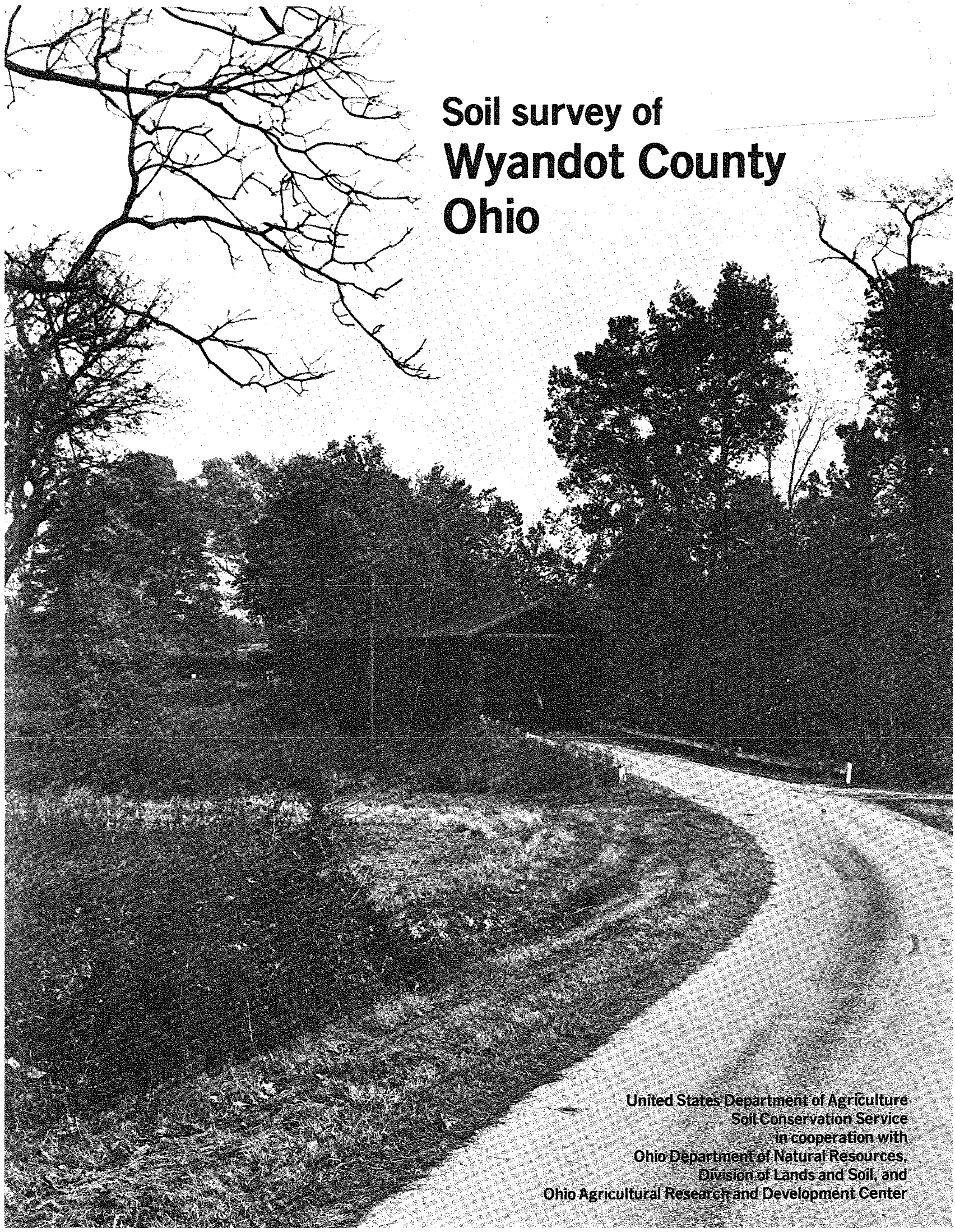
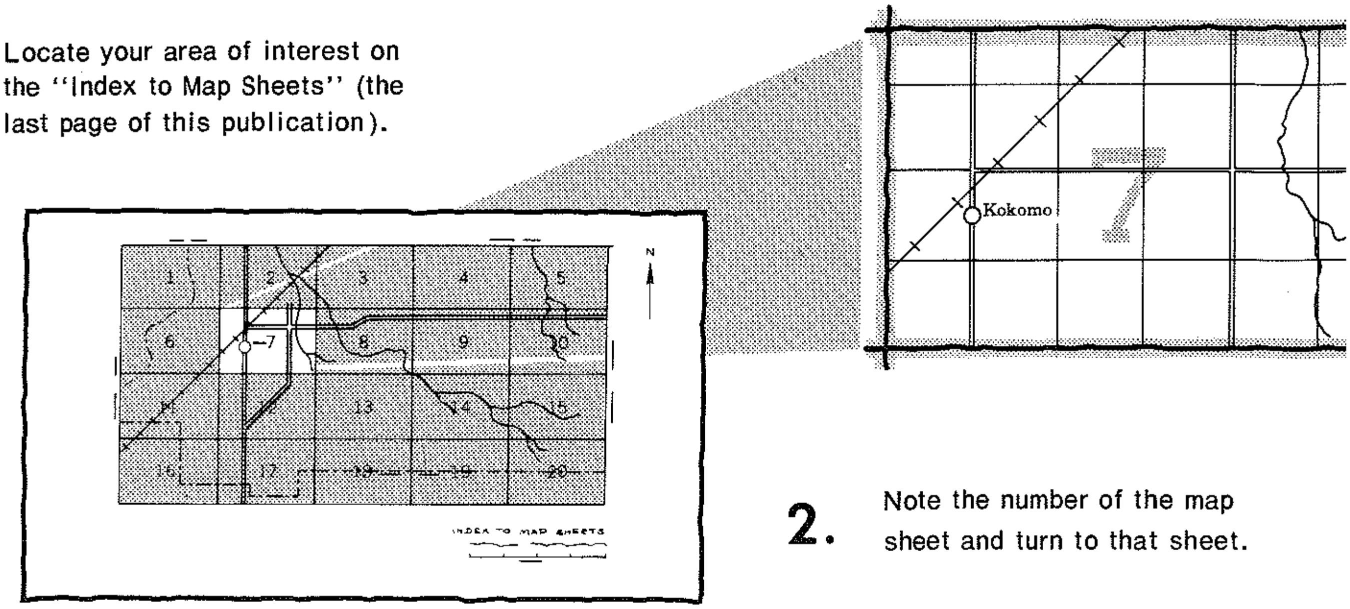
Soil survey of
Wyandot County Ohio



