gravel; neutral; clear smooth boundary.

B1—10 to 17 inches; yellowish brown (10YR 5/4) gravelly sandy loam; common medium faint dark brown (7.5YR 4/4) and few medium faint brown (10YR 5/3) mottles; weak medium and fine granular structure; friable; common roots; thin very patchy brown (10YR 5/3) clay films on faces of peds; 15 percent gravel; medium acid; clear smooth boundary.

B21t—17 to 28 inches; yellowish brown (10YR 5/4) gravelly sandy clay loam; common medium distinct gray (10YR 5/1) and common medium faint dark brown (7.5YR 4/4) mottles; weak medium and fine subangular blocky structure; friable; few roots; thin patchy gray (10YR 5/1) clay films on faces of peds, in pores, and bridging sand grains; 15 percent gravel; very strongly acid; clear smooth boundary.

B22t—28 to 37 inches; yellowish brown (10YR 5/4) gravelly sandy clay loam; many medium faint dark brown (7.5YR 5/4) and common medium distinct light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; few roots; thin patchy light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) clay films on faces of peds and bridging sand grains; 25 percent gravel; common very dark gray (10YR 3/1) concretions; very strongly acid; clear smooth boundary.

B3—37 to 49 inches; yellowish brown (10YR 5/4) gravelly clay loam; common medium distinct grayish brown (10YR 5/2) and common medium faint dark brown (7.5YR 4/4) mottles; massive; friable; 30 percent coarse fragments; slightly acid; clear smooth boundary.

C—49 to 60 inches; dark brown (10YR 4/3) gravelly sandy loam; common medium distinct yellowish brown (10YR 5/6) and few medium distinct gray (10YR 5/1) mottles; massive; very friable; 25 percent gravel; neutral.

The solum ranges from 35 to 49 inches in thickness. The Ap horizon is from 2 to 15 percent, by volume, coarse fragments; the B horizon is 5 to 30 percent coarse fragments; and the C horizon is 15 to 50 percent coarse fragments.

The Ap horizon is very strongly acid to slightly acid, except where it is unlimed. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is loam, sandy loam, sandy clay loam, or clay loam and their gravelly analogs. The C horizon is gravelly loam or gravelly sandy loam. In some pedons there are thin subhorizons of loamy sand. The C horizon is slightly acid or neutral.

Brecksville series

The Brecksville series consists of moderately deep soils that are well drained and slowly permeable. These soils formed in residuum of shale bedrock on uplands (fig. 11). Slope ranges from 25 to 70 percent.

Brecksville soils are commonly adjacent to the Dekalb, the Ellsworth, the Geeburg, the Hornell, and the Mentor soils. The Dekalb soils contain more sand and coarse fragments throughout the soil than the Brecksville soils and are moderately deep to sandstone bedrock. The Ellsworth, the Geeburg, and the Mentor soils are deep to bedrock and have an argillic horizon. Hornell soils are wetter than the Brecksville soils and are more gray in the subsoil.

Typical pedon of Brecksville silt loam, 25 to 70 percent slopes, in Mayfield, approximately 4,000 feet east and 315 feet north of the intersection of State Route 91 and Highland Road, in the North Chagrin Reservation of the Cleveland Metropolitan Parks system.

A1—0 to 2 inches; very dark gray (10YR 3/1) silt loam; moderate fine granular structure; friable; many roots; very strongly acid; abrupt smooth boundary.

B1—2 to 6 inches; yellowish brown (10YR 5/4) silt loam; weak medium and fine subangular blocky structure; friable; many roots; 5 percent coarse fragments; very strongly acid; clear smooth boundary.

B21—6 to 14 inches; yellowish brown (10YR 5/4) silt loam; few fine faint yellowish brown (10YR 5/6) mottles; moderate medium and coarse subangular blocky structure; firm; common roots; 5 percent coarse fragments; very strongly acid; abrupt smooth boundary.

B22—14 to 22 inches; light olive brown (2.5Y 5/4) silty clay loam; few fine faint light olive brown (2.5Y 5/6) mottles; weak thin platy structure; firm; few roots; 8 percent shale fragments; very strongly acid; clear smooth boundary.

B3—22 to 27 inches; light olive brown (2.5Y 5/4) shaly silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak thin platy structure; firm; few roots; 20 percent shale fragments; very strongly acid; clear smooth boundary.

C—27 to 30 inches; light olive brown (2.5Y 5/4) shaly silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; 30 percent shale fragments; very strongly acid; abrupt smooth boundary.

Cr—30 to 36 inches; olive brown (2.5Y 4/4) thin bedded soft shale bedrock; can be cut with difficulty with a spade.

Thickness of the solum and depth to paralithic contact of shale is from 20 to 40 inches. Coarse fragments of shale or siltstone are throughout the solum and substratum. The A horizon is from 0 to 5 percent, by volume, coarse fragments; the B horizon is 5 to 25 percent coarse fragments; and the C horizon is 20 to 40 percent coarse fragments.

The A1 horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. It is very strongly acid or strongly acid.

Figure 11.—Outcropping of shale bedrock at the junction of the east and west branches of Rocky River. The Brecksville soils formed in residuum from this bedrock.

The B horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 or 4. It is dominantly silty clay loam or shaly silty clay loam. Subhorizons of silt loam are in the upper part, and thin subhorizons of shaly silty clay and silty clay are in the lower part of some pedons. The B horizon ranges from extremely acid to strongly acid. The C horizon has hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 1 to 4. Reaction is extremely acid to strongly acid.

Canadice series

The Canadice series consists of deep soils that are poorly drained and very slowly permeable. These soils formed in sediments in basins of former glacial lakes. Slope is 0 to 2 percent.

Canadice soils commonly are near the Caneadea and the Sebring soils and are similar to Condit soils. Caneadea soils are better drained than the Canadice soils and are less gray in the subsoil. Condit soils formed in glacial till and contain more coarse fragments in the subsoil and substratum than Canadice soils. Sebring soils have less clay in the subsoil and substratum.

Typical pedon of Canadice silty clay loam, in Solon, 2,000 feet northwest of the intersection of State Route 43 and the Geauga County line along State Route 43, then 1,000 feet south.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate medium and fine granular structure; friable; many roots; strongly acid; abrupt smooth boundary.

B21tg—8 to 19 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium distinct yellowish brown

(10YR 5/6) mottles; weak medium subangular blocky structure; friable; many roots; thin patchy light brownish gray (2.5Y 6/2) and gray (10YR 6/1) clay films on faces of peds; common medium and fine very dark grayish brown (10YR 3/2) concretions (iron and manganese oxides); medium acid; clear smooth boundary.

B22tg—19 to 27 inches; grayish brown (2.5Y 5/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium and fine granular; firm; common roots; thin patchy gray (N 5/0) clay films on faces of peds; common medium very dark grayish brown (10YR 3/2) concretions (iron and manganese oxides); medium acid; clear smooth boundary.

B23tg—27 to 34 inches; dark gray (N 4/0) silty clay; many medium distinct olive brown (2.5Y 4/4) and common medium faint gray (N 5/0) mottles; weak medium prismatic structure parting to weak medium platy; firm; medium continuous gray (N 5/0) clay films on vertical faces of peds and thin patchy clay films on horizontal faces of peds; common fine and medium dark grayish brown (10YR 3/2) concretions (iron and manganese oxides); neutral; clear smooth boundary.

B3—34 to 43 inches; olive brown (2.5Y 4/4) silty clay; weak coarse prismatic structure; firm; thin patchy gray (N 5/0) clay films on vertical faces of peds; common medium and fine very dark grayish brown (10YR 3/2) concretions (iron and manganese oxides); neutral; clear smooth boundary.

C1—43 to 57 inches; olive brown (2.5Y 4/4) silty clay; massive; firm; gray (N 5/0) coatings in vertical partings; slight effervescence; mildly alkaline; clear smooth boundary.

C2—57 to 60 inches; olive brown (2.5Y 4/4) silty clay; common medium distinct gray (N 5/0) mottles; massive; firm; common medium light gray (2.5Y 7/2) secondary carbonate segregations; strong effervescence; moderately alkaline.

The solum ranges from 37 to 50 inches in thickness. The Ap horizon is 8 to 10 inches thick. It is slightly acid to strongly acid. The B2 horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 0 to 4. This horizon is silty clay loam, clay, or silty clay. It 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 silty clay or clay.

Caneadea series

The Caneadea series consists of deep soils that are somewhat poorly drained and slowly permeable. These soils formed in lacustrine sediments on lake plains. Slope is 0 to 2 percent.

Caneadea soils are commonly adjacent to the Canadice, the Fitchville, and the Mahoning soils and are similar to the Fitchville and the Mahoning soils. Canadice soils are wetter than Caneadea soils and are on flats and in shallow depressions. Fitchville soils have less clay in the subsoil. Mahoning soils formed in glacial till and contain more coarse fragments in the subsoil and substratum than the Caneadea soils.

Typical pedon of Caneadea silt loam, 0 to 2 percent slopes, in Solon, 1,000 feet west of the intersection of State Route 43 and the Geauga County Line along State Route 43, then 2,000 feet north.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine granular structure; friable; common very dark grayish brown (10YR 3/2) fillings in root channels; strongly acid; clear smooth boundary.

B1—7 to 12 inches; grayish brown (10YR 5/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium and fine subangular blocky structure; firm; thin patchy grayish brown (2.5Y 5/2) coatings on faces of peds; strongly acid; clear smooth boundary.

B21t—12 to 17 inches; olive brown (2.5Y 4/4) silty clay; many medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to strong medium angular blocky; firm; faces of peds coated gray (10YR 5/1) and grayish brown (2.5Y 5/2); thin patchy clay films on faces of peds; many medium and fine very dark grayish brown (10YR 3/2) concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

B22t—17 to 27 inches; olive brown (2.5Y 4/4) silty clay; common medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to strong medium angular blocky; firm; faces of peds coated gray (10YR 5/1) and grayish brown (2.5Y 5/2); thin patchy clay films on faces of peds; many medium and fine very dark grayish brown (10YR 3/2) concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

B23t—27 to 36 inches; olive brown (2.5Y 4/4) silty clay; weak coarse prismatic structure parting to moderate medium angular blocky; firm; faces of peds coated grayish brown (2.5Y 5/2); thin patchy clay films on vertical faces of peds; thin very patchy clay films on horizontal faces of peds; common fine very dark grayish brown (10YR 3/2) concretions (iron and manganese oxides); slightly acid; clear smooth boundary.

B3—36 to 47 inches; olive brown (2.5Y 4/4) silty clay; weak coarse prismatic structure parting to moderate coarse angular blocky; firm; grayish brown (2.5Y 5/2) coatings on vertical faces of peds; common thin pale yellow (2.5Y 7/4) and light gray (10YR 7/2) carbonate coatings on faces of peds; strong effervescence; mildly alkaline; clear smooth boundary.

C—47 to 60 inches; olive brown (2.5Y 4/4) silty clay; massive; laminated; firm; few gray (N 5/0) seams; common medium light gray (10YR 7/1) carbonate coatings; strong effervescence; mildly alkaline.

The solum ranges from 34 to 50 inches in thickness. The Ap horizon is 5 to 10 inches thick. It is very strongly acid to medium acid, unless limed. The B1 horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is very strongly acid to medium acid. The B2 horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is silty clay or clay. Thin subhorizons of silty clay loam are in some pedons. The B2 horizon is very strongly acid or strongly acid in the upper part and slightly acid to mildly alkaline in the lower part. The C horizon has hue of 10YR or 2.5Y and value and chroma of 4 or 5. It is silty clay or silty clay loam.

Carlisle series

The Carlisle series consists of deep soils that are very poorly drained. These soils formed in organic deposits in bogs and swales on uplands. Permeability is moderately slow to moderately rapid. Slope is 0 to 2 percent.

Carlisle soils are commonly adjacent to Canadice soils that formed in lakebed sediments.

Typical pedon of Carlisle silty clay loam, in Middleburg Heights, approximately 187 feet west of the intersection of Fowles Road and Big Creek Parkway along Fowles Road, then 560 feet south.

A11—0 to 5 inches; dark grayish brown (10YR 4/2) silty clay loam; massive; sticky; many roots; neutral; abrupt smooth boundary.

A12—5 to 10 inches; very dark gray (10YR 3/1) silty clay loam; massive; sticky; many roots; neutral; abrupt smooth boundary.

IIOa1—10 to 17 inches; very dark gray (10YR 3/1) sapric material; 35 percent fiber, less than 5 percent rubbed; massive; very friable; neutral; abrupt smooth boundary.

IIOa2—17 to 40 inches; dark brown (7.5YR 3/2) sapric material; 60 percent fiber, 5 percent rubbed; massive; very friable; 8 percent woody fragments; neutral; abrupt smooth boundary.

IIOa3—40 to 60 inches; dark olive (5Y 3/3) sapric material; 70 percent fiber, less than 5 percent rubbed; massive; very friable; 5 percent woody fragments; neutral.

The organic matter commonly extends to more than 60 inches.