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

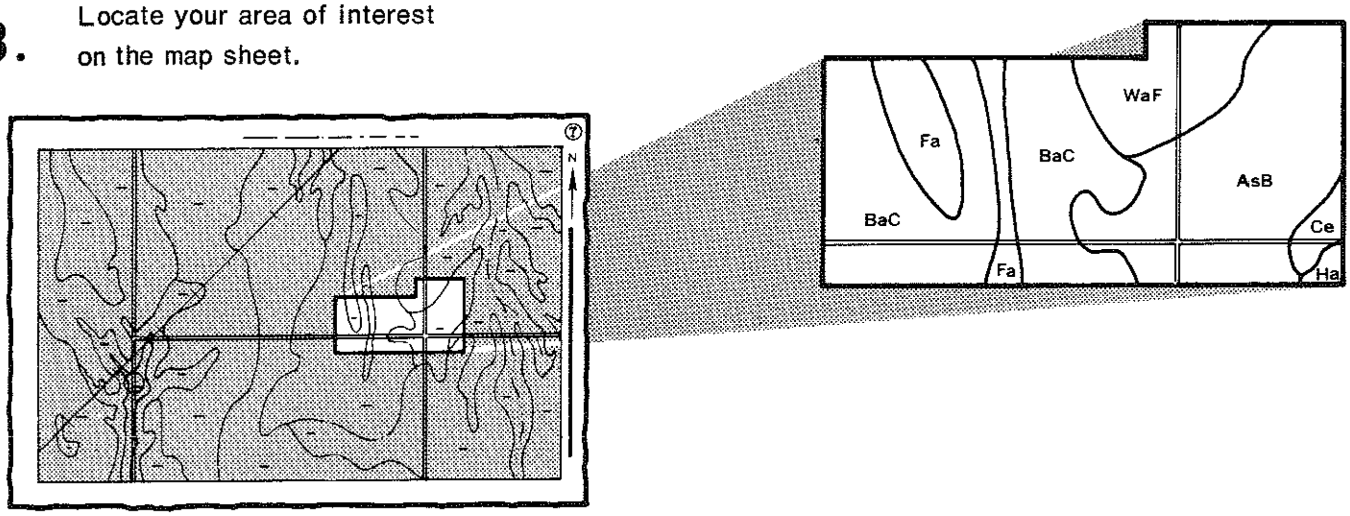
HOW TO U

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

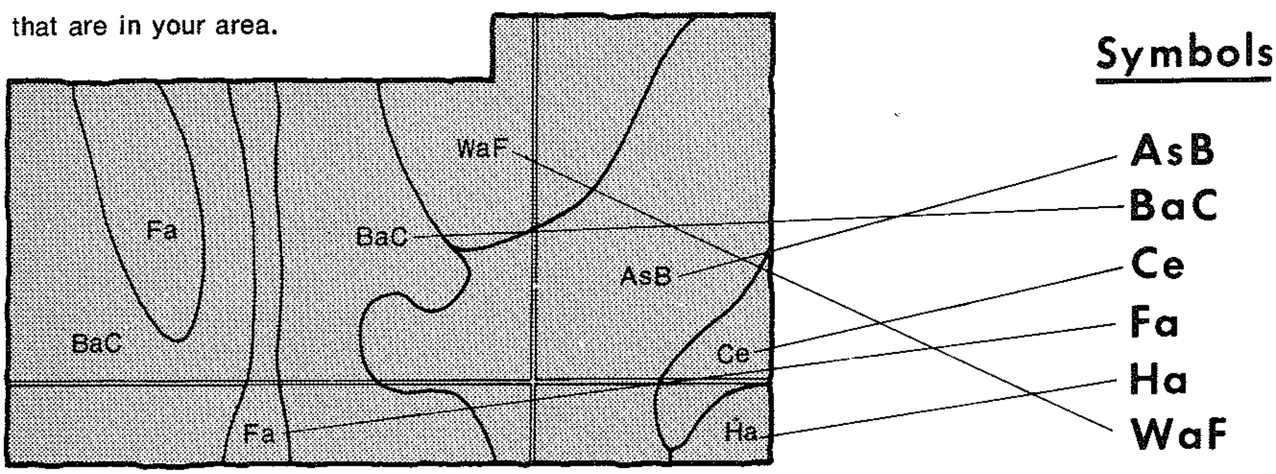


2. Note the number of the map sheet and turn to that sheet.

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

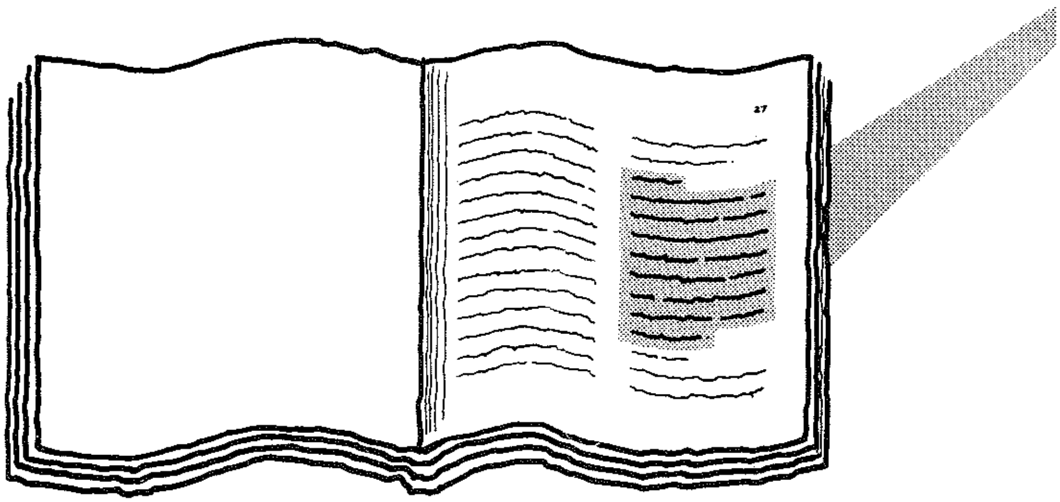


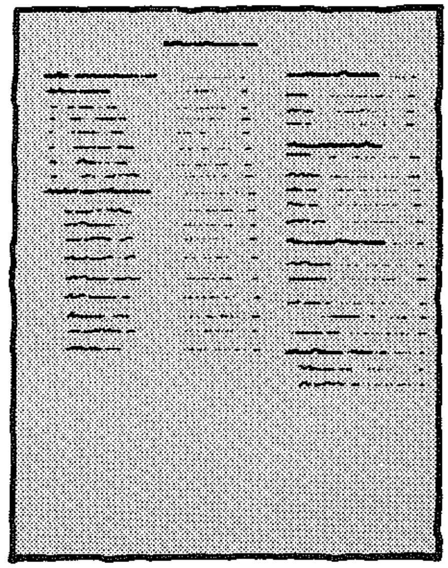
4. List the map unit symbols that are in your area.



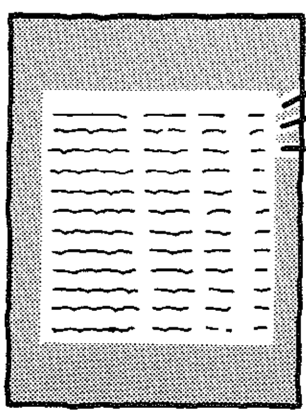
HIS SOIL SURVEY

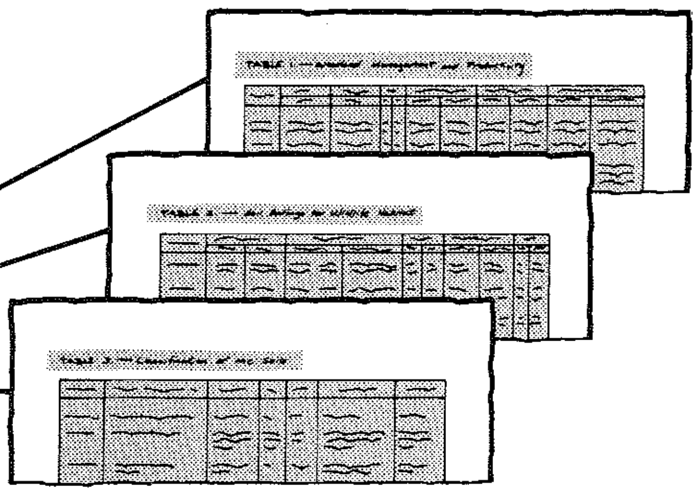
5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.





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.

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 Wyandot Soil and Water Conservation District. This survey was materially aided by funds from the Wyandot County Commissioners.

Major fieldwork for this soil survey was performed in the period 1975-79. Soil names and descriptions were approved in 1980. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1980.

Cover: Covered bridge over the Sandusky River. Genesee soils are on the flood plains along the river.

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foreword

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

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

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

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

Robert R. Shaw
State Conservationist
Soil Conservation Service

Location of Wyandot County in Ohio.

soil survey of
Wyandot County, Ohio

By J.R. Steiger and R.L. Hendershot, Soil Conservation Service

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

WYANDOT COUNTY is in north-central Ohio near the watershed divide between Lake Erie and the Ohio River. The Sandusky River flows through the county to Lake Erie. The level to gently sloping uplands and broad valleys are typical of the Indiana and Ohio till plain. Wyandot County is in the Central Lowland Province and in the eastern Corn Belt. It has a total area of 259,840 acres, or 406 square miles. The population of the county in 1970 was 21,826.

Most of the land in the county is in farms. The main crops are soybeans, corn, wheat, and hay. In most areas that are used as farmland the soils have been drained to improve production. In undrained areas the soils are used mainly as woodland and as habitat for wildlife.

general nature of the county

This section discusses climate, relief and drainage, natural resources, history, and farming.

climate

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

Wyandot County is cold in winter and quite warm in summer. Winter precipitation, frequently snow, is heavy enough to produce a good accumulation of soil moisture by spring. Drought in summer is rare on most soils. The normal annual precipitation is adequate for all crops adapted to the local temperature and the length of the growing season.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Upper Sandusky in the period 1951 to 1978. 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 21 degrees. The lowest temperature on record, which occurred at Upper Sandusky on January 24, 1963, is -18 degrees. In summer the average temperature is 72 degrees, and the average daily maximum temperature is 84 degrees. The highest recorded temperature, which occurred on September 2, 1953, is 101 degrees.

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

The total annual precipitation is about 36 inches. Of this, 20 inches, or 55 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 3.27 inches at Upper Sandusky on September 20, 1957. Thunderstorms occur on about 42 days each year, and most occur in summer.

Average seasonal snowfall is 32 inches. The greatest snow depth at any one time during the period of record was 24 inches. On an average of 26 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 65 percent of the time possible in summer and 40 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 11 miles per hour, in spring.

Tornadoes and severe thunderstorms occur occasionally. These storms are usually local and of short duration and cause damage in a variable pattern.

relief and drainage

The surface features in Wyandot County range from gently rolling hills and a few steep valley walls to extensive nearly level plains and flat basins. Total relief is about 270 feet. The highest point is a ridge in the village of Wyandot in the southeastern part of the county. The lowest point is where the Sandusky River crosses the northern county line.

Streams are generally sluggish, except for Sycamore Creek in Sycamore Township and the Sandusky River in Antrim Township where the decrease in elevation is greater. Most of the county is drained by the Sandusky River. The area along the western edge is drained by the Blanchard River, and a very small area in the southeastern corner is drained by the Little Scioto River.

Glacial deposits cover the county. They range in depth from a few feet to more than 80 feet. The ridges north of Carey are shallowest to bedrock. The plains of the central and western parts of the county were formed by glacial ice or glacial lakes. Irregularly shaped high ridges are common in the eastern part of the county. They formed at the edge of a melting glacier.

natural resources

Abundant ground water resources are available in Wyandot County. Most of the water from wells comes out of the dolomite and limestone bedrock. The water from shallower wells comes from the sand and gravel deposits in glacial drift. In the northwestern and southwestern parts of the county, the potential yield from the bedrock ranges from 50 to 200 gallons per minute. The ridge areas north of Carey have a high potential yield because the dolomite is porous, and the layer of glacial drift is thin. Yields as high as 700 gallons per minute have been reported. In the central part of the county, the yield is 150 to 600 gallons per minute, and in the eastern part it is 500 to 1,000 gallons per minute (*18, 19*).

The main limitation to the use of ground water is the recharge potential, that is, the ability of water to infiltrate the water-bearing rock formation. The ridge area north of Carey has high recharge potential. Other areas in the northwestern and southwestern parts of the county have a lower recharge potential because uniformly dense glacial till covers the bedrock. A high level of nitrate is a problem in some wells because of leaching of domestic sewage, animal waste, and fertilizers. In parts of Wyandot County the ground water is high in dissolved solids and sulfates. In a few areas it has hydrogen sulfide.

Several areas in Wyandot County are potential sites for wells that can produce a large quantity of good quality water. A small area of porous dolomite in the vicinity of Carey is one such area; another is a broad, relatively undeveloped area in the eastern part of the county.

Dolomitic limestone, sand, gravel, and clay are other important natural resources in Wyandot County. In the Carey area, high quality dolomitic limestone is mined for industrial uses. This limestone is used mainly in steelmaking and glassmaking. Other uses include railroad ballast, aggregate for building and road construction, and agricultural lime. Smaller quarries are located in Crane and Pitt Townships.

Several large sand and gravel pits are located in Eden and Pitt Townships along prominent esker ridges. One active clay pit is near Upper Sandusky. The lacustrine deposits are used for making brick.

Oil and gas were produced in parts of the county early in the 20th century. Most of the oil and gas came from the upper part of the Trenton Formation. Exploration in that formation has continued, although production has been very low (*9*).

history

The earliest accounts of the area that is now Wyandot County came from hunters and trappers who traded with the Indians (*12*). The Wyandot Indians first settled in this area in the mid-eighteenth century, after migrating from eastern Canada. The Indians cultivated the soils on the bottom lands along the Sandusky River.