The A1 horizon is 3 to 15 inches thick. It has hue of 10YR, value of 3 to 5, and chroma of 1 to 3. It is slightly acid or neutral. The subsurface tier has hue of 10YR or 7.5YR, value of 3, and chroma of 1 or 2. It is slightly acid or neutral. The bottom tier has hue of 5YR to 5Y, value of 3, and chroma of 1 to 3. It is slightly acid or neutral.

Chagrin series

The Chagrin series consists of deep soils that are well drained and moderately permeable. These soils formed in recent alluvium on flood plains. Slope is 0 to 2 percent.

In Cuyahoga County the Chagrin soils have less clay and a little less sand than is defined as the range for the Chagrin series. This difference, however, does not alter the use or behavior of the soils.

Chagrin soils are commonly adjacent to the Euclid, the Holly, the Orrville, and the Tioga soils and the Tioga Variant and are similar to the Tioga soils. The Euclid, the Holly, and the Orrville soils are wetter than the Chagrin soils and are more gray in the subsoil. The Euclid soils and the Tioga Variant are on low stream terraces. The Tioga soils and the Tioga Variant contain more sand in the B and C horizons than the Chagrin soils.

Typical pedon of Chagrin silt loam, occasionally flooded, in Brecksville, 1,400 feet east of the intersection of Vaughn Road and Riverview Road along Vaughn Road, then 100 feet south.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium and fine granular structure; friable; many roots; slightly acid; clear smooth boundary.

B1—8 to 16 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium and fine subangular blocky structure; friable; many roots; many brown (7.5YR 5/2) organic coatings in pores and on vertical faces of peds; slightly acid; gradual smooth boundary.

B21—16 to 25 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium and fine subangular blocky structure; friable; common roots; thin patchy brown (7.5YR 4/2) organic coatings in pores and on vertical faces of peds; slightly acid; gradual smooth boundary.

B22—25 to 35 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium and coarse subangular blocky structure; friable; common roots; common dark grayish brown (10YR 4/2) organic coatings in pores and on vertical faces of peds; slightly acid; clear smooth boundary.

C1—35 to 55 inches; dark brown (7.5YR 4/4) silt loam; massive; friable; few roots; few dark grayish brown (10YR 4/2) coatings in pores; slightly acid; gradual smooth boundary.

C2—55 to 60 inches; dark brown (7.5YR 4/4) and olive brown (2.5Y 4/4) silt loam; massive; friable; neutral.

The solum ranges from 33 to 44 inches in thickness. The Ap horizon is slightly acid or neutral. The B horizon has hue of 10YR, value of 4, and chroma of 3 or 4. It is silt loam or loam that is slightly acid or neutral. The C horizon has hue of 10YR or 7.5YR, value of 4, and chroma of 3 or 4. It is silt loam, loam, or sandy loam that has evidence of stratification.

Chili series

The Chili series consists of deep soils that are well drained and moderately rapidly permeable. These soils formed in stratified outwash deposits on outwash terraces and end moraines. Slope ranges from 0 to 18 percent.

Chili soils are commonly adjacent to the Bogart, the Jimtown, and the Oshtemo soils. The Bogart and the Jimtown soils are wetter than the Chili soils and have gray mottles in the subsoil. Oshtemo soils have less clay and gravel in the subsoil than Chili soils.

Typical pedon of Chili loam, 6 to 12 percent slopes, in Middleburg Heights, about 465 feet west of the intersection of the Baltimore and Ohio Railroad tracks and Engle Road.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam; weak medium and fine granular structure; friable; many roots; 5 percent gravel; strongly acid; abrupt smooth boundary.

B1—7 to 12 inches; yellowish brown (10YR 5/4) gravelly sandy loam; weak medium subangular blocky structure parting to weak medium and fine granular, friable; many roots; 15 percent gravel; strongly acid; clear smooth boundary.

B21t—12 to 18 inches; brown (7.5YR 4/4) gravelly loam; moderate medium subangular blocky structure; friable; many roots; thin patchy dark brown (7.5YR 4/4) clay films bridging sand grains; 25 percent gravel; strongly acid; clear smooth boundary.

B22t—18 to 24 inches; brown (7.5YR 4/4) gravelly loam; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; common roots; thin patchy dark brown (7.5YR 4/4) clay films bridging sand grains; 25 percent gravel; strongly acid; clear smooth boundary.

B23t—24 to 28 inches; brown (7.5YR 4/4) gravelly loam; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; few roots; thin patchy dark brown (7.5YR 4/4) clay films bridging sand grains; 30 percent gravel; strongly acid; abrupt smooth boundary.

B24t—28 to 32 inches; dark brown (7.5YR 4/4) gravelly sandy loam; weak medium and coarse prismatic structure parting to moderate medium and coarse subangular blocky; firm; few roots; thin dark brown (7.5YR 4/4) clay films bridging sand grains; 30 percent coarse fragments; strongly acid; abrupt smooth boundary.

B3—32 to 42 inches; reddish brown (5YR 4/3) gravelly sandy loam; massive; very friable; few roots; 30 percent gravel; medium acid; clear smooth boundary.

C—42 to 60 inches; yellowish brown (10YR 5/4) stratified loamy sand and very gravelly sand; single grained; loose; medium acid.

The solum ranges from 40 to 50 inches in thickness. The Ap horizon is from 2 to 20 percent, by volume, coarse fragments, and the B horizon is from 15 to 35 percent coarse fragments.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is loam or gravelly loam and strongly acid to slightly acid. The B horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 3 or 4. It is loam, sandy loam, or clay loam, or their gravelly analogs. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is strongly acid to slightly acid.

Condit series

The Condit series consists of deep soils that are poorly drained and slowly permeable. These soils formed in glacial till on ground moraines. Slope is 0 to 2 percent.

Condit soils commonly are near the Ellsworth, the Mahoning, and the Miner soils and are similar to the Canadice and the Allis soils. The Ellsworth and the Mahoning soils are better drained than Condit soils and are less gray in the subsoil than Condit soils. Miner soils have a darker colored surface layer than Condit soils. Canadice soils formed in lacustrine sediments and lack coarse fragments in the solum. Allis soils are underlain by shale bedrock at a depth of 20 to 40 inches, and they lack an argillic horizon.

Typical pedon of Condit silty clay loam, in Strongsville, 875 feet south of the intersection of Folty Parkway and State Route 82 along Folty Parkway, then 390 feet west.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate medium and fine granular structure; friable; many roots; few fine very dark gray (10YR 3/1) concretions (iron and manganese oxides); about 2 percent coarse fragments; very strongly acid; abrupt smooth boundary.

B1g—7 to 13 inches; grayish brown (10YR 5/2) silty clay loam; few fine prominent reddish brown (5YR 4/4) mottles; moderate medium and fine subangular blocky structure; firm; many roots; about 2 percent coarse fragments; very strongly acid; clear smooth boundary.

B21tg—13 to 18 inches; gray (10YR 5/1) silty clay loam; common medium prominent brown (7.5YR 5/4) and few medium prominent strong brown (7.5YR 5/6) mottles; moderate coarse and medium subangular blocky structure; firm; common roots; faces of peds coated grayish brown (10YR 5/2); patchy thin clay films on faces of peds; common medium very dark gray (10YR 3/1) concretions (iron and manganese oxides); about 2 percent coarse fragments; very strongly acid; clear smooth boundary.

B22tg—18 to 26 inches; gray (10YR 6/1) silty clay loam; common medium prominent brown (7.5YR 5/4) and strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; common roots; faces of peds coated gray (10YR 5/1); thin patchy clay films on faces of peds; common medium very dark gray (10YR 3/1) concretions (iron and manganese oxides); about 2 percent coarse fragments; strongly acid; clear smooth boundary.

B23tg—26 to 31 inches; grayish brown (10YR 5/2) silty clay; many medium prominent brown (7.5YR 5/4) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; firm; common roots; faces of peds coated grayish brown (10YR 5/2); thin patchy clay films on faces of peds; common fine very dark gray (10YR 3/1) concretions (iron and manganese oxides); about 2 percent coarse fragments; medium acid; clear smooth boundary.

B24tg—31 to 37 inches; gray (10YR 5/1) silty clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; firm; common roots; gray (10YR 5/1) coatings on faces of peds; thin patchy clay films on faces of peds; common fine coarse fragments; neutral; clear smooth boundary.

B31tg—37 to 43 inches; gray (10YR 5/1) silty clay loam; common medium distinct yellowish brown (10YR 5/4) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; few roots; gray (10YR 5/1) coatings on faces of peds; thin patchy clay films on faces of peds; few fine very dark gray (10YR 3/1) concretions (iron and manganese oxides); about 2 percent coarse fragments; neutral; clear smooth boundary.

B32tg—43 to 52 inches; gray (10YR 5/1) silty clay loam; common medium distinct yellowish brown (10YR 5/4) mottles; weak medium prismatic structure; firm; gray (10YR 5/1) coatings on faces of peds; thin very patchy clay films on faces of peds; about 4 percent coarse fragments; slight effervescence; mildly alkaline; clear smooth boundary.

C—52 to 60 inches; brown (10YR 4/3) silty clay loam; many medium distinct gray (10YR 5/1) and common medium distinct yellowish brown (10YR 5/4) mottles; massive; firm; few gray (10YR 5/1) partings; about 4 percent coarse fragments; strong effervescence; moderately alkaline.

The solum ranges from 45 to 55 inches in thickness. The Ap horizon is 6 to 10 inches thick. It is very strongly acid to medium acid, unless limed. The B2 horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 0 to 2. In some pedons chroma is 3 or more below a depth of 30 inches. The B horizon is silty clay loam, silty clay, or clay. It is very strongly acid to medium acid in the upper part and medium acid to mildly alkaline in the lower part. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 0 to 3. It is silty clay loam or clay loam.

Darien series

The Darien series consists of deep soils that are somewhat poorly drained and slowly permeable. These soils formed in glacial till on till plains. Slope is 0 to 2 percent.

Darien soils are commonly adjacent to the Mahoning and the Mitiwanga soils and are similar to Mitiwanga soils. Mahoning soils contain more clay in the subsoil than Darien soils. Mitiwanga soils have sandstone bedrock at a depth of 20 to 40 inches.

Typical pedon of Darien silt loam, 0 to 2 percent slopes, in Richmond Heights, approximately 200 feet southwest of the intersection of Gleeton and Snavely Roads.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium and fine granular structure; friable; many roots; about 2 percent coarse fragments; medium acid; abrupt smooth boundary.

B1—6 to 12 inches; brown (10YR 4/3) silt loam; common medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; weak medium and fine subangular blocky structure; friable; many roots; brown (10YR 5/3) coatings on faces of peds; about 4 percent coarse fragments; slightly acid; clear smooth boundary.

B21t—12 to 20 inches; brown (10YR 4/3) silty clay loam; many medium distinct dark brown (7.5YR 4/4), common medium distinct olive gray (5Y 5/2), and few fine prominent strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium and fine subangular blocky; friable; common roots; grayish brown (10YR 5/2) coatings on faces of peds; thin very patchy clay films on faces of peds; common fine very dark gray (10YR 3/1) concretions (iron and manganese oxides); about 5 percent coarse fragments; medium acid; clear smooth boundary.

B22t—20 to 29 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine distinct strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; firm; few roots; olive gray (5Y 5/2) coatings on faces of peds; thin patchy clay films on faces of peds; common fine very dark gray (10YR 3/1) concretions (iron and manganese oxides); about 4 percent coarse fragments; neutral; clear smooth boundary.

B3t—29 to 42 inches; dark yellowish brown (10YR 4/4) silty clay loam; few medium distinct strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium and fine subangular blocky; firm; few roots; grayish brown (10YR 5/2) coatings on faces of peds; thin patchy clay films on faces of peds; few fine very dark gray (10YR 3/1) concretions (iron and manganese oxides); about 5 percent coarse fragments; neutral; clear smooth boundary.

C1—42 to 50 inches; dark yellowish brown (10YR 4/4) channery silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; massive; very firm; few vertical gray (10YR 5/1) partings; common light gray (10YR 7/2) calcium carbonate accumulations; about 20 percent coarse fragments; strong effervescence; mildly alkaline; clear smooth boundary.

C2—50 to 60 inches; yellowish brown (10YR 5/4) channery silty clay loam; few fine distinct strong brown

(7.5YR 5/6) mottles; massive; very firm; few vertical grayish brown (10YR 5/2) partings; about 40 percent coarse fragments; strong effervescence; mildly alkaline.

The solum ranges from 33 to 42 inches in thickness. Depth to siltstone or shale bedrock is dominantly greater than 60 inches, but in some pedons, it ranges from 40 to 60 inches.

The Ap horizon is 6 to 10 inches thick. Where it is unlimed, it is slightly acid or medium acid. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is heavy silt loam or silty clay loam that is medium acid or slightly acid in the upper part and slightly acid or 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 channery silt loam or channery silty clay loam.

Dekalb series

The Dekalb series consists of moderately deep soils that are well drained and rapidly permeable. These soils formed in residuum weathered mainly from sandstone bedrock on uplands. Slope ranges from 25 to 70 percent.

Dekalb soils are commonly adjacent to the Brecksville and the Loudonville soils. Brecksville soils formed in residuum from shale bedrock and contain more clay in the subsoil than Dekalb soils. Loudonville soils contain more clay and less coarse fragments throughout the soil than Dekalb soils do.

Typical pedon of Dekalb channery sandy loam from an area of Dekalb-Loudonville complex, 25 to 70 percent slopes, in Brecksville, approximately 2,000 feet east of the intersection of State Route 82 and U. S. Route 21 along State Route 82, then 100 feet south.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) channery sandy loam; moderate fine granular structure; very friable; many roots; about 15 percent coarse fragments; very strongly acid; abrupt smooth boundary.

B1—2 to 9 inches; yellowish brown (10YR 5/6) channery sandy loam; weak medium and fine granular structure; very friable; many roots; about 25 percent coarse fragments; very strongly acid; clear smooth boundary.

B2—9 to 19 inches; yellowish brown (10YR 5/6) channery sandy loam; weak medium subangular blocky structure; very friable; many roots; about 30 percent coarse fragments; very strongly acid; clear smooth boundary.

B3—19 to 23 inches; yellowish brown (10YR 5/4) channery sandy loam; weak medium subangular blocky structure; friable; many roots; about 35 percent coarse fragments; very strongly acid; clear smooth boundary.

C—23 to 31 inches; light yellowish brown (10YR 6/4) very flaggy sandy loam; weak medium and fine granular structure; friable; common roots; about 65 percent coarse fragments; very strongly acid; abrupt smooth boundary.

R—31 inches; fractured sandstone bedrock.

The thickness of the solum or depth to bedrock is from 20 to 40 inches. Coarse fragments of mainly sandstone are throughout the solum and the substratum. The A horizon is from 2 to 15 percent, by volume, coarse fragments; the B horizon is 20 to 60 percent coarse fragments; the C horizon is 60 to 80 percent coarse fragments.

The A horizon is very strongly acid to medium acid. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is channery sandy loam or channery loam and very strongly acid or strongly acid. The C horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. It is very strongly acid or strongly acid.

Ellsworth series

The Ellsworth series consists of deep soils that are moderately well drained and slowly or very slowly permeable. The soils formed in glacial till on ground moraines and end moraines. Slope ranges from 2 to 70 percent.

Ellsworth soils are commonly adjacent to the Brecksville, the Geeburg, the Mahoning, and the Mentor soils and are similar to the Rittman soils. Brecksville soils contain more shale in the subsoil than Ellsworth soils and are underlain by shale bedrock at a depth of 20 to 40 inches. Geeburg soils formed in lacustrine sediments and have more clay and less coarse fragments in the subsoil and substratum. Mahoning soils are wetter than Ellsworth soils and are more gray in the subsoil. Mentor soils formed in lacustrine sediments and contain more silt and less coarse fragments in the subsoil and substratum than Ellsworth soils. Rittman soils contain less clay in the subsoil and have a fragipan.

Typical pedon of Ellsworth silt loam, 2 to 6 percent slopes, in Brecksville, approximately 2,000 feet east of the intersection of Whitewood Road and State Route 21 along Whitewood Road, then 1,006 feet south.

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam; weak medium and fine granular structure; friable; many roots; 3 percent coarse fragments; very strongly acid; clear smooth boundary.

B21t—7 to 12 inches; yellowish brown (10YR 5/4) silty clay; common fine distinct strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; many roots; brown (10YR 5/3) coatings on faces of peds; thin patchy brown (10YR 5/3) clay films on faces of peds; 3 percent coarse fragments; very strongly acid, clear smooth boundary.

B22t—12 to 18 inches; dark yellowish brown (10YR 4/4) silty clay; common medium distinct strong brown

(7.5YR 5/6) and few medium distinct grayish brown (10YR 5/2) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; firm; common roots; brown (10YR 5/3) coatings on faces of peds; thin patchy clay films on faces of peds; 8 percent coarse fragments; very strongly acid; clear smooth boundary.

B23t—18 to 26 inches; dark yellowish brown (10YR 4/4) silty clay loam; few medium distinct grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; common roots; brown (10YR 5/3) and grayish brown (10YR 5/2) coatings on faces of peds; thin patchy clay films on faces of peds; 8 percent coarse fragments; common medium very dark gray (10YR 3/1) concretions (iron and manganese oxides); medium acid; clear smooth boundary.

B31t—26 to 34 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium faint yellowish brown (10YR 5/4) mottles; moderate medium and fine subangular blocky structure; very firm; thin patchy brown (10YR 5/3) and grayish brown (10YR 5/2) clay films on faces of peds; 8 percent coarse fragments; neutral; clear smooth boundary.

B32t—34 to 42 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium platy structure, some vertical partings; very firm; dark yellowish brown (10YR 4/4) coatings on faces of peds; thin patchy clay films on vertical faces of peds; common light gray (10YR 7/2) calcium carbonate coatings; 10 percent coarse fragments; slight effervescence; mildly alkaline; clear smooth boundary.

C1—42 to 52 inches; olive brown (2.5Y 4/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; massive; very firm; common light gray (10YR 7/1) calcium carbonate coatings; 10 percent coarse fragments; slight effervescence; mildly alkaline; clear smooth boundary.

C2—52 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; common medium distinct light olive brown (2.5Y 4/4) mottles; massive; very firm; 10 percent coarse fragments; slight effervescence; mildly alkaline.

The solum ranges from 28 to 46 inches in thickness. The A horizon and upper part of the B horizon are 2 to 6 percent, by volume, coarse fragments, and the lower part of the B horizon and the C horizon are 6 to 10 percent coarse fragments.

The A horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is very strongly acid to neutral. The B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. It is silty clay loam, silty clay, or clay. It is very strongly acid to medium acid in the upper part and neutral or mildly alkaline in the lower part. 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.

Elnora series

The Elnora series consists of deep soils that are moderately well drained. These soils formed in sandy, water-deposited material on lake plains. Permeability is moderately rapid or rapid. Slope ranges from 0 to 3 percent.

Elnora soils are commonly adjacent to the Glenford and the Oshtemo soils and the Stafford Variant. Glenford soils contain more silt and clay and less sand in the subsoil than Elnora soils. Oshtemo soils and Stafford Variant have more clay in the subsoil. Oshtemo soils are better drained than the Elnora soils and have an argillic horizon. The Stafford Variant is wetter than the Elnora soils and more gray in the subsoil.

Typical pedon of Elnora loamy fine sand from an area of Urban land-Elnora complex, nearly level, in Cleveland, 250 feet east of the intersection of St. Clair Street and East Boulevard along St. Clair Street, then 1,200 feet south.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy fine sand; weak medium and fine granular structure; very friable; common roots; slightly acid; abrupt smooth boundary.

B1—9 to 21 inches; yellowish brown (10YR 5/6) loamy fine sand; weak fine subangular blocky structure; very friable; common roots; medium acid; clear smooth boundary.

B2—21 to 26 inches; yellowish brown (10YR 5/4) loamy fine sand; few medium distinct grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; very friable; few roots; medium acid; clear smooth boundary.

B3—26 to 32 inches; yellowish brown (10YR 5/4) loamy fine sand; common medium distinct strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2) mottles; weak fine subangular blocky structure; very friable; medium acid; clear smooth boundary.

C—32 to 60 inches; grayish brown (10YR 5/2), brown (10YR 5/3), and yellowish brown (10YR 5/4) stratified fine sand and loamy fine sand; single grained; loose; medium acid.

The solum ranges from 30 to 40 inches in thickness. The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2. It is slightly acid or medium acid. The B horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. It is medium acid or strongly acid. The C horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2 to 6. It is loamy fine sand or sand and medium acid or strongly acid.

Euclid series

The Euclid series consists of deep soils that are somewhat poorly drained and moderately slowly permeable. These soils formed in silty and loamy deposits on low stream terraces. Slope is 0 to 2 precent.

Euclid soils are commonly adjacent to the Chagrin, the Fitchville, the Orrville, and the Tioga soils and the Tioga Variant. The Chagrin, the Orrville, and the Tioga soils are on flood plains and are more frequently flooded than the Euclid soils. Fitchville soils formed in lacustrine deposits and have an argillic horizon. Tioga Variant soils contain more sand and less clay than Euclid soils. They are less gray in the subsoil.

Typical pedon of Euclid silt loam, in Strongsville, approximately 150 feet north of the intersection of Albion Road and the Brecksville-Royalton Parkway along Albion Road, then 250 feet west.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium and fine granular structure; friable; many roots; strongly acid; abrupt smooth boundary.

B1—6 to 12 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct grayish brown (2.5Y 5/2) mottles; weak medium prismatic structure parting to moderate medium and fine subangular blocky; friable; many roots; light brownish gray (2.5Y 6/2) silt coatings on faces of peds; very strongly acid; clear smooth boundary.

B21—12 to 21 inches; strong brown (7.5YR 5/6) light silty clay loam; common medium prominent grayish brown (2.5Y 5/2) and few medium faint strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; common roots; light brownish gray (2.5Y 6/2) silt coatings on vertical faces of peds; very strongly acid; clear smooth boundary.

B22—21 to 26 inches; strong brown (7.5YR 5/6) light silty clay loam; common medium distinct grayish brown (2.5Y 5/2) and common medium faint strong brown (7.5YR 5/8) mottles; weak coarse prismatic structure parting to moderate medium and coarse subangular blocky; friable; common roots; grayish brown (2.5Y 5/2) and light brownish gray (2.5Y 6/2) silt coatings on faces of peds; strongly acid; clear smooth boundary.

B3—26 to 37 inches; yellowish brown (10YR 5/4) light silty clay loam; common medium distinct dark brown (7.5YR 4/4) and common fine distinct grayish brown (10YR 5/2) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm; few roots; grayish brown (2.5Y 5/2) and light brownish gray (2.5Y 6/2) silt coatings on vertical faces of peds; thin strata and lenses of loam 1/8 to 1/2 inch in thickness; medium acid; clear smooth boundary.

C1—37 to 47 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct dark brown (7.5YR 5/4) and grayish brown (10YR 5/2) mottles; massive; firm; thin strata and lenses of loam 1/8 to 1/2 inch in thickness; slightly acid; clear smooth boundary.

C2—47 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct dark brown (7.5YR 4/4) and few medium distinct grayish brown (10YR 5/2) mottles; massive; firm; thin strata of silt loam and loam; neutral.

The solum ranges from 36 to 42 inches in thickness. It is very strongly acid to medium acid, and the C horizon ranges from medium acid to neutral.

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 C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 to 4. It is stratified and is dominantly silt loam, silty clay loam, or loam.

Fitchville series

The Fitchville series consists of deep soils that are somewhat poorly drained and moderately slowly permeable. These soils formed in lacustrine deposits on terraces and in basins of former glacial lakes. Slope ranges from 0 to 6 percent.

Fitchville soils are commonly adjacent to the Caneadea, the Euclid, the Glenford, the Mahoning, and the Sebring soils and are similar to the Caneadea and the Mahoning soils. Caneadea soils contain more clay in the subsoil and substratum than Fitchville soils. Euclid soils do not have an argillic horizon. Glenford soils are less gray in the subsoil. Mahoning soils formed in glacial till and contain more clay and coarse fragments throughout than Fitchville soils. Sebring soils are wetter than Fitchville soils and are more gray in the subsoil.

Typical pedon of Fitchville silt loam, 0 to 2 percent slopes, in Bentleyville, approximately 1,750 feet south of the intersection of Liberty Road and Solon Road along Liberty Road, then 100 feet east.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine granular structure; friable; many roots; common fine very dark gray (10YR 3/1) concretions (iron and manganese oxides); medium acid; clear smooth boundary.

B1—8 to 11 inches; brown (10YR 5/3) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium and fine subangular blocky structure; friable; many roots; common fine very dark gray (10YR 3/1) concretions (iron and manganese oxides); dark grayish brown (10YR 4/2) coatings on faces of peds; strongly acid; clear smooth boundary.

B21t—11 to 19 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct gray (10YR 5/1) and yellowish brown (10YR 5/6) mottles; weak medium prismatic structure; friable; common roots; grayish brown (10YR 5/2) coatings on faces of peds; thin patchy clay films on faces of peds; common fine very dark gray (10YR 3/1) concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

B22t—19 to 24 inches; yellowish brown (10YR 5/6) silty clay loam; few medium distinct gray (10YR 5/1) mottles; moderate medium subangular blocky structure; firm; common roots; grayish brown (10YR 5/2) coatings on faces of peds; thin patchy clay films on faces of peds; common medium very dark gray (10YR 3/1) concretions (iron and manganese oxides); few pebbles; strongly acid; clear smooth boundary.

B23t—24 to 29 inches; yellowish brown (10YR 5/4) silty clay loam; few medium faint yellowish brown (10YR 5/6) and few medium distinct gray (10YR 5/1) and dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; firm; few roots; dark grayish brown (10YR 5/2) coatings on faces of peds; thin patchy clay films on vertical faces of peds; common medium very dark gray (10YR 3/1) concretions (iron and manganese oxides); few pebbles; medium acid; clear smooth boundary.