In 1782, at the end of the Revolutionary War, the Crawford expedition, which was made up of settlers from Pennsylvania, explored the territory of the Wyandot Indians. The area remained Indian territory until the early 19th century because it was north of the historic Greenville Treaty line.

The War of 1812 brought many American troops and suppliers into the area. Fort Ferree at Upper Sandusky served as a supply post. After the war, many veterans returned to settle in the area.

Initially, the settlers cultivated the well drained, rolling soils along streams and in the higher areas on end moraines. Cattle, hogs, and sheep were pastured on the woodland and swampy land. Markets were inaccessible because of poor roads, so the settlers raised crops, mainly corn, wheat, and hay, only for local consumption.

farming

In 1979, there were 1,080 farms in Wyandot County. Farms took up about 90 percent of the land. The principal crops in that year were soybeans, on 83,700 acres; corn, on 49,600 acres; wheat, on 35,800 acres; and hay, on 6,000 acres. Other small grains, pasture, and specialty crops took up about 10,000 acres.

Acreage in woodland and pasture has decreased in recent years with the conversion of more acreage to cultivated land. The most important source of income is from the sale of grain. Much of the grain is sold for export. Hogs, beef and dairy cattle, and poultry are raised.

The average size of a farm is about 218 acres. Most farms range from 50 to 500 acres, although some are smaller than 10 acres and a few are more than 2,000 acres (*4*).

Mechanized farming has made it possible for relatively few farmers to cultivate large acreages. Fields have been enlarged by removing fencerows, which are no longer necessary because most livestock is now confined in feedlots and barns. The few existing woodlands have been cleared, particularly in areas where drainage is being improved. Drain tubing and automated trenching machines have made it easy to install underground drains. Improved techniques have resulted in more intensive cropping and a higher level of production.

how this survey was made

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

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

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

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

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

general soil map units

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

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

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

soil descriptions

nearly level to moderately steep soils on till plains

These soils make up about 57 percent of the county. They are well drained to very poorly drained. They are on landscapes that range from broad flats on ground moraines to hilly areas on end moraines and on bedrock controlled ridges. The soils are used mainly for farming. Erosion, depth to bedrock, seasonal wetness, and restricted permeability are the major concerns in management.

1. Blount-Pewamo association

Deep, nearly level and gently sloping, somewhat poorly drained and very poorly drained soils that formed in glacial till

This association consists of extensive, broad flats on ground moraines that have sags and swells of 3 to 5 feet in relief. Some areas are slight rises and low knolls and ridges that have drainageways and a few closed depressions. Most areas are drained by small streams and drainage ditches. Some areas are narrow flood plains.

This association makes up about 40 percent of the county. It is about 50 percent Blount soils, 20 percent Pewamo soils, and 30 percent soils of minor extent.

Blount soils are deep, nearly level and gently sloping, and somewhat poorly drained. They are on slight rises and low knolls and ridges or on extensive upland flats that have intermittent drainageways. Their surface layer is silt loam, and the subsoil is silty clay loam and silty clay. A water table is in the upper part of the subsoil during the dormant season and after prolonged rainy periods. Permeability is slow or moderately slow.

Pewamo soils are deep, nearly level, and very poorly drained. They are in the lower part of the flats and in drainageways and depressions. Their surface layer is silty clay loam, and the subsoil is silty clay loam and silty clay. A water table is near or above the surface during wet seasons, and the soils are sometimes ponded. Permeability is moderately slow.

Some of the minor soils in this association are the more loamy Haskins and Kibbie soils and the more silty Tiro soils on knolls and ridges that are slightly higher than the surrounding landscape. Other minor soils are the somewhat poorly drained Shoals soils and the very poorly drained Sloan soils that are on the narrow flood plains of small streams, the moderately well drained Glynwood soils and the well drained Morley soils in dissected upland areas, and the poorly drained Pandora soils that formed in glacial till, and the very poorly drained Bono and Milford soils that formed in lakebed sediment. Pandora, Bono, and Milford soils are on the lower flats along intermittent drainageways and in depressions. Also included are areas of Elliott soils, which have a darker colored surface layer than Blount soils and are on long slopes between Blount and Pewamo soils.

The soils in this association are used mainly for corn, soybeans, and wheat. In a few small tracts, they are used for pasture, trees, and specialty crops. If properly drained, these soils are well suited to large grain-farming operations. They are poorly to moderately well suited to building site development.

Wetness is the main limitation to use of these soils for farming and most other purposes. Ponding is common on the Pewamo soils in winter and spring and after intense rains. Subsurface and surface drainage systems help remove excess water. Blount soils crust following intense rains. Management concerns are improving and maintaining drainage systems, maintaining tilth by incorporating crop residue, tilling at the proper moisture condition, and preventing soil compaction. Excavations and on-site filtration of waste water are limited by the soil wetness and slow or moderately slow permeability. Use of these soils for crops has exposed areas to strong winds and thus has changed the suitability of the soils as habitat for wildlife. Windbreaks and shelterbelts provide habitat for wildlife and protection for buildings.

2. Glynwood-Blount-Nappanee association

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

These soils are on end moraines that are slightly elevated above the surrounding landscape and on dissected parts of ground moraines. Most areas have long and gentle slopes, numerous waterways, and a few closed depressions. This association is drained by small streams that have narrow flood plains.

This association makes up about 8 percent of the county. It is about 35 percent Glynwood soils, 25 percent Blount soils, 15 percent Nappanee soils, and 25 percent soils of minor extent.

Glynwood soils are deep, moderately well drained, and gently sloping and sloping. Their surface layer is silt loam, and the subsoil is clay, silty clay, and silty clay loam. They are generally on convex ridgetops and knolls at the head of small drainageways and on side slopes along small streams. The hazard of erosion is moderate to severe.

Blount soils are deep and are nearly level and gently sloping. They are on slight rises and on slightly elevated knolls and ridges. Their surface layer is silt loam, and the subsoil is silty clay loam and silty clay. These soils are somewhat poorly drained. They have a seasonal high water table in the upper part of the subsoil during the dormant season and after prolonged rainy periods.

Nappanee soils are deep and are nearly level to sloping. They are generally on slightly elevated crowns, long gentle slopes, convex ridgetops, at the head of small drainageways, and on valley side slopes. Their surface layer is silty clay loam or silt loam, and the subsoil is silty clay and clay. These soils are somewhat poorly drained. They have a seasonal high water table in the upper part of the subsoil in winter and spring and during other extended wet periods. Permeability is very slow, and erosion is a hazard.

Some of the minor soils in this association are the poorly drained Pandora soils and the very poorly drained Pewamo soils in slight depressions and minor drainageways; more silty Tiro soils and more loamy Kibbie soils on slightly elevated knolls and ridges; more silty Lykens soils on the higher knolls and ridges; and the well drained Morley soils on the sloping to very steep hillsides.

In most areas the soils in this association are used as cropland. In some areas they are used for pasture or as woodland. Corn, wheat, and soybeans are the main crops. The wooded areas are generally scattered small woodlots of less than 40 acres. The dominant soils are suited and moderately well suited to building site development. They are suited to use as woodland and as habitat for openland and woodland wildlife. These soils have numerous sites suitable for ponds.

These soils are best suited to farming that includes forage crops and small grains. Cash-grain farming requires intensive management. Seasonal wetness, the hazard of erosion, and slope are the main limitations for farming and most other uses. Rills and gullies are common in the sloping areas. Controlling water erosion, improving and maintaining drainage systems, reducing surface crusting, and maintaining tilth are management concerns. Returning crop residue, minimizing tillage, and planting meadow crops and winter cover crops are effective management practices. Wetness, slope, and the moderate shrink-swell potential limit the use of these soils as sites for buildings.

3. Tiro-Bennington association

Deep, nearly level and gently sloping, somewhat poorly drained soils that formed in glacial till and water-deposited material

These soils are on gently undulating to broad flats on ground moraines that have sags and swells that vary in relief from 3 to 5 feet. Most areas are slight rises, low knolls, and low ridges. There are minor drainageways. Most areas are drained by small streams that have narrow flood plains.

This association makes up about 5 percent of the county. It is about 40 percent Tiro soils, 30 percent Bennington soils, and 30 percent soils of minor extent.

Tiro and Bennington soils are nearly level and gently sloping. They are on low knolls and ridges or on extensive upland flats that have intermingled drainageways. The Tiro soils are generally in slightly higher positions than the Bennington soils. The surface layer of the Tiro soils is silt loam, and the subsoil is silty clay loam and loam. Permeability is moderate in the subsoil and slow or moderately slow in the underlying material. The surface layer of the Bennington soils is silt loam, and the subsoil is silty clay loam and silty clay. Permeability is slow. Both Tiro and Bennington soils are deep and are somewhat poorly drained. They have a seasonal high water table in the upper part of the subsoil during the dormant season and after prolonged rainy periods. The surface layer crusts after heavy rains.

Some of the minor soils in this association are the very poorly drained Luray and Pewamo soils and the poorly drained Pandora soils in slight depressions and drainageways and on low broad flats; the somewhat poorly drained Shoals soils on narrow flood plains; the moderately well drained Cardington soils in dissected areas; and the moderately well drained Lykens and more loamy Kibbie soils on slightly elevated knolls and ridges.

The soils in this association are used as cropland. Corn, soybeans, and wheat are the main crops. In some small areas these soils are used for woodlots and pasture. If they are adequately drained, these soils are well suited to grain farming. However, they require some intensive management. The soils in this association are moderately well suited to building site development. They are well suited to use as woodland and as habitat for openland and woodland wildlife.

Wetness is the main limitation to use of these soils for farming and most other uses. Subsurface drainage systems are used to lower the seasonal high water table. Improving and maintaining drainage systems, reducing surface crusting, maintaining tilth, and controlling water erosion are management concerns. Incorporating crop residue, minimizing tillage, and planting meadow crops and winter cover crops are effective management practices. Onsite filtration of waste water and excavations are limited by soil wetness and the slow or moderately slow permeability. The use of these soils for crops has changed their suitability as habitat for wildlife by exposing the area to strong winds. Windbreaks and shelterbelts can be planted to provide habitat for wildlife and protection for buildings.

4. Cardington-Bennington association

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

These soils are on undulating ground moraines and end moraines and in a few closed depressions. Most areas are slight rises, knolls, and ridges and have a well defined drainage pattern. Most areas are drained by small streams that have narrow flood plains.

This association makes up about 2 percent of the county. It is about 40 percent Cardington soils, 30 percent Bennington soils, and 30 percent soils of minor extent.

Cardington soils are deep and are gently sloping to moderately steep. They are on knobs and ridges and at the head of tributary drainage systems. They are dominant on the hills, bluffs, and stream valley side slopes. Their surface layer is silt loam, and the subsoil is silty clay loam, loam, and clay loam. These soils are moderately well drained. Erosion is a moderate to severe hazard. The surface layer crusts after heavy rains. Permeability is moderately slow. A seasonal high water table is in the lower part of the subsoil in winter and spring and during other extended wet periods.

Bennington soils are deep and are nearly level and gently sloping. They are on slight rises, knolls, and swells or on extensive undulating uplands that have intermingled minor drainageways. Their surface layer is silt loam, and the subsoil is silty clay loam and clay loam. These soils are somewhat poorly drained. They have a seasonal high water table in the upper part of the subsoil during the dormant season and after prolonged rainy periods. The surface layer crusts after heavy rains.

Some of the minor soils in this association are the very poorly drained Pewamo soils and the poorly drained Pandora soils in slight depressions and minor drainageways; the somewhat poorly drained Shoals soils on flood plains; and the more loamy Kibbie soils and the more silty Tiro and Lykens soils on slightly elevated crowns, knolls, and ridges.

The soils in this association are used for row crops, small grains, and hay. In a few small areas they are used for pasture and as woodland. Corn, soybeans, and wheat are the main crops. The soils are suited to moderately well suited to building site development. They are well suited to use as woodland and as habitat for openland and woodland wildlife. These soils have numerous sites suitable for ponds.

The soils in this association are best suited to farming that includes small grains or forage crops. Grain farming requires intensive management. Artificial drainage is needed in the Bennington soils. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Windbreaks can be planted to provide protection for buildings and habitat for wildlife.

5. Ritchey-Milton association

Shallow and moderately deep, nearly level to sloping, well drained soils that formed in glacial till and in residuum of dolomitic limestone

These soils are in areas where dolomitic limestone bedrock is generally at a depth of 1 to 10 feet. Most areas are ridges that are commonly 25 to 50 feet in elevation above the surrounding plains. The ridges are about one-half mile wide and as much as 2 miles long. In some areas these soils are only 5 to 10 feet higher in elevation than the adjacent soils. The mantle of glacial till is thinner at the high elevations. Long, gentle slopes and a few waterways extend to the lower elevations.

This association makes up about 2 percent of the county. It is about 40 percent Ritchey soils, 20 percent Milton soils, and 40 percent soils of minor extent.

Ritchey soils are generally on the crest of ridges where the mantle of glacial till is thinnest. They are shallow, well drained, and gently sloping and sloping. Their surface layer is silt loam, and the subsoil is channery clay loam, clay, and channery sandy clay loam. Dolomitic limestone bedrock is at a depth of 10 to 20 inches. In most of the cultivated areas stones have been removed from the surface layer. These soils warm early in spring. They are droughty. Permeability is moderate.

Milton soils are on long, gentle slopes. They are moderately deep, well drained, and nearly level and gently sloping. Their surface layer is silt loam, and the subsoil is loam, silty clay, clay, and silty clay loam. Dolomitic limestone bedrock is at depths of 20 to 40 inches. Permeability is moderate or moderately slow. The surface layer of both the Milton soils and the Ritchey soils crusts after heavy rains.

Some of the minor soils in this association are the very poorly drained Millsdale and Mermill soils on the broad, low plains between the dolomitic limestone bedrock ridges; the somewhat poorly drained Tiro and Randolph soils on low knolls and ridges; and the moderately well drained Lykens soils on the margins between the ridges.

In most areas the soils in this association are used as cropland. Wheat and hay are the main crops. Corn and soybeans are also grown, especially in low areas of the included deeper soils. In a few areas specialty crops are grown using irrigation. In a few areas the soils in this association are so shallow to bedrock that they are not cultivated. In some of these small areas they are used for pasture and as woodland. There are many quarries, ranging in size from small to very large. These soils are suited to use as woodland and as habitat for openland and woodland wildlife.

The soils in this association are well suited to farming that includes small grains and hay. Droughtiness, erosion, and crusting of the surface layer are the main limitations. The shallowness and moderate depth to bedrock limit the available water capacity and reduce crop yields. These soils are well suited to no-till planting. Increasing water infiltration in order to reduce erosion and improve crop yields is a major management concern. The most effective way to increase infiltration is to maintain a vegetative cover or a cover of residue.

The soils in this association are well suited to moderately well suited as sites for buildings. They are poorly suited to septic tank absorption fields. These soils are better suited to houses without basements than to houses with basements. The bedrock hinders excavations. A specially designed waste water treatment system is needed for dwellings and for livestock. The effluent from sanitary facilities can move through fissures in the bedrock and pollute underground water supplies. Trees selected for planting on the Ritchey soils should be tolerant of droughtiness and the shallow root zone.

level to gently sloping soils on lake plains

These soils make up about 23 percent of the county. They are somewhat poorly drained to very poorly drained and are level to gently sloping. They are on broad flats and low knolls and ridges. These soils are used mainly for farming and as habitat for wildlife. Ponding, seasonal wetness, restricted permeability, a high content of clay, and a high shrink-swell potential are the major concerns of management.

6. Del Rey-Milford association

Deep, nearly level and gently sloping, somewhat poorly drained and very poorly drained soils that formed in lacustrine sediment

These soils are on extensive plains in former glacial lake basins and have minor sags and swells varying 3 to 5 feet in local relief. Some areas are slight rises, low knolls, and ridges and have drainageways. Most areas are drained by small streams and drainage ditches. A few closed depressions are included.

This association makes up about 15 percent of the county. It is about 30 percent Del Rey soils, 25 percent Milford soils, and 45 percent soils of minor extent.

Del Rey soils are deep and are nearly level and gently sloping. They are on slight rises, slightly elevated knolls, and ridges and on extensive upland flats that have intermingled minor drainageways. Their surface layer is silt loam, and the subsoil is silty clay loam. These soils are somewhat poorly drained. They have a seasonal high water table in the upper part of the subsoil during the dormant season and after prolonged rainy periods. Permeability is slow.

Milford soils are deep and are nearly level. They are in flat extensive basins, along drainageways, and in depressional areas. They are generally slightly lower in elevation than the Del Rey soils. Their surface layer is silty clay loam, and the subsoil is silt loam and silty clay loam. These soils are very poorly drained. They have a seasonal high water table near or above the soil surface and are sometimes ponded. Permeability is moderately slow.

Some of the minor soils in this association are the more clayey Bono soils and the Olentangy soils that have a mucky surface layer, in depressions; the Blount and Pewamo soils that formed in glacial till and the more silty Fitchville, Tiro, and Luray soils that are on the margins of this association; the Elliott soils that have a darker surface layer than Del Rey soils and the more loamy Kibbie soils on slight rises; and the moderately well drained Shinrock soils in dissected areas.

The soils in this association are used extensively as cropland. In a few small areas they are used for pasture, as woodland, and for specialty crops. Corn, soybeans, and wheat are the main crops. If they are adequately drained, these soils are well suited to large grain farms. They are poorly suited to moderately well suited to building site development. They are suited to use as woodland and as habitat for openland and woodland wildlife.

Ponding and wetness are the main limitations for farming and most other purposes. Surface and subsurface drains are used to remove excess water. In a few areas a drainage outlet is not available. The surface layer of the Del Rey soils crusts following intense rains. Maintaining drainage systems, utilizing crop residue to control erosion, and reducing soil compaction, cloddiness, and crusting are management concerns. Septic tank absorption fields and excavations are limited by ponding, wetness, and the slow or moderately slow permeability. Use of these soils as cropland has changed their suitability as habitat for wildlife by exposing the area to strong winds. Windbreaks and shelterbelts can be planted to provide habitat for wildlife and protection for buildings.

7. Latty-Paulding-Fulton association

Deep, level and nearly level, very poorly drained and somewhat poorly drained soils that formed in lacustrine sediment

These soils are on broad, depressed flats that have slightly elevated knolls and on slight rises in former glacial lake basins. They are in lower positions than the adjacent soils. In most areas these soils are drained by drainage ditches.

This association makes up about 8 percent of the county. It is about 30 percent Latty soils, 25 percent Paulding soils, 15 percent Fulton soils, and 30 percent soils of minor extent.

Latty soils are deep and are nearly level. They are on extensive low flats. Their surface layer is silty clay and silty clay loam, and the subsoil is clay. These soils are very poorly drained. They have a seasonal high water table near or above the surface and are sometimes ponded. Permeability is very slow.

Paulding soils are deep and are level. They are on extensive low flats. Their surface layer and subsoil are clay. These soils are very poorly drained. They have a seasonal high water table near or above the surface and are sometimes ponded. Permeability is very slow.

Fulton soils are deep and are nearly level. They are on slight rises, low knolls and ridges, and extensive flats. Their surface layer is silty clay loam, and the subsoil is silty clay. These soils are somewhat poorly drained. They have a seasonal high water table in the upper part of the subsoil in winter and spring and during other extended wet periods. Permeability is slow or very slow.

Some of the minor soils in this association are Bono, Pewamo, and Milford soils that have a darker surface layer and are in depressions; the Blount and Nappanee soils that formed in glacial till and are on slight rises; and the more silty Del Rey soils and the more loamy Kibbie soils that are on the margins of this soil association.

The soils in this association are used mainly for row crops, small grains, and occasionally for hay. In some areas they are used for pasture, as woodland, and as habitat for wetland wildlife. Corn and soybeans are the main crops. If they are adequately drained, these soils are suited to large cash-grain farms. However, they need intensive management. The Paulding and Latty soils are well suited to use as habitat for wetland wildlife.

Wetness, the slow and very slow permeability, and the high content of clay are the main limitations for farming and most other purposes. Surface and subsurface drainage systems are used to remove excess water. Improving and maintaining drainage systems and maintaining tilth are management concerns. Planting deep-rooted meadow crops and tilling at the proper moisture content to reduce crusting, clodding, and soil compaction are effective management practices.