B3—29 to 36 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct grayish brown (10YR 5/2) and common medium faint yellowish brown (10YR 5/6) mottles; weak thick platy structure; firm; few medium very dark gray (10YR 3/1) concretions (iron and manganese oxides); slightly acid; clear smooth boundary.

C1—36 to 46 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct gray (10YR 5/1) mottles; inherited thick plates; firm; few medium very dark gray (10YR 3/1) concretions (iron and manganese oxides); slightly acid; clear smooth boundary.

C2—46 to 60 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct gray (10YR 5/1) mottles; massive with inherited thick plates; firm; neutral.

The solum ranges from 35 to 42 inches in thickness. The A horizon is very strongly acid to medium acid. The B1 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam or silty clay loam and very strongly acid to medium acid. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 6. It is laminated or stratified silt loam and silty clay loam, but includes thin strata of loam or fine sandy loam.

Geeburg series

The Geeburg series consists of deep soils that are moderately well drained and very slowly permeable. These soils formed in lacustrine sediments. They are dissected parts of terraces. Slope ranges from 25 to 70 percent.

Geeburg soils are commonly adjacent to the Ellsworth, the Brecksville, and the Mentor soils and are similar to the Ellsworth soils. Brecksville soils have shale bedrock at a depth of 20 to 40 inches. Ellsworth soils formed in glacial till and contain more coarse fragments in the subsoil and the substratum than Geeburg soils. Mentor soils contain less clay in the subsoil and substratum than Geeburg soils and are better drained.

Typical pedon of Geeburg silt loam, from an area of Geeburg-Mentor silt loams, 25 to 70 percent slopes, in Brecksville Reservation of the Cleveland Metropolitan Park system, 800 feet west of the intersection of Parkview Drive and Riverview Road along Parkview Drive, then 900 feet south.

A1—0 to 1 inch; very dark grayish brown (10YR 3/2) silt loam; moderate fine granular structure; friable; very strongly acid; clear smooth boundary.

A2—1 to 5 inches; brown (10YR 5/3) and yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure parting to moderate medium granular; friable; many roots; very strongly acid; clear smooth boundary.

B1—5 to 13 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; many roots; dark grayish brown (10YR 4/2) fillings in root channels; very strongly acid; clear smooth boundary.

B21t—13 to 18 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium faint dark brown (7.5YR 4/4) and few medium distinct gray (10YR 5/1) mottles; moderate medium subangular blocky structure; firm; common roots; thin patchy brown (10YR 5/3) clay films on horizontal faces of peds; strongly acid; clear smooth boundary.

B22t—18 to 29 inches; dark brown (10YR 4/3) silty clay; common medium distinct yellowish red (5YR 5/6) and few medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common roots; thin continuous dark brown (10YR 4/3) clay films on faces of peds; neutral; abrupt smooth boundary.

C1—29 to 41 inches; dark brown (10YR 4/3) silty clay; common medium distinct light olive brown (2.5Y 5/4) and brown (7.5YR 4/4) mottles; laminated; firm; light brownish gray (10YR 6/2) calcium carbonate coatings in partings; slight effervescence; mildly alkaline; clear smooth boundary.

C2—41 to 60 inches; grayish brown (2.5Y 5/2) silty clay; common medium distinct light olive brown (2.5Y 5/4) mottles; laminated; firm; light brownish gray (10YR 6/2) calcium carbonate coatings in partings; slight effervescence; mildly alkaline.

The solum ranges from 22 to 37 inches in thickness. The A horizon is strongly acid or very strongly acid, unless limed. The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2. It is 1 or 2 inches thick. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 5. It is silt loam or light silty clay loam. The B2t horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 5. It is clay, silty clay, or silty clay loam. It has a reaction of strongly acid or very strongly acid in the upper part and medium acid to neutral in the lower part. The C horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 to 4.

Glenford series

The Glenford series consists of deep soils that are moderately well drained and moderately slowly permeable. These soils formed in glacio-lacustrine or stream-deposited material on lake plains and terraces. Slope ranges from 2 to 12 percent.

Glenford soils are commonly adjacent to the Bogart, the Elnora, the Fitchville, the Mentor, and the Sebring soils. Bogart soils contain more sand and gravel throughout than the Glenford soils. Elnora soils have more sand and less silt in the subsoil and substratum. Fitchville and Sebring soils are wetter than Glenford soils and are more gray in the subsoil. Mentor soils are better drained and do not have mottles in the subsoil.

Typical pedon of Glenford silt loam, 2 to 6 percent slopes, in Bentleyville, in Quarry Rock picnic area of the Cleveland Metropolitan Park system, 600 feet southwest of the intersection of Solon Road and River Road along Solon Road, then 400 feet west.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) silt loam; moderate medium and fine granular structure; very friable; many roots; very strongly acid; abrupt smooth boundary.

A2—3 to 7 inches; light yellowish brown (10YR 6/4) silt loam; weak coarse subangular blocky structure; friable; many roots; very dark grayish brown (10YR 3/2) organic coatings in root channels; 1 percent pebbles; very strongly acid; clear smooth boundary.

B1—7 to 13 inches; yellowish brown (10YR 5/6) silt loam; weak coarse subangular blocky structure; friable; many roots; very dark grayish brown (10YR 3/2) organic coatings in root channels; 1 percent pebbles; very strongly acid; clear smooth boundary.

B21t—13 to 19 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; common roots; very dark grayish brown (10YR 3/2) organic coatings in root channels; thin very patchy yellowish brown (10YR 5/4) clay films on vertical faces of peds; 1 percent pebbles; very strongly acid; clear smooth boundary.

B22t—19 to 26 inches; yellowish brown (10YR 5/4) silt loam; few fine faint yellowish brown (10YR 5/6) and common fine distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; common roots; light brownish gray (10YR 6/2) coatings on faces of peds; thin very patchy clay films on faces of peds; 1 percent pebbles; very strongly acid; clear smooth boundary.

B23t—26 to 33 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine distinct strong brown (7.5YR 5/6) and common fine distinct light brownish gray (10YR 6/2) mottles; moderate medium and fine subangular blocky structure; firm; common roots; grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) coatings on faces of peds; thin patchy grayish brown (10YR 5/2) and brown (10YR 5/3) clay films on faces of peds; very strongly acid; clear smooth boundary.

B3t—33 to 45 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak coarse prismatic structure parting to moderate medium and coarse subangular blocky; firm; common roots; grayish brown (10YR 5/2) and brown (10YR 5/3) coatings on faces of peds; thin very patchy clay films on faces of peds; medium acid; clear smooth boundary.

C1—45 to 53 inches; yellowish brown (10YR 5/4) silty clay loam; massive; firm; neutral; clear smooth boundary.

C2—53 to 60 inches; brown (10YR 5/3) silty clay loam; massive; firm; common soft light gray (10YR 7/2) calcium carbonate accumulations; slight effervescence; mildly alkaline.

The solum ranges from 39 to 50 inches in thickness. It is very strongly acid to medium acid in the upper part and medium acid to neutral in the lower part. The C horizon is medium acid to mildly alkaline.

The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is dominantly silt loam or silty clay loam, but some pedons have thin strata of fine sandy loam.

Haskins series

The Haskins series consists of deep soils that are somewhat poorly drained. These soils formed in glacial outwash and the underlying glacial till or lacustrine materials on terraces and beach ridges. Permeability is moderate through the outwash and slow or very slow through the glacial till or lacustrine materials. Slope ranges from 0 to 6 percent.

Haskins soils are commonly adjacent to the Jimtown, the Mahoning, and the Mermill soils and are similar to the Jimtown soils. Jimtown soils formed in glacial outwash, and Mahoning soils formed in glacial till. Mermill soils are wetter than Haskins soils and are more gray in the subsoil.

Typical pedon of Haskins loam, 0 to 2 percent slopes, in Berea, approximately 1,650 feet east of the intersection of Eastland Road and Austin Road.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam; moderate medium and fine granular structure; friable; many roots; common fine black (10YR 2/1) concretions; 3 to 5 percent gravel; medium acid; abrupt smooth boundary.

B1—9 to 13 inches; dark yellowish brown (10YR 4/4) sandy clay loam; common medium distinct gray (10YR 6/1) mottles; weak medium subangular blocky structure; friable; common roots; grayish brown (2.5Y 5/2) coatings on faces of peds; thin patchy grayish brown (2.5Y 5/2) clay films bridging sand grains; 3 to 5 percent gravel; common fine black (10YR 2/1) concretions; strongly acid; gradual smooth boundary.

B21t—13 to 17 inches; yellowish brown (10YR 5/4) sandy clay loam; common medium distinct grayish brown (10YR 5/2) and few medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; common roots; grayish brown (10YR 5/2) coatings on faces of peds; thin patchy clay films on faces of peds; 3 to 5 percent gravel; strongly acid; clear smooth boundary.

B22t—17 to 27 inches; dark yellowish brown (10YR 4/4) sandy clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; common roots; gray (10YR 5/1) coatings on faces of peds; thin patchy clay films on faces of peds; 6 percent gravel; strongly acid; clear smooth boundary.

B31t—27 to 33 inches; yellowish brown (10YR 5/4) gravelly clay loam; few medium distinct brownish yellow (10YR 6/6) mottles; weak medium prismatic structure; firm; few roots; grayish brown (10YR 5/2) coatings on faces of peds; medium patchy gray (10YR 5/1) clay films on vertical faces of peds; 20 percent gravel; slightly acid; abrupt smooth boundary.

IIB32t—33 to 42 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak coarse prismatic structure; firm; thin patchy clay films and grayish brown (10YR 5/2) coatings on vertical faces of peds; 10 percent gravel; mildly alkaline; clear smooth boundary.

IIC—42 to 60 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; common grayish brown vertical partings; common medium light gray (10YR 7/2) calcium carbonate coatings in partings; 10 percent gravel; slight effervescence; mildly alkaline.

The solum ranges from 28 to 48 inches in thickness. The Ap horizon is medium acid or slightly acid. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is sandy clay loam or clay loam or their gravelly analogs. Reaction is strongly acid to slightly acid. The IIB horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silty clay loam, clay loam, or clay that ranges from slightly acid to mildly alkaline. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

Holly series

The Holly series consists of deep soils that are poorly drained. These soils formed in alluvium. Permeability is moderate or moderately slow. Slope is 0 to 2 percent.

Holly soils are commonly adjacent to the Chagrin, the Orrville, and the Sebring soils. The Chagrin and the Orrville soils are better drained and on slightly higher positions on the flood plains. Sebring soils are on terraces and in basins of former glacial lakes. They contain more silt and less sand than Holly soils. They also have an argillic horizon.

Typical pedon of Holly silt loam, frequently flooded, in North Royalton, 2,250 feet north of the intersection of York Road and State Route 82 along York Road, then 625 feet west.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; common medium prominent dark reddish brown (5YR 3/3) mottles; weak medium and fine granular structure; friable; many roots; neutral; clear smooth boundary.

B21g—8 to 24 inches; gray (10YR 5/1) silt loam; many fine prominent dark brown (7.5YR 4/4) mottles; weak coarse prismatic structure parting to weak medium and fine subangular blocky; friable; common roots; about 3 percent gravel; patchy very dark gray (10YR 3/1) coatings on faces of peds; slightly acid; clear smooth boundary.

B22g—24 to 32 inches; dark gray (10YR 4/1) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; common roots; about 3 percent coarse fragments; common medium very dark gray (10YR 3/1) concretions (iron and manganese oxides); slightly acid; clear smooth boundary.

IIC1g—32 to 44 inches; grayish brown (10YR 5/2) clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; few roots; 8 to 10 percent coarse fragments; common medium very dark gray (10YR 3/1) concretions (iron and manganese oxides); slightly acid; clear smooth boundary.

IIC2g—44 to 51 inches; grayish brown (10YR 5/2) gravelly loam; common medium prominent yellowish brown (10YR 5/6) mottles; massive; friable; 15 percent coarse fragments; slightly acid; clear smooth boundary.

IIC3—51 to 60 inches; grayish brown (10YR 5/2) gravelly loam; massive; friable; 20 to 25 percent coarse fragments; slightly acid; clear smooth boundary.

The solum ranges from 27 to 37 inches in thickness. The Ap horizon is commonly silt loam, but in some pedons it is loam. It is medium acid to neutral depending upon the liming program. The B horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 2 or less. It is silt loam, loam, or silty clay loam. Reaction is medium acid or slightly acid. The C horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 2 or less. It is dominantly silty clay loam, loam, sandy loam, or clay loam or their gravelly analogs.

Hornell series

The Hornell series consists or moderately deep, somewhat poorly drained soils that have slow or very slow permeability. They formed in glacial till and residuum of shale bedrock on uplands. Slope ranges from 2 to 18 percent.