These soils are poorly suited or are generally not suited to building site development. Wetness, ponding, the high shrink-swell potential, and the slow or very slow permeability are severe limitations for building sites and septic tank absorption fields. Use of these soils as cropland has changed their suitability as habitat for wildlife by exposing the area to strong winds. Windbreaks and shelterbelts can be planted to provide habitat for wildlife and protection for buildings.

nearly level to very steep soils on lake plains, deltas, terraces, end moraines, and beach ridges

These soils make up about 7 percent of the county. They are well drained to somewhat poorly drained and are nearly level to very steep. The landscape is dominantly flat to rolling. These soils are mainly used for farming. In the steeper areas they are used as woodland. Erosion, seasonal wetness, droughtiness, and slope are the major management concerns.

8. Tuscola-Fitchville-Glenford association

Deep, nearly level and gently sloping, moderately well drained and somewhat poorly drained soils that formed in glacial lake shoreline deposits and in lacustrine sediment

This association consists of undulating areas on lake plains and the shoreline of glacial lakes that have sags and swells of 3 to 10 feet in relief. Most areas are rises, low knolls, and ridges interspersed with drainageways and a few closed depressions. Most areas are drained by small streams that have narrow flood plains.

This association makes up about 6 percent of the county. It is about 15 percent Tuscola soils, 15 percent Fitchville soils, 10 percent Glenford soils, and 60 percent soils of minor extent.

Tuscola soils are deep, gently sloping, and moderately well drained. They are on low knobs and ridges, the highest areas of the local relief. Their surface layer is fine sandy loam, and the subsoil is fine sandy loam, sandy loam, and sandy clay loam. These soils are moderately permeable. Erosion is a moderate hazard. A seasonal high water table is in the lower part of the subsoil during the dormant season and after prolonged rainy periods.

Fitchville soils are deep, somewhat poorly drained, and nearly level and gently sloping. They are on low knolls, rises, swells, and extensive flats on lake plains. Their surface layer is silt loam, and the subsoil is silt loam and silty clay loam. These soils have a seasonal high water table in the upper part of the subsoil in winter and spring and during other extended wet periods.

Glenford soils are deep, moderately well drained, and gently sloping. They are on irregular and convex slopes. Their surface layer is silt loam, and the subsoil is silt loam and silty clay loam. These soils have a water table in the lower part of the subsoil in winter and spring and during other extended wet periods.

Some of the minor soils in this association are the very poorly drained Olentangy soils in depressions, the very poorly drained Colwood, Luray, and Milford soils in drainageways and on low flats, and the somewhat poorly drained Tiro and Kibbie soils on low knolls and ridges. Other minor soils are Glynwood soils that formed in glacial till, Shinrock soils that have more clay in the subsoil and are in mildly dissected areas, and the well drained Martinsville soils on prominent knolls and ridges. Some areas are Urban land.

The soils in this association are used for row crops, small grains, and hay. In a few small areas they are used as pasture and woodland. Corn, soybeans, and wheat are the principal crops. These soils are suited to farming that includes forage crops and small grains. They are moderately well suited to poorly suited to building site development. The soils are well suited to use as woodland and as habitat for openland and woodland wildlife.

Erosion and seasonal wetness are the main limitations to use of these soils for farming and most other purposes. Surface and subsurface drainage are effective on the Fitchville soils. On the gently sloping soils, erosion is a moderate hazard. Incorporating crop residue into the soil, minimizing tillage, including forage crops in the cropping system, and planting cover crops reduce crusting and maintain tilth. The Tuscola and Glenford soils are better suited as a site for buildings than the Fitchville soils.

9. Oshtemo-Belmore association

Deep, nearly level to very steep, well drained soils that formed in glacial outwash

These soils are on outwash and stream terraces, deltas, beach ridges, and moraines. Slopes are short and hummocky or uniform. These soils have many closed depressions and do not have a well defined drainage pattern. Numerous springs are included.

This association makes up about 1 percent of the county. It is about 40 percent Oshtemo soils, 35 percent Belmore soils, and 25 percent soils of minor extent.

Oshtemo soils are deep and are nearly level to very steep. Their surface layer is fine sandy loam, and the subsoil is fine sandy loam and coarse sandy loam. These soils are generally in slightly higher positions than the Belmore soils and are more sloping. Erosion is a moderate to severe hazard. These soils are well drained and are somewhat droughty. Permeability is moderately rapid in the subsoil and very rapid in the underlying material.

Belmore soils are deep and are nearly level and gently sloping. Their surface layer is loam, and the subsoil is loam and gravelly clay loam. These soils generally are on flats or low knolls. Erosion is a slight or moderate hazard. These soils are somewhat droughty. Permeability is moderately rapid.

Some of the minor soils in this association are the very poorly drained Colwood and Millgrove soils in slight depressions and on flats; the somewhat poorly drained Digby and Kibbie soils on low knolls and ridges; the moderately well drained Haney and Tuscola soils on knolls and in higher areas; and the moderately well drained Shinrock soils in dissected areas near the margins of this association.

In most areas the soils in this association are used for row crops, small grains, and hay. In a few small areas they are used for pasture, and in some sloping to very steep areas they are used as woodland. Wheat, corn, and soybeans are the main crops. These soils are suited to farming that includes small grains and forage crops. They are also suited to use as orchards and vineyards and for specialty crops. The nearly level to sloping soils are well suited as sites for buildings. The soils in this association are well suited to use as woodland and as habitat for woodland wildlife.

Droughtiness, the hazard of erosion, and slope are the main limitations to farming. These soils are well suited to no-till planting. Because of the limited available water capacity, they are better suited to crops that mature early than to crops that mature late in summer. Using minimum tillage, planting winter cover crops, and including small grains and forage in the rotation increase infiltration and reduce erosion and runoff. Seedlings are difficult to establish during dry periods in summer.

level to sloping soils on flood plains, terraces, till plains, and lake plains

These soils make up about 13 percent of the county. They are well drained to very poorly drained and are level to sloping. They are on flood plains, dissected uplands, stream terraces, lake plains, and outwash plains. These soils are used mainly for farming. Flooding, wetness, the hazard of erosion, and low strength are the major management concerns.

10. Glynwood-Shoals-Genesee association

Deep, nearly level to sloping, moderately well drained, somewhat poorly drained, and well drained soils that formed in glacial till and alluvium

These soils are in the valleys of major streams, on flood plains, stream terraces, and the dissected uplands along the sides of streams. The flood plains and stream terraces are benches.

This association makes up about 12 percent of the county. It is about 20 percent Glynwood soils, 15 percent Shoals soils, 10 percent Genesee soils, and 55 percent soils of minor extent.

Glynwood soils are deep and are gently sloping and sloping. They formed in glacial till and are on the dissected uplands and valley side slopes. Their surface layer is silt loam, and the subsoil is clay, silty clay, and silty clay loam. These soils are moderately well drained. Erosion is a moderate to severe hazard. Permeability is slow.

Shoals soils are deep and are nearly level. They are on flood plains. Their surface layer is silt loam, and the underlying material is silt loam and loam. These soils are somewhat poorly drained. They are subject to occasional and rare flooding. A seasonal high water table is at a depth of 12 to 36 inches in winter and spring and during other extended wet periods. Permeability is moderate.

Genesee soils are deep and are nearly level. They formed in alluvium and are on flood plains. Their surface layer is silt loam, and the underlying material is silt loam and loam. These soils are well drained. They are subject to occasional flooding. Permeability is moderate.

Some of the minor soils in this association are the very poorly drained Sloan and moderately well drained Lindside soils on flood plains; the well drained Chagrin and moderately well drained Medway soils on low stream terraces; the Belmore, Oshtemo, Haney, and Millgrove soils that formed in water-sorted material and are on glacial stream terraces; the moderately well drained Cardington soils and well drained Morley soils that formed in glacial till and are on dissected valley side slopes; and the moderately well drained Shinrock soils that formed in lacustrine sediment on dissected valley side slopes.

In most areas on flood plains the soils in this association are used for crops. These soils are well suited to cash-grain farming. The valley walls and dissected uplands are generally in woodland or grass. Glynwood soils are suited as sites for buildings. Shoals and Genesee soils are generally not suited to this use. The soils in this association are well suited to use as woodland and as habitat for openland and woodland wildlife. They have many scenic areas and are well suited to use as natural areas and to some recreation uses.

Flooding and erosion are the main limitations for farming. Flooding usually does not occur during the growing season. In a few areas levees have been constructed to reduce flooding. Erosion is common in high-water channels during flooding. Stabilizing eroding streambanks is often difficult. Minimizing tillage, incorporating crop residue, and planting cover crops reduce erosion, crusting, loss of crop residue, and scouring by floodwater.

11. Carlisle-Colwood association

Deep, level and nearly level, very poorly drained soils that formed in organic deposits and in water-deposited material

These soils are in a smooth concave depression between dolomitic limestone ridges. The depression is a bog in a glacial lake outlet channel and is lower than the surrounding landscape. The soils in this association receive runoff and seepage from the adjacent higher soils. They are drained mainly by ditches.

This association makes up less than 1 percent of the county. It is about 25 percent Carlisle soils, 25 percent Colwood soils, and 50 percent soils of minor extent.

Carlisle soils are deep and are level. They formed in organic deposits. Their surface layer and underlying material are muck. These soils are in the lowest positions on the landscape. They are very poorly drained. The water table is at or above the surface for extended periods, and the soils are subject to ponding. They have very low strength and high compressibility. Permeability is moderately rapid to moderately slow.

Colwood soils are deep and are nearly level. They are in slightly higher positions than Carlisle soils and are along the edge of the association. Their surface layer is silt loam, and the subsoil is silty clay loam, silt loam, loam, and clay loam. These soils are very poorly drained. They have a seasonal high water table near or above the surface during the dormant season and after prolonged rainy periods and are subject to ponding. Permeability is moderate.

Some of the minor soils in this association are the very poorly drained Olentangy soils that formed in organic material over lacustrine sediment or glacial till; the moderately deep Millsdale soils at the margins of the association; and the somewhat poorly drained Blount and Randolph soils that formed dominantly in glacial till and that are on the fringe of the area. Udorthents are in areas where most of the organic material has been removed.

The soils in this association are used mainly as cropland. Corn and potatoes are the main crops. If they are adequately drained, these soils are well suited to truck crop farming. In some areas these soils are not drained. They are poorly suited or are generally not suited to building site development. They are suited to use as habitat for wetland wildlife.