Hornell soils are commonly adjacent to the Allis, the Brecksville, and the Loudonville soils and are similar to the Allis soils. Allis soils are wetter than Hornell soils and are more gray in the subsoil. The Brecksville and the Loudonville soils are better drained. Brecksville soils are steeper than the Hornell soils, and Loudonville soils contain less clay in the subsoil and are underlain by sandstone bedrock.

Typical pedon of Hornell silt loam, 2 to 6 percent slopes, in Parma, 2,800 feet east of the intersection of Pleasant Valley Road and York Road along Pleasant Valley Road, then 1,000 feet south.

A11—0 to 3 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine granular structure; friable; many roots; 5 percent shale fragments; extremely acid; clear smooth boundary.

A12—3 to 6 inches; brown (10YR 4/3) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate fine granular structure; friable; many roots; common dark grayish brown (10YR 4/2) organic stains; 5 percent shale fragments; extremely acid; clear smooth boundary.

B1—6 to 12 inches; yellowish brown (10YR 5/4) silty clay loam; common medium faint yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; common roots; grayish brown (10YR 5/2) coatings on faces of peds; 5 percent shale fragments; very strongly acid; clear smooth boundary.

B21—12 to 20 inches; yellowish brown (10YR 5/4) shaly silty clay loam; many medium distinct grayish brown (2.5Y 5/2) mottles; weak coarse prismatic structure parting to moderate medium and fine angular blocky; firm; few roots; faces of peds coated grayish brown (2.5Y 5/2); 20 percent shale fragments; very strongly acid; clear smooth boundary.

B3—20 to 26 inches; grayish brown (10YR 5/2) shaly silty clay; common medium prominent reddish yellow (5YR 6/6) and few fine distinct light olive brown (2.5Y 5/6) mottles; moderate medium platy structure; firm; few roots; light olive brown (2.5Y 5/4) coatings on faces of peds; 20 percent shale fragments; very strongly acid; gradual smooth boundary.

C—26 to 34 inches; grayish brown (2.5Y 5/2) shaly silty clay loam; moderate thick and medium platy structure; firm; 40 percent shale fragments; very strongly acid; clear smooth boundary.

Cr—34 inches; grayish brown (2.5Y 5/2) thin-bedded rippable shale bedrock; strongly acid.

The solum ranges from 26 to 36 inches in thickness. The A1 horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is extremely acid to strongly acid. The B2 horizon has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 3 or 4. It is silty clay loam or silty clay or their shaly analogs. The C horizon has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 2. It is silty clay loam or silty clay or their shaly analogs.

Jimtown series

The Jimtown series consists of deep soils that are somewhat poorly drained and moderately permeable. These soils formed in stratified outwash deposits on terraces and beach ridges. Slope ranges from 0 to 3 percent.

Jimtown soils are commonly adjacent to the Bogart, the Chili, and the Haskins soils and are similar to Haskins soils. The Bogart and the Chili soils are better drained and are at slightly higher positions on the landscape than the Jimtown soils. They are less gray in the subsoil. Haskins soils formed in glacial outwash over glacial till or lacustrine materials.

Typical pedon of Jimtown loam, 0 to 3 percent slopes, in Brecksville, 1,000 feet northeast of the intersection of Fitzwater Road and Greenhaven Parkway along Fitzwater Road, then 100 feet northwest.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam; moderate medium and fine granular structure; friable; many roots; 8 to 10 percent gravel; medium acid; abrupt smooth boundary.

B21t—9 to 16 inches; dark yellowish brown (10YR 4/4) clay loam; common fine distinct grayish brown (10YR 5/2) and common medium distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; many roots; dark grayish brown (10YR 4/2) coatings on faces of peds; thin patchy clay films on faces of peds; 4 to 6 percent gravel; medium acid; clear smooth boundary.

B22t—16 to 29 inches; dark yellowish brown (10YR 4/4) sandy clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common roots; gray (10YR 5/1) coatings on faces of peds; medium patchy grayish brown (10YR 5/2) clay films on faces of peds and bridging sand grains; 10 percent gravel; very strongly acid; clear smooth boundary.

B23t—29 to 40 inches; dark yellowish brown (10YR 4/4) sandy clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; few roots; grayish brown (10YR 5/2) clay films bridging sand grains and on vertical faces of peds; 10 percent gravel; very strongly acid; clear smooth boundary.

B3—40 to 48 inches; dark brown (10YR 4/3) gravelly sandy clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; massive; firm; thin very patchy grayish brown (10YR 5/2) clay films bridging sand grains; 15 percent gravel; very strongly acid; clear smooth boundary.

C—48 to 60 inches; dark yellowish brown (10YR 4/4) gravelly sandy loam; massive; friable; 15 percent gravel; slightly acid.

The solum ranges from 39 to 48 inches in thickness. It is from 5 to 25 percent, by volume, coarse fragments in the B horizon.

The A horizon is very strongly acid to slightly acid. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is loam, sandy clay loam, or clay loam or their gravelly analogs. Thin subhorizons of sandy loam are in some pedons. The B horizon is very strongly acid to slightly acid. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is loamy sand or sandy loam or their gravelly analogs. It is medium acid to neutral.

Loudonville series

The Loudonville series consists of moderately deep soils that are well drained and moderately permeable. These soils formed in glacial till and residuum of the underlying sandstone bedrock on uplands. Slope ranges from 2 to 18 percent and 25 to 70 percent.

Loudonville soils are commonly adjacent to the Dekalb, the Hornell, the Mitiwanga, and the Rittman soils. The Dekalb and the Hornell soils do not have an argillic horizon. Dekalb soils also have more coarse fragments in the solum, and Hornell soils are more gray in the subsoil than Loudonville soils. Mitiwanga soils are on low knolls and flats and are gray in the upper part of the argillic horizon. Rittman soils are deep to bedrock and have a fragipan.

Typical pedon of Loudonville silt loam, 2 to 6 percent slopes, in Brecksville, 3,500 feet south of the intersection of State Route 21 and Fitzwater Road along State Route 21, then 2,400 feet east.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium and fine granular structure; friable; many roots; about 2 percent coarse fragments; strongly acid; abrupt smooth boundary.

B1—6 to 8 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; many roots; dark brown (10YR 4/3) and dark grayish brown (10YR 4/2) organic coatings on faces of peds; about 5 percent coarse fragments; very strongly acid; clear smooth boundary.

B21t—8 to 13 inches; yellowish brown (10YR 5/4) light silty clay loam; weak medium subangular blocky structure; friable; many roots; thin very patchy yellowish brown (10YR 5/4) clay films on faces of peds; about 5 percent coarse fragments; very strongly acid; clear smooth boundary.

B22t—13 to 20 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium and fine subangular blocky structure; friable; common roots; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; 10 percent coarse fragments; very strongly acid; clear smooth boundary.

IIB3t—20 to 25 inches; yellowish brown (10YR 5/4) channery silt loam; moderate medium subangular blocky structure; friable; few roots; thin patchy yellowish brown (10YR 5/4) clay films on faces of peds; about 45 percent coarse fragments; very strongly acid; abrupt smooth boundary.

IIR—25 inches; sandstone bedrock.

The thickness of the solum and depth to bedrock are 20 to 40 inches. The solum is very strongly acid to medium acid. It is 0 to 5 percent, by volume, coarse fragments in the Ap and B1 horizons; 5 to 10 percent coarse fragments in the B2 horizon; and 10 to 50 percent coarse fragments in the B3 horizon.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. The B2 horizon is loam, silt loam, or silty clay loam. Some pedons have a C horizon that has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The C horizon is silt loam or loam or their channery analogs.

Mahoning series

The Mahoning series consists of deep soils that are somewhat poorly drained and slowly or very slowly permeable. These soils formed in glacial till on till plains and on higher parts of lake plains that do not have a lacustrine mantle. Slope ranges from 0 to 6 percent.

Mahoning soils are commonly adjacent to the Allis, the Condit, the Darien, the Ellsworth, and the Mitiwanga soils and are similar to the Mitiwanga and the Wadsworth soils. Allis soils do not have an argillic horizon and have shale bedrock at a depth of 20 to 40 inches. Condit soils are wetter than Mahoning soils and more gray in the subsoil. Darien soils contain less clay in the subsoil. Ellsworth soils are better drained than Mahoning soils and less gray in the subsoil. Mitiwanga soils are underlain by sandstone bedrock at a depth of 20 to 40 inches. Wadsworth soils have a fragipan.

Typical pedon of Mahoning silt loam, 0 to 2 percent slopes, in Strongsville, 1,100 feet east of the intersection of State Route 82 and the Cuyahoga-Lorain County line along State Route 82, then 1,300 feet south.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium and fine granular structure; friable; many roots; about 2 percent coarse fragments; strongly acid; abrupt smooth boundary.

B1—7 to 9 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct light brownish gray (10YR 6/2) and few fine faint strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; dark grayish brown (10YR 4/2) coatings on faces of peds; many roots; about 2 percent coarse fragments; very strongly acid; clear smooth boundary.

B21t—9 to 15 inches; yellowish brown (10YR 5/4) silty clay loam; few medium distinct light brownish gray (10YR 6/2) and common medium distinct yellowish brown (10YR 5/8) mottles; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; firm; many roots; grayish brown (10YR 5/2) coatings on faces of peds; thin patchy clay films on faces of peds; about 2 percent coarse fragments; very strongly acid; clear smooth boundary.

B22t—15 to 24 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; common roots; grayish brown (10YR 5/2) coatings on faces of peds; thin patchy clay films on faces of peds; 3 to 5 percent coarse fragments; common medium very dark gray (10YR 3/1) concretions (iron and manganese oxides); medium acid; clear smooth boundary.

B23t—24 to 34 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium and fine prismatic structure; firm; few roots; gray (10YR 5/1) coatings on faces of peds; thin patchy clay films on vertical faces of peds; 3 to 5 percent coarse fragments; neutral; clear smooth boundary.

B3t—34 to 39 inches; olive brown (2.5Y 4/4) silty clay loam; few medium distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure; firm; gray (N 5/0) coatings on faces of peds; about 5 percent coarse fragments; mildly alkaline; clear smooth boundary.

C1—39 to 48 inches; olive brown (2.5Y 4/4) silty clay loam; massive; firm; dark gray (N 4/0) seams in partings; about 8 percent coarse fragments; slight effervescence; mildly alkaline; clear smooth boundary.

C2—48 to 60 inches; olive brown (2.5Y 4/4) clay loam; few medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; about 12 percent coarse fragments; grayish brown (10YR 5/2) seams in partings; light gray (10YR 7/2) calcium carbonate coatings in seams; slight effervescence; mildly alkaline.

The solum ranges from 28 to 44 inches in thickness. The upper part of the solum is strongly acid or very strongly acid unless it is limed; the lower part ranges from medium acid to mildly alkaline.

The B 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. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4.

Mentor series

The Mentor series consists of deep soils that are well drained and moderately permeable. These soils formed in lacustrine sediments on dissected terraces. Slope ranges from 25 to 70 percent.

Mentor soils are commonly adjacent to the Brecksville, the Ellsworth, the Geeburg, and the Glenford soils. Brecksville soils have shale bedrock at a depth of 20 to 40 inches; Ellsworth soils formed in glacial till and have more clay and coarse fragments in the subsoil and substratum than Mentor soils. The Geeburg and the Glenford soils are wetter than Mentor soils and are gray in the subsoil. Geeburg soils also have more clay in the subsoil than Mentor soils have.

Typical pedon of Mentor silt loam, from an area of Geeburg-Mentor silt loams, 25 to 70 percent slopes, in Brecksville Reservation of the Cleveland Metropolitan Park system, 800 feet west of the intersection of Parkview Drive and Riverview Road along Parkview Drive, then 1,100 feet south.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam; moderate fine granular structure; friable; many roots; medium acid; abrupt smooth boundary.

A2—4 to 7 inches; brown (10YR 5/3) silt loam; weak thin platy structure; friable; many roots; very strongly acid; clear smooth boundary.

B1—7 to 13 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium blocky structure; friable; many roots; very strongly acid; clear smooth boundary.

B21t—13 to 25 inches; yellowish brown (10YR 5/6) silt loam; weak medium and coarse subangular blocky structure; friable; common roots; thin patchy yellowish brown (10YR 5/4) clay films, mainly on horizontal faces of peds; common very dark grayish brown (10YR 3/2) fillings in root channels; very strongly acid; clear smooth boundary.

B22t—25 to 33 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; common roots; thin patchy brown (10YR 4/3) clay films on faces of peds; medium acid; clear smooth boundary.

B3—33 to 36 inches; dark yellowish brown (10YR 4/4) silt loam; few medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure parting to weak medium platy; friable; few roots; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; slightly acid; clear smooth boundary.

C1—36 to 44 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct yellowish brown (10YR 5/8) mottles; massive; firm; few roots; slightly acid; gradual smooth boundary.

C2—44 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; common coarse distinct yellowish brown (10YR 5/6) mottles; massive; friable; slightly acid.

The solum ranges from 36 to 44 inches in thickness. The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is very strongly acid to medium acid in the upper part and strongly acid to slightly acid in the lower part. The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is dominantly silt loam or light silty clay loam and strata of loam or sandy loam.

Mermill series

The Mermill series consists of deep soils that are very poorly drained. These soils formed in glacial outwash and the underlying glacial till or lacustrine material on lake plains. Permeability is moderate through the outwash and slow or very slow through the underlying till or lacustrine material. Slope is 0 to 2 percent.

Mermill soils are commonly adjacent to the Haskins and the Miner soils and the Stafford Variant and are similar to the Miner soils. The Haskins soils and the Stafford Variant are better drained than the Mermill soils and less gray in the subsoil. Miner soils formed in glacial till and have a higher clay content in the upper part of the subsoil than Mermill soils.

Typical pedon of Mermill loam, in Westlake, 1,062 feet north of the intersection of Columbia Road and Maple Ridge Road along Columbia Road, then 810 feet east.

Ap—0 to 8 inches; very dark gray (10YR 3/1) loam; gray (10YR 5/1) dry; weak medium and fine granular structure; friable; many roots; 3 percent coarse fragments; medium acid; clear smooth boundary.

B21t—8 to 17 inches; dark grayish brown (10YR 4/2) loam; common medium distinct light yellowish brown (10YR 6/4) and gray (N 5/0) mottles; weak medium subangular blocky structure; friable; common roots; thin patchy light brownish gray (10YR 6/2) clay films bridging sand grains; 3 percent gravel; common very dark gray (10YR 3/1) organic coatings lining root channels; slightly acid; abrupt wavy boundary.

B22tg—17 to 21 inches; dark grayish brown (10YR 4/2) clay loam; common medium distinct yellowish brown (10YR 5/4) and few fine distinct light brownish gray (10YR 6/2) mottles; massive; friable; common roots; thin patchy dark grayish brown (10YR 4/2) clay films bridging sand grains; 10 percent fine gravel; slightly acid; abrupt smooth boundary.

IIB23tg—21 to 36 inches; dark grayish brown (10YR 4/2) silty clay loam; common medium distinct yellowish brown (10YR 5/4) mottles; weak medium prismatic structure; firm; few roots; medium continuous dark gray (10YR 4/1) clay films on vertical faces of peds; 8 percent coarse fragments; neutral; clear smooth boundary.

IIC1—36 to 51 inches; dark gray (10YR 4/1) silty clay loam; common medium distinct yellowish brown (10YR 5/4) mottles; massive; firm; 10 percent coarse fragments; slight effervescence; mildly alkaline; clear smooth boundary.

IIC2—51 to 60 inches; dark gray (10YR 4/1) silty clay loam; common medium distinct light olive brown (2.5Y 5/4) mottles; massive; firm; 10 percent coarse fragments; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 30 to 48 inches. The depth to fine-textured till or lacustrine material ranges from 20 to 34 inches.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is slightly acid or neutral. The B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is medium acid to neutral. The IIB horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 0 to 2. It is silty clay loam, clay loam, or clay and neutral or mildly alkaline. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is silty clay loam or clay.

Miner series

The Miner series consists of deep soils that are very poorly drained and slowly permeable. These soils formed in glacial till on the lake plains and till plains. Slope is 0 to 2 percent.

Miner soils are commonly adjacent to the Allis, the Condit, the Ellsworth, the Mahoning, and the Mermill soils. Allis soils are underlain by shale bedrock at a depth of 20 to 40 inches, and they lack an argillic horizon. The Ellsworth and the Mahoning soils are better drained than the Miner soils and are less gray in the subsoil. Condit soils have an ochric epipedon. Mermill soils formed in glacial outwash over glacial till or lacustrine material.

Typical pedon of Miner silty clay loam, in Westlake, 500 feet east of the intersection of Center Ridge Road and Canterbury Road along Center Ridge Road, then 440 feet south.

Ap—0 to 7 inches; very dark gray (10YR 3/1); silty clay loam, gray (10YR 5/1) dry; few fine prominent reddish brown (5YR 4/4) mottles; moderate medium and fine granular structure; friable; many roots; slightly acid; abrupt smooth boundary.

B21tg—7 to 15 inches; gray (10YR 5/1) clay; many medium distinct dark brown (7/5YR 4/4) and common medium distinct strong brown (7/5YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium and fine angular blocky; firm; many roots; thin patchy gray (10YR 5/1) clay films on faces of peds; medium acid; clear smooth boundary.

B22tg—15 to 26 inches; gray (10YR 5/1) clay; common medium distinct yellowish brown (10YR 5/4 and 5/6) mottles; weak coarse and medium angular blocky structure; firm; common roots; thin continuous gray (10YR 5/1) clay films on faces of peds; common medium very dark gray (10YR 3/1) concretions (iron and manganese oxides); about 2 percent coarse fragments; slightly acid; clear smooth boundary.

B3tg—26 to 42 inches; gray (10YR 5/1) clay; many medium distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium and fine subangular and angular blocky; firm; common roots; thin patchy gray (10YR 5/1) clay films on faces of peds; few medium very dark gray (10YR 3/1) concretions (iron and manganese oxides); 10 percent coarse fragments; neutral; clear smooth boundary.

C1g—42 to 54 inches; gray (10YR 5/1) silty clay; common medium distinct olive brown (2.5Y 4/4) mottles; massive, few vertical partings; firm; about 10 percent coarse fragments; slight effervescence; mildly alkaline; clear smooth boundary.

C2g—54 to 60 inches; dark grayish brown (2.5Y 4/2) shaly clay loam; common medium distinct olive brown (2.5Y 4/4) mottles; massive; firm; 30 percent shale fragments; neutral.

The solum ranges from 40 to 50 inches in thickness. The Ap horizon has hue of 10YR or 2.5Y, value of 3, and chroma of 1 or 2. The B horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 2 or less. It is silty clay loam, silty clay, or clay. The C horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 0 to 4. It is silty clay loam, silty clay, clay loam, or shaly clay loam.

Mitiwanga series

The Mitiwanga series consists of moderately deep soils that are somewhat poorly drained and moderately permeable. These soils formed in glacial till over sandstone bedrock on till plains and lake plains. Slope ranges from 0 to 6 percent.

The Mitiwanga soils in Cuyahoga County are more acid and have a lower base saturation than is defined in the range for the Mitiwanga series. This difference, however, does not alter the use or behavior of the soils.

Mitiwanga soils are commonly adjacent to the Darien, the Loudonville, and the Mahoning soils. The Darien and the Mahoning soils are deep to bedrock. Loudonville soils are better drained than Mitiwanga soils and are less gray in the subsoil.

Typical pedon of Mitiwanga silt loam, 0 to 2 percent slopes, in Mayfield, 1,062 feet south of the intersection of State Route 91 and the Cuyahoga-Lake county line along State Route 91, then 312 feet east.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; few fine prominent yellowish red (5YR 5/6) mottles; moderate medium and fine granular structure; friable; many roots; few fine very dark gray (10YR 3/1) concretions (iron and manganese oxides); about 5 percent coarse fragments; very strongly acid; abrupt smooth boundary.

A2—9 to 12 inches; light brownish gray (2.5Y 6/2) silt loam; common medium prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; many roots; about 5 percent coarse fragments; very strongly acid; abrupt smooth boundary.

B21t—12 to 17 inches; yellowish brown (10YR 5/4) silty clay loam; common medium faint yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; friable; common roots; thin patchy clay films and grayish brown (10YR 5/2) coatings on faces of peds; about 7 percent coarse fragments; very strongly acid; clear smooth boundary.

B22t—17 to 23 inches; yellowish brown (10YR 5/4) silty clay loam; common medium faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; common roots; thin patchy clay films and grayish brown (10YR 5/2) coatings on faces of peds; about 12 percent coarse fragments; very strongly acid; clear smooth boundary.

C—23 to 29 inches; yellowish brown (10YR 5/4) flaggy loam; many medium distinct yellowish red (5YR 5/6) and many medium distinct grayish brown (10YR 5/2) mottles; massive; friable; common medium very dark gray (10YR 3/1) concretions (iron and manganese oxides); about 40 percent coarse fragments; very strongly acid; abrupt smooth boundary.

IIR—29 inches; sandstone bedrock.

The thickness of the solum and depth to lithic contact are from 20 to 40 inches. The Ap horizon is very strongly acid to medium acid. The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silty clay loam, silt loam, or loam that is extremely acid to strongly acid. It is from 5 to 15 percent, by volume, coarse fragments. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is sandy loam, loam, silt loam, or their flaggy analogs. Reaction is extremely acid to strongly acid. The C horizon is from 10 to 50 percent, by volume, coarse fragments.

Orrville series

The Orrville series consists of deep soils that are somewhat poorly drained and moderately permeable. These soils formed in alluvium on flood plains. Slope is 0 to 2 percent.

Orrville soils are commonly adjacent to the Chagrin, the Euclid, and the Holly soils. Chagrin soils are better drained than Orrville soils and are less gray in the subsoil. Euclid soils contain less sand than Orrville soils and are at relatively higher positions on the landscape. Holly soils are wetter and more gray in the subsoil than Orrville soils.

Typical pedon of Orrville silt loam, frequently flooded, in village of Brecksville, 438 feet north of the intersection of Riverview Road and Snowville Road along Riverview Road, then 625 feet east.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; weak medium and fine granular structure; friable; few fine very dark gray (10YR 3/1) concretions (iron and manganese oxides); strongly acid; abrupt smooth boundary.

B21—9 to 18 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct yellowish brown (10YR 5/8) and gray (10YR 5/1) mottles; weak medium and fine subangular blocky structure; friable; few fine very dark gray (10YR 3/1) concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

B22g—18 to 30 inches; light brownish gray (10YR 6/2) silt loam; many medium prominent strong brown (7.5YR 5/6) and few fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; friable; patchy grayish brown (10YR 5/2) coatings on vertical faces of peds; few fine very dark gray (10YR 3/1) concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

B3g—30 to 41 inches; grayish brown (10YR 5/2) silt loam; many medium prominent reddish brown (5YR 4/4) mottles; weak coarse and medium subangular blocky structure; friable; few fine dark gray (10YR 3/1) concretions (iron and manganese oxides); medium acid; abrupt smooth boundary.

Cg—41 to 60 inches; grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) stratified loamy sand and sandy loam; many medium distinct dark reddish brown (5YR 3/4) mottles; massive; loose; medium acid.

The solum ranges from 30 to 48 inches in thickness. It is from slightly acid to strongly acid in the solum and the underlying material.

The B horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. It is silt loam, loam, or silty clay loam. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

Oshtemo series

The Oshtemo series consists of deep soils that are well drained. These soils formed in stratified loamy and sandy material on outwash terraces and beach ridges. Permeability is moderately rapid in the subsoil and very rapid in the substratum. Slope ranges from 0 to 8 percent and 25 to 55 percent.

The Oshtemo soils are commonly adjacent to the Chili and the Elnora soils and the Stafford and Tioga Variants. They are similar to Chili soils. Chili soils contain more gravel and clay in the subsoil than Oshtemo soils. Elnora soils contain more sand and less silt in the B horizon than the Oshtemo soils and have mottles of 2 chroma in the lower part of the B horizon. The Stafford Variant is wetter than Oshtemo soils and is more gray in the subsoil. The Tioga Variant contains less sand in the subsoil than the Oshtemo soils, and it lacks an argillic horizon.

Typical pedon of Oshtemo sandy loam, 0 to 2 percent slopes, in Brecksville, 3,000 feet southeast of the intersection of Riverview Road and Parkview Road along Riverview Road, then 900 feet east.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) sandy loam; weak medium and fine granular structure; very friable; many roots; strongly acid; abrupt smooth boundary.

A2—8 to 16 inches; yellowish brown (10YR 5/4) loamy sand; weak thick platy structure; very friable; dark grayish brown (10YR 4/2) organic stains; strongly acid; clear smooth boundary.

B21t—16 to 25 inches; brown (7.5YR 5/4) sandy loam; weak coarse subangular blocky structure; very friable; thin patchy dark brown (7.5YR 4/4) clay films bridging sand grains; dark grayish brown (10YR 4/2) organic stains in root channels; strongly acid; clear smooth boundary.

B22t—25 to 35 inches; brown (7.5YR 5/4) sandy loam; weak coarse subangular blocky structure; very friable; dark yellowish brown (10YR 4/4) coatings on faces of peds; medium patchy dark brown (7.5YR 4/4) clay films bridging sand grains; medium acid; clear smooth boundary.

B23t—35 to 39 inches; brown (7.5YR 4/4) sandy loam; massive; very friable; thin very patchy dark brown (7.5YR 4/4) clay films bridging sand grains; about 8 percent pebbles; medium acid; clear smooth boundary.

B31—39 to 43 inches; brown (7.5YR 5/4) loamy sand; single grained; loose; about 5 percent pebbles; medium acid; clear smooth boundary.

B32—43 to 53 inches; brown (7.5YR 5/4) sandy loam; massive; very friable; about 3 percent pebbles; medium acid; abrupt smooth boundary.

C—53 to 60 inches; brown (10YR 5/3) sand; single grained; loose; few pebbles; slightly acid.