Wetness is the main limitation to use of these soils for farming and most other purposes. Surface and subsurface drainage systems are used to remove excess water. Outlets for subsurface drains are difficult to establish. Pump drainage is used in some areas. Subsidence or shrinkage occurs in the Carlisle soils because the organic material oxidizes after draining. Subsidence causes displacement of subsurface drains. Controlling wetness reduces subsidence, soil blowing, and the possibility of burning.

detailed soil map units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Glynwood silt loam, 2 to 6 percent slopes, is one of several phases in the Glynwood 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. Kibbie-Blount complex, 0 to 2 percent slopes, is an example.

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

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

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

soil descriptions

BeA—Belmore loam, 0 to 2 percent slopes. This is a deep, well drained, nearly level soil on beach ridges of former glacial lakes and on outwash terraces, stream terraces, and deltas. The surface is uniform and generally slopes slightly in only one direction. Most areas are 3 to 70 acres in size and are oval or irregular in shape.

Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is about 37 inches thick. It is dark brown, friable loam in the upper part and dark yellowish brown and dark brown, firm gravelly clay loam in the middle and lower parts. The underlying material to a depth of about 60 inches is stratified dark brown, loose gravelly sandy loam and dark grayish brown, loose loamy sand. In some areas the surface layer is silt loam or sandy loam. In some areas the subsoil has less clay and more sand. In a few areas the surface layer is darker colored, and the subsoil has gray mottles.

Included with this soil in mapping are small areas of Glynwood, Morley, Chagrin, Digby, and Millgrove soils. The Glynwood and Morley soils have dense glacial till below a depth of 4 or 5 feet and are near breaks to the uplands. The Chagrin soils are on low stream terraces and are rarely flooded. The Tuscola soils are on deltas. The somewhat poorly drained Digby soils and very poorly drained Millgrove soils are in drainageways and depressions. Also included are a few small pits where gravel has been removed for local use. The included soils make up less than 10 percent of most areas.

Runoff is slow, and much of the rainwater infiltrates into the soil where it falls. The soil crusts slightly after hard rains. Permeability is moderately rapid, and the available water capacity is moderate. The content of organic matter is moderately low. The root zone is deep. The subsoil is medium acid to mildly alkaline.

This soil is used mainly as cropland. It has high potential for use as cropland. Corn, soybeans, small grains, hay, and pasture are the common crops. Plants often show moisture stress in summer. Because of the limited available water capacity, this soil is better suited to crops that mature early in summer than to crops that mature late. This soil is well suited to irrigation and no-till planting. The surface layer reaches the optimum moisture content for tillage much sooner after rains than the surface layer in soils that have a higher content of clay. Plant nutrients are leached at a moderately rapid rate; consequently, the soil generally responds better to smaller, more frequent or timely applications of fertilizer and lime than to one large application.

In a few areas this soil is in native hardwoods. It is well suited to use as woodland. Plant competition can be reduced by spraying, mowing, or disking.

This soil is one of the most suitable for building site development because it is nearly level, is not saturated seasonally, and is good foundation material. It is also suited to septic tank absorption fields. The soil is a good source of earthfill for roads. However, it is too porous for use as reservoir embankments.

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

BeB—Belmore loam, 2 to 6 percent slopes. This is a deep, well drained, gently sloping soil on low knolls and ridges on beach ridges, terraces, and deltas. Most areas are 3 to 35 acres in size and are long and narrow in shape.

Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is about 37 inches thick. It is dark brown, friable loam in the upper part and dark yellowish brown and dark brown, firm clay loam and gravelly clay loam in the middle and lower parts. The underlying material to a depth of about 60 inches is stratified dark brown, loose gravelly sandy loam and dark grayish brown, loose loamy sand. In places, the surface layer is silt loam or sandy loam. In a few small areas clay loam glacial till is at a depth of 3 to 5 feet. In a few areas slopes are 6 to 12 percent, and the soil is eroded.

Included with this soil in mapping are small areas of Chagrin, Tuscola, Digby, Haney, Glynwood, and Morley soils. The Chagrin soils are on low stream terraces. The Tuscola soils are on beach ridges and deltas. The somewhat poorly drained Digby soils and the moderately well drained Haney soils are in drainageways and depressions. The Glynwood and Morley soils are on slope breaks to uplands. Small abandoned gravel pits are included in mapping. Also included are areas along Sycamore Creek in Sycamore Township that have dolomitic limestone in the underlying material. The included soils make up less than 15 percent of most areas.

Permeability is moderately rapid, and the available water capacity is moderate. Runoff is medium. The content of organic matter is moderately low. The soil crusts slightly after hard rains. The root zone is deep. The subsoil is medium acid to mildly alkaline.

Most areas of this soil are used for cropland. It has medium potential for cropland. Corn, soybeans, small grain, hay, and pasture are commonly grown. The soil dries early in spring and plants often show moisture stress in summer months. The surface layer reaches optimum moisture content for tillage much sooner after rains than soils with a higher clay content. Because of the limited available water capacity it is better suited to early maturing crops than to crops that mature late in summer. Grassed waterways help prevent gully erosion where runoff collects in concentrated flow. Including close growing crops such as small grains and forages in crop rotations will reduce erosion. Returning crop residues and barnyard manure and using minimum tillage methods will reduce runoff and soil loss by erosion. This soil is suited to no-till and irrigation. Plant nutrients are leached at a moderately rapid rate from this soil; consequently, response is generally better to smaller, more frequent or timely applications of fertilizer and lime than to one large application.

This soil is suited to trees. Seedlings make good growth if competing vegetation is controlled or removed by cutting, spraying, girdling, or mowing.

Many areas are good sites for buildings and septic tank absorption fields. Drains at the base of footings are needed in included wetter soils. This soil is a good source of earthfill for roads, but it is too porous for reservoir embankments.

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

BgA—Bennington silt loam, 0 to 2 percent slopes. This is a deep, nearly level, somewhat poorly drained soil on ground moraines and end moraines. It is commonly on slight rises only 1 or 2 feet higher than nearby wetter soils. Most areas are 10 to 160 acres in size and irregular in shape.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 32 inches thick. The upper part is yellowish brown, mottled, firm silty clay loam; and the lower part is dark brown, mottled, firm clay loam. The underlying material to a depth of about 60 inches is dark brown, mottled, calcareous, firm and very firm clay loam glacial till. In some areas on the hummocky part of end moraines, a layer of silt loam or loam extends to a depth of 2 or 3 feet. The layer is free of gravel.

Included with this soil in mapping and making up about 20 percent of most areas are small areas of very poorly drained Pewamo soils on flats and in depressions.

Surface runoff is slow. This soil has moderate organic matter content and crusts after hard rains. The crust reduces infiltration of water. Potential frost action is high. A perched seasonal high water table is present in the upper part of the subsoil during the dormant season and after prolonged rainy periods. Permeability is slow. Available water capacity is moderate. The subsoil is very strongly acid to slightly acid in the upper part and slightly acid to mildly alkaline in the lower part. The root zone is moderately deep or deep to dense glacial till.

In most areas this soil is partially drained and is used as cropland. This soil has medium potential for use as cropland. Corn, soybeans, and small grain grown in rotation are the main crops. Some rotations include grass-legume hay, and in a few areas this soil is used for pasture. Management of this soil for crops should include practices to reduce crusting and soil compaction and improve drainage. Surface and subsurface drains are commonly used to improve drainage. Water moves laterally above the slowly permeable substratum. Timely tillage and the use of crop residues can reduce compaction. A rough or ridged surface in fall tilled areas hastens drying in the spring. This soil is suited to no-till planting, if adequately drained.

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

This soil is moderately well suited to building site development and poorly suited to use as septic tank absorption fields. The seasonal wetness that limits the use of the soil as a site for buildings can be partly overcome by surface and subsurface drainage. Agricultural drainage outlets are generally not adequate in size or depth to handle excess water from residential areas. Drains at the base of footings help prevent wet basements. Local roads can be improved by providing artificial drainage and using a suitable base material. Perimeter drains are used around septic tank absorption fields to lower the seasonal high water table.

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

BgB—Bennington silt loam, 2 to 6 percent slopes. This is a deep, gently sloping, somewhat poorly drained soil on slightly dissected parts of ground moraines and on knolls in hummocky areas of end moraines. Most areas are 2 to 320 acres in size and are irregular in shape.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 32 inches thick. It is yellowish brown and dark brown, mottled, firm silty clay loam and clay loam. The underlying material to a depth of about 60 inches is dark brown, mottled, calcareous, firm and very firm clay loam glacial till. In some areas layers of loam, silt loam, and sandy loam are in the subsoil. In a few areas the soil is eroded, and the surface layer is silty clay loam.

Included with this soil in mapping are narrow bands of very poorly drained Pewamo soils along drainageways. Small areas of better drained Cardington soils are included on knolls and ridges.

Surface runoff is medium. Areas at the base of slopes receive runoff and seepage from higher adjacent soils. This soil has moderate organic matter content. The crust that forms after hard rains reduces infiltration of water. Potential frost action is high. A perched seasonal water table is in the upper part of the subsoil. The root zone is moderately deep or deep. The available water capacity is moderate. The upper part of the subsoil is very strongly acid to slightly acid, and the lower part is slightly acid to mildly alkaline.

This soil is partially drained by subsurface and surface drainage and is used as cropland. It has medium potential for use as cropland. Corn, soybeans, and small grains are commonly grown in rotation. Some rotations contain grass-legume hay. Improving drainage and controlling erosion are the major concerns of management. Erosion can be controlled by planting winter cover crops and using no-till, contour tillage, and grassed waterways. Infiltration can be increased by returning crop residue and delaying the last tillage operation in seedbed preparation until just prior to planting. Subsurface drainage is effective in lowering the seasonal high water table. Deep-rooted crops help to improve soil structure and internal water movement.

In undrained areas this soil is commonly used for pasture and as woodland. It is suited to use as woodland. Species selected for planting should tolerate some wetness. Plant competition can be reduced by spraying, mowing, or disking.

This soil is moderately well suited to use as a site for buildings and poorly suited to use as septic tank absorption fields. Seasonal wetness and slow permeability limit the use of this soil for these uses. Surface grading, french drains, and perimeter drains are used around septic tank absorption fields to lower the water table. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Local roads can be improved by providing artificial drainage and using a suitable base material.