The solum ranges from 40 to 60 inches in thickness. It is from 0 to 20 percent, by volume, fine gravel. The C horizon is 0 to 30 percent fine gravel.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is strongly acid or medium acid where it is unlimed. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is strongly acid or medium acid. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

Rittman series

The Rittman series consists of deep soils that are moderately well drained. These soils have a dense fragipan that restricts rooting depth and water movement. Permeability is moderate above the fragipan and slow in the fragipan. The Rittman soils formed in glacial till on uplands. Slope ranges from 2 to 12 percent.

Rittman soils are commonly adjacent to the Wadsworth and the Loudonville soils and are similar to the Ellsworth soils. Wadsworth soils are wetter than Rittman soils and are more gray in the subsoil. Ellsworth soils contain more clay in the subsoil and do not have a fragipan. Loudonville soils are better drained than Rittman soils, and they have sandstone bedrock at depths of 20 to 40 inches.

Typical pedon of Rittman silt loam, 2 to 6 percent slopes, in Broadview Heights, 5,500 feet west of the intersection of Edgerton Road and State Route 176 along Edgerton Road, then 880 feet north.

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam; moderate medium and fine granular structure; friable; many roots; about 8 percent pebbles; strongly acid; abrupt smooth boundary.

B21t—7 to 14 inches; yellowish brown (10YR 5/4) silty clay loam; common medium faint yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; friable; many roots; brown (10YR 5/3) thin patchy clay films and silt coatings on faces of peds; about 5 percent pebbles; strongly acid; clear smooth boundary.

B22t—14 to 22 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct strong brown (7.5YR 5/6) and common fine distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; common roots; grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; common roots; grayish brown (10YR 5/2) silt coatings on faces of peds; thin patchy dark brown (10YR 4/3) clay films on faces of peds; about 10 percent pebbles; few medium very dark gray (10YR 3/1) concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

Bx1—22 to 26 inches; dark yellowish brown (10YR 4/4) silty clay loam; few medium distinct grayish brown (10YR 5/2) mottles; weak coarse prismatic structure; very firm; about 60 percent brittle; faces of peds coated grayish brown (10YR 5/2); thick patchy clay films on vertical faces of peds; about 10 percent pebbles; common medium very dark gray (10YR 3/1) concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

Bx2—26 to 38 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak very coarse prismatic structure parting to moderate medium platy; very firm; brittle; vertical faces of peds coated gray (10YR 5/1); thick patchy clay films on vertical faces of peds; 10 percent pebbles; many medium very dark gray (10YR 3/1) concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

Bx3—38 to 44 inches; dark yellowish brown (10YR 4/4) silty clay loam; few medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak thick platy; very firm; brittle; vertical faces of peds coated grayish brown (10YR 5/2); medium patchy clay films on vertical faces of peds; about 10 percent pebbles; medium acid; clear smooth boundary.

C—44 to 60 inches; dark brown (10YR 4/3) silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; common grayish brown (10YR 5/2) coatings in fractures; about 10 percent pebbles; slight effervescence; mildly alkaline.

The solum ranges from 34 to 55 inches in thickness. It is from 0 to 10 percent, by volume, coarse fragments above the Bx horizon and from 2 to 15 percent coarse fragments in the Bx and C horizons.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Where it is unlimed, the Ap horizon is strongly acid or very strongly acid. The B2t horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The Bx horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silty clay loam, heavy loam, or clay loam. The Bx horizon is strongly acid or very strongly 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.

Sebring series

The Sebring series consists of deep soils that are poorly drained and moderately slowly permeable. They formed in water-laid deposits on terraces and in basins of former glacial lakes. Slope is 0 to 2 percent.

Sebring soils are commonly adjacent to the Canadice, the Fitchville, and the Glenford soils and are similar to the Canadice and the Condit soils. The Canadice and the Condit soils contain more clay in the B horizon. The Glenford and the Fitchville soils are better drained than the Sebring soils and are less gray in the subsoil.

Typical pedon of Sebring silt loam, in Bentleyville, 1,900 feet north of the intersection of Franklin Street and Holbrook Road along Franklin Street, then 1,300 feet west.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium and fine granular structure; friable; many roots; slightly acid; clear smooth boundary.

A2—9 to 13 inches; gray (10YR 5/1) silt loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; many roots; slightly acid; clear smooth boundary.

Blg—13 to 17 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; thin continuous grayish brown silt coatings on faces of peds; medium acid; clear smooth boundary.

B21tg—17 to 21 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; few roots; grayish brown

(10YR 5/2) coatings and thin patchy clay films on faces of peds; medium acid; clear smooth boundary.

B22tg—21 to 24 inches; grayish brown (10YR 5/2) silty clay loam; many medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; few roots; light brownish gray (10YR 6/2) coatings and thin patchy clay films on faces of peds; few fine very dark gray (10YR 3/1) concretions (iron and manganese oxides); slightly acid; clear smooth boundary.

B23tg—24 to 28 inches; grayish brown (2.5Y 5/2) silty clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; few roots; grayish brown (2.5Y 5/2) coatings and thin very patchy clay films on faces of peds; neutral; clear smooth boundary.

B31g—28 to 37 inches; gray (N 6/0) silty clay loam; many medium prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; few roots; neutral; clear smooth boundary.

B32g—37 to 44 inches; gray (N 5/0) silty clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; few roots; neutral; clear smooth boundary.

Cg—44 to 60 inches; gray (10YR 5/1) silty clay loam; few medium prominent strong brown (7.5YR 5/6) mottles; massive; firm; neutral.

The solum ranges from 35 to 52 inches in thickness. The A horizon is not present in some pedons. It has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. It is silt loam or silty clay loam. The B horizon has hue of 10YR or 2.5Y or is neutral, value of 4 to 6, and chroma of 0 to 2. It is medium acid to very strongly acid in the upper part and neutral to medium acid in the lower part. The C horizon has hue of 10YR or 2.5Y, value of 5, and chroma of 0 to 2. It is stratified silt loam and silty clay loam. Reaction in the C horizon is slightly acid to mildly alkaline.

Stafford Variant

The Stafford Variant consists of deep soils that are somewhat poorly drained and moderately rapidly permeable. These soils formed in glaciofluvial sands on lake plains. Slope is 0 to 2 percent.

Stafford Variant soils are commonly adjacent to the Elnora, the Mermill, and the Oshtemo soils. The Elnora and the Oshtemo soils are better drained and less gray in the subsoil than the Stafford Variant. The Mermill and the Oshtemo soils have an argillic horizon. Mermill soils have a darker colored surface layer and have moderately fine textured or fine textured glacial till in the lower part of the subsoil and in the substratum.

Typical pedon of Stafford Variant sandy loam, in Westlake, 500 feet west of the intersection of Center Ridge Road and Dover Road along Center Ridge Road, then 550 feet south.

Ap—0 to 4 inches; dark grayish brown (10YR 4/2) sandy loam; moderate medium and fine granular structure; friable; many roots; slightly acid; clear smooth boundary.

B1—4 to 9 inches; brown (10YR 5/3) loamy sand; few medium distinct yellowish brown (10YR 5/6) mottles; weak medium platy structure; loose; many roots; few medium very dark gray (10YR 3/1) concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

B21g—9 to 17 inches; grayish brown (10YR 5/2) sandy loam; common medium distinct yellowish brown (10YR 5/6) and few medium faint light brownish gray (10YR 6/2) mottles; weak medium granular structure; very friable; common roots; few medium very dark gray (10YR 3/1) concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

B22g—17 to 24 inches; grayish brown (10YR 5/2) sandy clay loam; many medium distinct strong brown (7.5YR 5/6) mottles; massive; firm; common roots; few medium very dark gray (10YR 3/1) concretions (iron and manganese oxides); strongly acid, clear smooth boundary.

C1—24 to 39 inches; dark gray (10YR 4/1) loamy sand; few fine distinct brown (10YR 5/3) mottles; massive; loose; 1 percent pebbles; medium acid; gradual smooth boundary.

C2—39 to 49 inches; dark gray (10YR 4/1) loamy sand; few fine distinct brown (10YR 5/3) mottles; massive; loose; 1 percent pebbles; medium acid; gradual smooth boundary.

C3—49 to 60 inches; dark gray (10YR 4/1) loamy sand; few fine distinct reddish brown (5YR 5/3) mottles; massive; loose; 1 percent coarse fragments; slightly acid.

The solum ranges from 24 to 40 inches in thickness. The Ap horizon is strongly acid or medium acid, unless it is limed. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The B1 horizon is loamy sand or sandy loam. The B horizon is strongly acid to slightly acid. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. It is loamy sand or sand and medium acid to neutral.

Tioga series

The Tioga series consists of deep, well drained soils that formed in alluvium on flood plains. Permeability is moderate or moderately rapid. Slope is 0 to 2 percent.

Tioga soils are commonly adjacent to the Chagrin and the Euclid soils and the Tioga Variant and are similar to the Chagrin soils and the Tioga Variant. Chagrin soils have less sand between 10 and 40 inches. Euclid soils are wetter than Tioga soils and are more gray in the subsoil. The Tioga Variant differs from the Tioga soils in that it is on low stream terraces, has more acid solum, and has more profile development.

Typical pedon of Tioga loam, frequently flooded, in Gates Mills Reservation, Cleveland Metropolitan Parks, 200 feet south of the intersection of Chagrin River Road and Rogers Road along Chagrin River Road, then 350 feet east.

Ap—0 to 8 inches; dark brown (10YR 4/3) loam; weak fine granular structure; very friable; many roots; medium acid; clear smooth boundary.

B21—8 to 18 inches; dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; very friable; common roots; strongly acid; clear smooth boundary.

B22—18 to 29 inches, dark yellowish brown (10YR 4/4) fine sandy loam; weak medium subangular blocky structure; very friable; few roots; medium acid; clear smooth boundary.

C1—29 to 35 inches; brown (10YR 5/3) loamy sand; single grained; loose; few roots; slightly acid; clear smooth boundary.

C2—35 to 38 inches; brown (10YR 5/3) coarse sand; single grained; loose; slightly acid; clear smooth boundary.

C3—38 to 41 inches; yellowish brown (10YR 5/4) sandy loam; massive; very friable; slightly acid; abrupt smooth boundary.

C4—41 to 60 inches; yellowish brown (10YR 5/4) gravelly loamy sand; single grained; loose; about 35 percent fine gravel; neutral.

The solum ranges from 20 to 40 inches in thickness. Reaction ranges from strongly acid to neutral in the solum and medium acid to neutral in the substratum.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam, loam, or fine sandy loam and thin subhorizons of loamy sand. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is silt loam, loamy sand, sand, or sandy loam and their gravelly analogs.

Tioga Variant

The Tioga Variant consists of deep, well drained soils that formed in outwash material on low stream terraces. Permeability is moderate or moderately rapid in the subsoil and rapid in the underlying materials. Slope is 0 to 2 percent.

The Tioga Variant is commonly adjacent to the Chagrin, the Euclid, the Oshtemo, and the Tioga soils and is similar to the Chagrin and the Tioga soils. The Chagrin and the Tioga soils are on flood plains and have less development in the subsoil. Euclid soils are wetter than the Tioga Variant and are more gray in the subsoil. Oshtemo soils are on outwash terraces and beach ridges and have an argillic horizon.

Typical pedon of Tioga Variant loam, in Moreland Hills, approximately 100 feet south of the intersection of Chagrin River Road and Chagrin Boulevard along Chagrin River Road, then 210 feet east.

Ap—0 to 8 inches; dark brown (10YR 4/3) loam; moderate medium and fine granular structure; friable; many roots; strongly acid; abrupt smooth boundary.

B1—8 to 15 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; many roots; few medium dark brown (10YR 4/3) fillings in root channels; strongly acid, clear smooth boundary.

B21—15 to 20 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; common roots; strongly acid; clear smooth boundary.

B22—20 to 25 inches; yellowish brown (10YR 5/4) fine sandy loam; few fine faint yellowish brown (10YR 5/6) and few medium faint brown (10YR 5/3) mottles; weak medium subangular blocky structure; friable; few roots; strongly acid; clear smooth boundary.

B3—25 to 33 inches; dark yellowish brown (10YR 4/4) sandy loam; few medium and fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few roots; strongly acid; clear smooth boundary.

C1—33 to 37 inches; dark yellowish brown (10YR 4/4) loam; massive; friable; few roots; about 3 percent pebbles; medium acid; abrupt smooth boundary.

C2—37 to 53 inches; yellowish brown (10YR 5/4) loamy sand; single grained; loose; about 10 percent pebbles; medium acid; clear smooth boundary.

C3—53 to 60 inches; yellowish brown (10YR 5/4) gravelly loamy sand; single grained; loose; about 25 percent coarse fragments; slightly acid.

The solum ranges from 29 to 37 inches in thickness. Reaction ranges from very strongly acid to medium acid in the solum and strongly acid to slightly acid in the C horizon.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The B horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 or 4. It is silt loam, loam, fine sandy loam, or sandy loam. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is silt loam, sandy loam, or loamy sand and their gravelly analogs.