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

BoA—Blount silt loam, 0 to 2 percent slopes. This is a deep, nearly level, somewhat poorly drained soil on uplands. It is on low rises or on extensive upland flats. Most areas are 2 to 320 acres in size and are irregular or convoluted in shape.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 25 inches thick. It is multicolored, firm silty clay loam and silty clay. The underlying material to a depth of about 60 inches is dark grayish brown very firm silty clay loam glacial till that has mottles in the upper part. In some areas, the lower part of the subsoil and the underlying material are loam or silt loam. In other areas, the underlying material is silty clay. In a few areas the soil is poorly drained, and the surface layer is very dark grayish brown.

Included with this soil in mapping are small areas of Digby, Glynwood, Haskins, Fitchville, Kibbie, and Pewamo soils. Kibbie, Haskins, and Digby soils have a loamy surface layer. Fitchville soils have a more silty subsoil. Glynwood soils are moderately well drained and are on knolls. Pewamo soils are very poorly drained and are in depressions and along drainageways. The included soils make up 10 to 15 percent of most areas.

Runoff is slow. The content of organic matter is moderate. The surface layer crusts after hard rains and reduces infiltration. Permeability is slow or moderately slow. The root zone is mainly moderately deep to compact glacial till. The available water capacity is moderate. Reaction in the subsoil is very strongly acid to medium acid in the upper part and slightly acid to mildly alkaline in the lower part. A perched seasonal high water table is in the subsoil during the dormant season and after prolonged rainy periods.

In most areas this soil is used as cropland. It has medium potential for use as cropland. Corn, soybeans, and wheat are commonly grown in rotation. Grass-legume hay is grown occasionally. The main concerns of management are lowering the seasonal high water table, increasing the infiltration rate, reducing soil compaction, and improving fertility. Subsurface drainage systems are commonly used to lower the water table. Management practices that reduce compaction include minimum tillage, tilling at the proper moisture content, and planting deep-rooted legumes and grasses in rotation with cultivated crops. This soil is suited to no-till planting if adequately drained.

In a few areas this soil is used for trees. The seasonal high water table and high content of clay in the subsoil limit the selection and growth of trees. Species selected for planting should be tolerant of the clay in the subsoil.

This soil is moderately well suited to building site development and poorly suited to use as septic tank absorption fields. Wetness severely limits these uses. This soil is better suited to houses without basements than to houses with basements. Storm and foundation drains are needed, especially where basements are installed. The drains used in agricultural areas are generally inadequate in size and depth to remove excess water from residential areas. Perimeter drains are used around septic tank absorption fields to lower the water table.

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

BoB—Blount silt loam, 2 to 6 percent slopes. This is a deep, gently sloping, somewhat poorly drained soil on uplands. Some areas have concave slopes that receive runoff from adjacent soils. Other areas are convex knolls or ridges. In some areas this soil is at the head of minor drainageways where surface water begins to collect in channels. Most areas are 5 to 80 acres in size and are irregular or convoluted in shape.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 26 inches thick. It is multicolored, firm silty clay loam and silty clay. The underlying material to a depth of about 60 inches is dark grayish brown, mottled, very firm silty clay loam glacial till. In some hummocky areas, loam or silt loam is in the lower part of the subsoil and in the underlying material. In some small eroded areas near the crest of slopes the surface layer is silty clay loam. In a few areas the subsoil is thicker than is typical. In some flat areas the soil is poorly drained.

Included with this soil in mapping are small areas of Kibbie, Haskins, Digby, Glynwood, and Pewamo soils. Kibbie, Haskins, and Digby soils have a loamy surface layer. Glynwood soils are moderately well drained and are on knolls. Pewamo soils are very poorly drained and are in depressions and along drainageways. The included soils make up 10 to 15 percent of most areas.

The content of organic matter is moderate. The soil crusts after hard rains, and infiltration is reduced. Runoff is medium. Erosion is a hazard, especially where slopes are long. The root zone is mainly moderately deep to compact glacial till. The available water capacity is moderate. Permeability is slow or moderately slow. The subsoil ranges from very strongly acid to medium acid in the upper part and slightly acid to mildly alkaline in the lower part. A seasonal high water table is perched in the subsoil during the dormant season and after prolonged rainy periods.

In most areas this soil is used as cropland. It has medium potential for cultivated crops. The main concerns of management are controlling erosion, lowering the seasonal high water table, increasing infiltration, reducing soil compaction, and improving fertility. Minimum tillage, grassed waterways, and the inclusion of forage crops in the rotation reduce soil loss by erosion. Lowering the seasonal water table improves chances for deeper root development. Subsurface drainage systems are commonly used to lower the water table. Management practices that reduce compaction include minimum tillage, tilling at the proper moisture content, and planting deep-rooted legumes and grasses in rotation with cultivated crops. This soil is suited to no-till planting if adequately drained.

Only a small acreage remains in native mixed hardwoods. The seasonal high water table and high content of clay in the subsoil limit the growth of trees. Species selected for planting should be tolerant of the high content of clay in the subsoil.

This soil is moderately well suited to building site development and poorly suited to use as septic tank absorption fields. Wetness severely limits the use of the soil as a site for buildings. Storm and foundation drains are needed, especially where basements are installed. Drains used in agricultural areas are generally inadequate in size and depth to remove excess water from residential areas. Perimeter drains are used around septic tank absorption fields to lower the water table.

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

Br—Bono silty clay. This is a deep, nearly level, very poorly drained soil in well defined local depressions and on flat basins. Many of these areas are intermittently ponded in winter and spring by surface runoff from nearby soils. Slope is 0 to 2 percent. Most areas are 2 to 80 acres in size and are roughly circular or ribbon shaped.

Typically, the surface layer is very dark gray, friable silty clay about 8 inches thick. The subsurface layer is very dark gray, mottled, firm silty clay about 4 inches thick. The subsoil is about 48 inches thick and is mottled. It is dark gray and olive brown firm silty clay in the upper part and dark grayish brown, firm and very firm silty clay loam in the lower part. The underlying material to a depth of about 70 inches is dark brown, mottled, firm, laminated silt loam and silty clay loam. In some areas slopes are 2 to 6 percent. In a few areas the surface layer is silty clay loam and the subsoil has less clay.

Included with this soil in mapping are small areas of Pewamo and Olentangy soils. Pewamo soils formed in glacial till on the fringes of some areas of the Bono soil, and Olentangy soils are in the center or lowest part of some depressions. In some included areas, glacial till that is relatively stable is in the underlying material. A few areas along Potato Run and other streams are occasionally flooded. The included soils make up about 15 percent of most areas.

Runoff is very slow or ponded (fig. 1). The content of organic matter is high. The root zone is deep. The subsoil is slightly acid to mildly alkaline in the upper part and neutral to moderately alkaline in the lower part. Permeability is slow or very slow. The available water capacity is moderate. However, crops seldom show moisture stress because of runoff and seepage from nearby soils. The seasonally high water table is above or near the surface in winter and spring and during other extended wet periods. The shrink-swell potential is high in the subsoil.

This soil is used mainly as cropland. It has medium potential for use as cropland. Corn and soybeans are commonly grown. Improving drainage and tilling at optimum moisture content are major concerns in management. In undrained areas this soil is too wet for cultivation. Stands of small grain are poor in some years where good drainage is not provided. Surface and subsurface drains are commonly used to remove excess water. Deep excavations are often required to install outlets for subsurface drains, and ditch channels must be deepened for a good outlet for the subsurface drains. Subsurface drains must be closely spaced for uniform drainage. This soil shrinks and cracks when it dries. It becomes cloddy if tilled when wet. Fall tillage that partially covers crop residue and leaves a rough or ridged surface increases infiltration and hastens drying.

This soil is suited to trees and to use as habitat for wetland wildlife. In many undrained areas it is used by waterfowl for nesting and feeding. Woodlands consist mainly of water tolerant species. Wetness limits the planting and harvesting of trees. Logging and planting can be done during the drier part of the year.

This soil is generally not suited to use as a site for buildings and septic tank absorption fields. The high shrink-swell potential, ponding, and slow or very slow permeability severely limit the use of this soil for these uses. Installing adequate drainage is difficult.

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

CdB2—Cardington silt loam, 2 to 6 percent slopes, eroded. This is a deep, gently sloping, moderately well drained soil on low knolls and ridges on end moraines and at the head of tributary drainage systems. Erosion has removed part of the original surface layer. The present surface layer has subsoil material that is high in clay. Most areas are 6 to 40 acres in size and ribbon shaped or roughly funnel shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 32 inches thick. The upper and middle parts are yellowish brown, firm silty clay loam and clay loam that has mottles below a depth of about 16 inches, and the lower part is dark brown, mottled, firm loam. The underlying material to a depth of about 60 inches is dark grayish brown, calcareous, very firm clay loam. In some hummocky areas on moraines the subsoil has less clay, and its texture varies.

Included with this soil in mapping are small areas of Tiro, Bennington, Pewamo, and Pandora soils. Tiro and Bennington soils are somewhat poorly drained and are in low spots and around the base of knolls. Pewamo and Pandora soils are along drainageways. Pewamo soils are very poorly drained, and Pandora soils are poorly drained. Also included are areas of severely eroded soils that have a silty clay loam surface layer or steeper slopes. The included soils make up less than 15 percent of most areas.