Wadsworth series

The Wadsworth series consists of deep, somewhat poorly drained soils that have moderate permeability or moderately slow permeability above the fragipan and slow or very slow permeability in the fragipan. They formed in glacial till on uplands. Slope ranges from 0 to 6 percent.

Wadsworth soils are commonly adjacent to the Mahoning and the Rittman soils and are similar to the Mahoning soils. Mahoning soils have more clay in the subsoil and do not have a fragipan. Rittman soils are better drained than Wadsworth soils and are less gray in the subsoil.

Typical pedon of Wadsworth silt loam, 0 to 2 percent slopes, in Bentleyville, South Chagrin Reservation, Cleveland Metropolitan Park system, 1,300 feet north of the intersection of Chagrin River Road and Cannon Road along Chagrin River Road, then 300 feet east.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium and fine granular structure; friable; common roots; 2 percent coarse fragments; very strongly acid; abrupt smooth boundary.

B1—8 to 13 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; few roots; light brownish gray (10YR 6/2) coatings on faces of peds; 4 percent coarse fragments; very strongly acid; clear smooth boundary.

B21tg—13 to 18 inches; yellowish brown (10YR 5/6) silty clay loam; common fine distinct grayish brown (10YR 5/2) and few fine faint strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to moderate coarse and medium subangular blocky; firm; grayish brown (10YR 5/2) coatings on faces of peds; thin patchy clay films on faces of peds; 2 percent coarse fragments; common medium very dark gray (10YR 3/1) concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

B22tg—18 to 25 inches; yellowish brown (10YR 5/6) silty clay loam; common fine distinct grayish brown (10YR 5/2) and common medium distinct strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to moderate coarse subangular blocky; very firm; grayish brown (10YR 5/2) coatings on faces of peds; thin patchy clay films on faces of peds; 4 percent coarse fragments; common medium distinct very dark gray (10YR 3/1) concretions (iron and manganese oxides); medium acid; clear smooth boundary.

Bx1—25 to 36 inches; yellowish brown (10YR 5/4) silty clay loam; few fine distinct strong brown (7.5YR 5/6) and few medium distinct grayish brown (10YR 5/2) mottles; weak coarse prismatic structure parting to moderate medium platy; very firm; 80 percent brittle; medium patchy grayish brown (10YR 5/2) clay films on vertical faces of peds; 8 percent coarse fragments; medium acid; clear smooth boundary.

Bx2—36 to 40 inches; dark brown (10YR 4/3) silt loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak very coarse prismatic structure parting to moderate medium platy; very firm; thin patchy grayish brown (10YR 5/2) clay films on vertical faces of peds; 4 percent coarse fragments; neutral; clear smooth boundary.

B3—40 to 48 inches; dark brown (10YR 4/3) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium platy; firm; 8 percent coarse fragments; slight effervescence; mildly alkaline; gradual smooth boundary.

C—48 to 60 inches; dark brown (10YR 4/3) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; light brownish gray (10YR 6/1) coatings on vertical fractures; 8 percent coarse fragments; slight effervescence; mildly alkaline.

The solum ranges from 43 to 55 inches in thickness. Depth to the top of the fragipan ranges from 18 to 28 inches.

The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam or silty clay loam that is medium acid to very strongly acid. The Bx horizon is silt loam or silty clay loam that is strongly acid or medium acid in the upper part and slightly acid or neutral in the lower part. The C horizon has hue of 10YR or 2.5Y and value and chroma of 3 or 4. It is silt loam, silty clay loam, or clay loam.

Formation of the soils

This section describes the major factors of soil formation, tells how these factors have effected the soils in Cuyahoga County, and explains some of the processes of soil formation.

Factors of soil formation

Unique soils are formed as a result of complex interactions among principal soil-forming factors. How soils formed and acquired their present character at any given geographical point depends upon the factors of: (1) physical and mineralogical composition of the parent material, (2) the relief, (3) the climate under which the soil material has formed, (4) the plant and animal life in and on the soil, and (5) the duration of time during which the forces of soil formation have acted upon the parent material.

Climate, vegetation, and animals are active factors in soil formation. The vegetative, animal, and microbial life, influenced by climate, act upon parent material and gradually change it into a natural body having genetically related horizons. The effects of climate and vegetation during soil formation are modified by the parent material and the relief, which influence drainage. The parent material and the relief determine the kind of soil profile that is formed, and in some cases dominate the other factors of soil formation.

Time is needed to allow active soil forming factors to change parent material into soil. Weathering, leaching, translocation of soil particles, formation of soil structure, and other soil-forming processes require time to differentiate horizons in parent material.

Parent material

The parent material in which mineral soils form is the unconsolidated mass of fine earth material that results from the weathering of rocks. Some kinds of parent material are derived from bedrock, in places some have been transported into the county by glaciers, and some have been transported by water (*5*). The parent material largely determines the chemical and mineralogical composition of soils.

In Cuyahoga County, parent materials originated from glacial till, glacial outwash and beach deposits, lacustrine sediments, recent stream alluvium, and locally accumulated organic materials. Soils that formed from glacial till are the most extensive. The Rittman, the Wadsworth, the Ellsworth, and the Mahoning soils are a few examples. Soils that formed from glacial outwash and beach deposits generally have a loamy subsoil and are commonly underlain by stratified sand and gravel. Examples of these are the Oshtemo and the Chili soils. Some soils in the county have formed in silty lacustrine or slack-water deposits. Examples of soils that formed in lacustrine material are the Glenford, the Fitchville, and the Sebring soils. Soils on the flood plain formed in recent alluvium. They commonly have little or no profile development. Examples of these are the Tioga, the Chagrin, and the Orrville soils. The Carlisle soil is an example of a soil that formed in organic material.

Climate

Cuyahoga County has a climate characterized as humid, temperate, and continental. Soils in the county formed under the influence of this type of climate in a region mostly covered with deciduous hardwood forest.

Climate, among its other influences, greatly regulated the rate of weathering and decomposition of minerals, so it is important to soil formation. Important climatic factors include precipitation and temperature characteristics and the evapotranspiration ratio. These factors are closely related to the plant and animal communities, and, on a regional bases, they affect kinds of soils that are formed. In an area the size of Cuyahoga county, the climate is fairly uniform, so soil differences are primarily related to other soil-forming factors, such as parent material, drainage, and the age of soil materials.

The climate has influenced the removal of material by leaching. Soluble bases are removed as they are released by decomposition of mineral material. Because of this, the soils that formed are mostly acid. Clay and sesquioxides are translocated by water percolating from the surface to lower horizons. Most soils of the county are naturally acid, at least in the upper horizons, because the bases are continually leached downward. The Mahoning and the Ellworth soils are examples of soils that show evidence of clay movement from the A to the B horizon.

Because of their relatively low position on the landscape, the Miner and the Mermill soils have formed under a wetter microclimate than adjoining soils at more elevated positions. This results in saturation for extended lengths of time and in gleying, which is caused by the reduction and the leaching of iron.

All soils in Cuyahoga County are classified as mesic at the family category based on temperature (see table 15). The average annual soil temperature at a depth of 20 inches is approximately 2 degrees Fahrenheit higher than the average annual air temperature.

More information about climate in Cuyahoga County is given in the section "General nature of the county."

Relief

Relief influences soil formation by its effect on water movement, erosion, local temperature, and vegetative cover. Surface runoff, depth to the water table, internal drainage, accumulation and removal of organic matter, and other phenomena are affected either directly or indirectly by relief.

In a humid climate such as in Cuyahoga County, relief can account for different kinds of soils forming from the same kind of parent material because it results in different natural drainage. For this reason, among the external features of soils, relief is often most reliable in differentiating many soil series. Commonly, a given set of soil characteristics is indirectly related to the slope and internal drainage. This is illustrated in comparing the somewhat poorly drained Mahoning soils with the moderately well drained Ellsworth soils, all of which have formed in a similar kind of Wisconsin-age glacial till.

Rainfall that does not infiltrate into the soil runs off and collects on those soils located in depressions or is removed through the natural surface drainage system. Therefore, from equivalent rainfall, sloping or gently sloping soils receive less water than depressional soils. Frequent or periodic movement of water through gently sloping soils commonly results in the greatest soil formation. These soils are neither saturated nor lack a significant amount of water.

Living organisms

All living organisms play a role in the process of soil formation. These include vegetation, animals, bacteria, and fungi. The vegetation is generally responsible for the amount of organic matter, color of the surface layer, and the principal amount of available nutrients in the natural soil. Animals, such as earthmoving worms, cicada, and burrowing animals, help keep the soil open and porous. Bacteria and fungi decompose the vegetation, thus they release nutrients for plant food. Even though vegetation is a major factor, man has greatly influenced the upper part of the soil where he has cleared the trees and plowed the land. He has added fertilizers, mixed some of the upper horizons, and has moved the soil material from place to place.

The original vegetation in Cuyahoga County was primarily deciduous forest. The trees that are common on the somewhat poorly drained soils, such as Mahoning soils, were beech, maple, and red oak. On the better drained sandy and gravelly soils, such as Chili soils, there were white oak, black oak, and hickory. Some soils in the county formed in swampy areas under elm, white ash, or red maple. The more extensive areas of soils that formed in swamps included the Condit, the Sebring, and the Miner soils.

Time

The length of time that parent material has been exposed to soil-forming elements is important. Generally within relatively broad limits, the longer that climatic elements and plant and animal life have acted upon parent material, the more distinct become the horizons of the soil profile. The distinctiveness of horizons indicates relative maturity of the soil.

The soils of Cuyahoga County have formed in the period since the last glaciation, which was about 10,000 to 15,000 years ago. In areas of steeper soils, geologic erosion has kept pace with soil formation, thus the horizons are thinner and the depth to parent material may only be a few inches. The Dekalb soils are an example of this. On the other hand, in areas where the soil is gently sloping, the profiles are thicker and depth to parent material is usually deeper than 36 inches. An example would be the Mahoning soils.

Soils that formed in recent alluvium on flood plains, such as Tioga and Orrville soils, have no strongly differentiated horizons. The time necessary for other soil-forming factors to significantly influence the soil has not elapsed. These soils are the youngest and the least developed in the county.

Processes of soil formation

Basic chemical and physical processes, such as oxidation, reduction, hydration, hydrolysis, solution, eluviation (leaching), and illuviation (accumulation), and other highly complex processes bring about additions to soils, losses from soils, and transfers and chemical changes within soils (*11*). These many processes, influenced by the interrelationships of the soil-forming factors, are responsible for changing parent materials by steps or stages into a soil. Gradually, parent material builds first to a youthful soil and finally to a mature soil or to a soil that is dynamically in equilibrium with its environment.

Additions to soils are made by additions of organic matter, by sediment depositions, or by accumulating nutrients and colloidal material from such sources as organic matter, ground water, lime, and fertilizers. Most likely, all virgin soils except perhaps recent soils on flood plains, originally had a surface layer of organic accumulations known as an A1 horizon. Cultivation, however, has since mixed this layer with other layers, or severe erosion has removed all evidence of this horizon from the soil profile. Some nutrients move in a cycle from soil to plants and then back to the soil as byproducts of organic matter decomposition. This is true for all soils in the county, except where this process is modified by harvesting crops. Alluvial soils, such as the Tioga, the Chagrin, and the Orrville soils, periodically receive sediment deposits from floodwaters.

Losses of soil or within soil commonly occur by erosion, leaching of soluble salts, eluviation of colloids by percolating water, and nutrient losses caused by harvesting crops. Leaching of carbonates accounts for the most significant soil nutrient losses in Cuyahoga County. Carbonates have been removed to a depth of 2 to 4 feet or more in such upland soils as the Mahoning and the Ellsworth soils. The tremendous change brought about by the leaching process is illustrated in soils that formed in parent material that contained 5 to 15 percent calcium carbonate equivalent but which are now acid in the upper part of the subsoil. Most of the other minerals in soils break down and are removed through leaching. They are lost at a slower rate than the carbonates.

The decomposition of some minerals produces free iron oxides, which account for the fairly bright brownish colors in the Chili and the Oshtemo soils. The periodic, or seasonal, high water table in the Sebring, the Condit, and other similar soils causes a reduction of iron oxides. This process is primarily responsible for the grayer colors of the subsoil in these soils.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

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 with magnesium carbonate) to effervescence 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.

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. Mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter.

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.

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.

Depth to rock. Bedrock is too near the surface for the specified use.

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 for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil 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 (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.

Hummocky. Refers to a landscape of hillocks, separated by low sags, having sharply rounded tops and steep sides. Hummocky relief resembles rolling or undulating relief, but the tops of ridges are narrower and the sides are shorter and less even.

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.

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.

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.

Light textured soil. Sand and loamy sand.

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 areas. Areas that have little or no natural soil and support 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, end 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.

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. Temporary accumulation of water in closed depressions or in nearly level and concave areas.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

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 groundwater 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.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	Less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

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. Any surface soil horizon (A1, A2, A3) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently referred to as the "plow layer" or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. 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.

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.