Permeability is moderately slow. The available water capacity is moderate. Runoff is medium. The content of organic matter is moderately low. The root zone is moderately deep or deep. The subsoil is medium acid to very strongly acid in the upper part and medium acid to mildly alkaline in the lower part. A seasonal high water

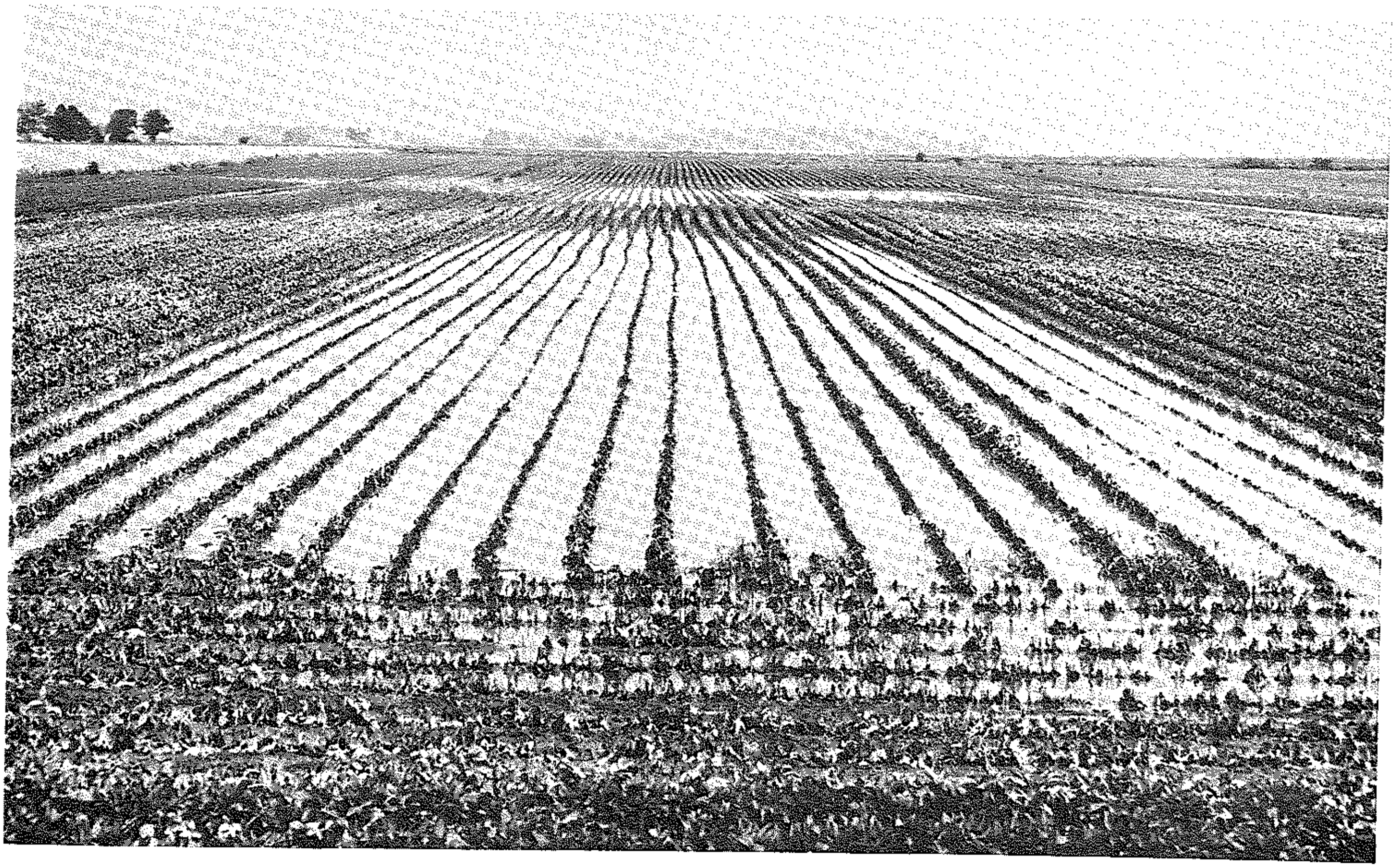

Figure 1.—Ponding on Bono silty clay.

table is perched in the lower part of the subsoil in winter and spring and during other extended wet periods.

In most areas this soil is used as cropland. It has medium potential for use as cropland. Corn, soybeans, small grains, and hay are the main crops. Controlling erosion, conserving water, and improving fertility are concerns of management. The clay in the surface layer makes the soil difficult to manage. Using minimum tillage and planting winter cover crops increase infiltration. Using contour tillage, grassed waterways, and small grains or forages in the crop rotation reduce soil loss by erosion. This soil is well suited to no-till planting.

In a few areas the soil is in native hardwoods. It is well suited to a wide variety of trees. Plant competition can be reduced by spraying, mowing, or disking.

This soil is suited to building site development; however, it is poorly suited to on-site filtration of waste water. Seasonal wetness and moderate shrink-swell potential in the subsoil limit the use of this soil as a site for buildings. It is better suited to use as sites for houses without basements than to houses with basements. The high parts of knolls and ridges are the best homesites. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. The increased runoff and erosion that occurs during construction can be reduced by maintaining soil cover wherever possible. Perimeter drains around septic tank absorption fields help lower the seasonal high water table.

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

CdC2—Cardington silt loam, 6 to 12 percent slopes, eroded. This is a deep, sloping, moderately well drained soil on knolls and ridges on the hummocky parts of end moraines and on hillsides near small streams. Erosion has removed part of the original surface layer. The present surface layer has subsoil material that is high in clay. Most areas are 6 to 40 acres in size with ribbon or roughly funnel shape.

Typically, the surface layer is dark grayish brown, friable silt loam and about 8 inches thick. The subsoil is yellowish brown and dark brown, firm silty clay loam,

loam, and clay loam about 32 inches thick. It is mottled below a depth of about 16 inches. The underlying material to a depth of about 60 inches is dark grayish brown, mottled, calcareous, very firm clay loam. In some hummocky areas the subsoil and underlying material have less clay, and the soil is better drained. In a few areas slopes are 12 to 18 percent. In other areas the soil is slightly eroded.

Included with this soil in mapping are small areas of Tiro, Bennington, Pewamo, and Pandora soils. Tiro and Bennington soils are somewhat poorly drained and are in low spots and around the base of knolls. Pewamo and Pandora soils are along drainageways. Pewamo soils are very poorly drained, and Pandora soils are poorly drained. Also included are spots where the surface layer is silty clay loam. The included soils make up less than 15 percent of most areas.

Permeability is moderately slow. The available water capacity is moderate. Runoff is rapid. The content of organic matter is moderately low. The root zone is moderately deep or deep to compact glacial till. The subsoil is very strongly acid to medium acid in the upper part and medium acid to mildly alkaline in the lower part. A seasonal high water table is perched in the lower part of the subsoil in winter and spring and during other extended wet periods.

In most areas this soil is used as cropland. It has low potential for use as cropland. Corn, soybeans, small grains, and hay are commonly grown. Maintaining fertility and the content of organic matter, controlling erosion, and conserving moisture are the main concerns of management. The clay in the surface layer makes the soil difficult to manage. This soil is suited to no-till planting. Using minimum tillage, planting winter cover crops, and using grassed waterways help reduce runoff and soil loss by erosion. Contour tillage and stripcropping can be used in many areas. Returning crop residue or regularly adding other organic material helps increase water infiltration.

This soil is well suited to a wide variety of trees. In some areas it is in hardwoods. Plant competition can be reduced by spraying, mowing, or disking.

This soil is suited to building site development. However, it is poorly suited to use as septic tank absorption fields. Because of seasonal wetness this soil is better suited to houses without basements than to houses with basements. The slope and moderate shrink-swell potential also limit building site development. The more convex parts of slopes should be selected for homesites. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. The increased runoff and erosion that occur during construction can be reduced by maintaining soil cover wherever possible. The distribution lines in septic tank absorption fields should be on the contour to reduce seepage of effluent to the soil surface.

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

CdD2—Cardington silt loam, 12 to 18 percent slopes, eroded. This is a deep, moderately steep, moderately well drained soil on hillsides along streams. It is dissected by many intermittent waterways. Erosion has removed part of the original surface layer. The present surface layer has subsoil material that has more clay than the original surface layer. Most areas are 6 to 20 acres in size and are lobed or fork shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is yellowish brown and brown, mottled firm silty clay loam, loam, and clay loam about 33 inches thick. It is mottled below a depth of about 16 inches. The underlying material to a depth of about 60 inches is dark grayish brown, calcareous very firm clay loam. In some areas the subsoil and underlying material have less clay, and the soil is better drained. In most wooded areas the soil is slightly eroded.

Included with this soil in mapping are a few spots of somewhat poorly drained Bennington soils along drainageways. Also included are many spots on the upper part of slopes where the soil is severely eroded and has a silty clay loam surface layer. Some of these severely eroded spots are gullied. The included soils make up less than 15 percent of most areas.

Permeability is moderately slow. The available water capacity is moderate. Runoff is very rapid. The content of organic matter is moderately low. The root zone is moderately deep or deep to compact glacial till. The subsoil is medium acid or strongly acid in the upper part and medium acid to mildly alkaline in the lower part. A seasonal high water table is perched in the lower part of the subsoil during extended wet periods.

In most areas this soil is used for pasture or as woodland. It has low potential for use as cropland. Controlling erosion and maintaining fertility and the content of organic matter are the main management concerns. This soil is suited to no-till planting. Using minimum tillage, planting winter cover crops, and using grassed waterways help reduce runoff and erosion. Slopes are too short or irregular for contour tillage. Returning crop residue or regularly adding other organic material helps increase infiltration.

This soil is well suited to a wide variety of trees. Many areas in native hardwoods need stand improvement. Plant competition can be reduced by spraying, mowing, or disking. Logging roads and skid trails should be protected against erosion by water bars or other practices.

This soil is poorly suited to building site development and to use as septic tank absorption fields. Slope, seasonal wetness, and moderately slow permeability severely limit this soil for these uses. Extensive land shaping is generally necessary to prepare an area.

Building sites should be carefully selected to avoid the line of runoff from adjacent soils. The distribution lines in septic tank absorption fields should be on the contour to reduce seepage of effluent to the soil surface. Cover should be maintained on the site as much as possible during construction to reduce the hazard of erosion.

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

Ck—Carlisle muck. This is a deep, level, very poorly drained soil in bogs on till plains and lake plains. It is subject to ponding in fall, winter, and spring. Slope is 0 to 2 percent. Most areas are 5 to 40 acres in size and are circular in shape. One area is about 400 acres in size and is oblong in shape.

Typically, the surface layer is black, very friable muck about 10 inches thick. Below that to a depth of about 60 inches are layers of very dark brown and dark reddish brown, friable muck. In some areas the soil has layers of muck that are less decomposed and have more fiber.

Included with this soil in mapping are small areas of Colwood and Olentangy soils near the edge of areas of the Carlisle soil. A few small included depressions have been filled with mineral material. Also included are areas that have mineral material at a depth of 40 to 60 inches or dolomitic limestone at a depth of 20 to 40 inches. The included soils make up 5 to 10 percent of most areas.

Permeability is moderately rapid to moderately slow. The root zone is deep and is strongly acid to mildly alkaline. The available water capacity and the content of organic matter are very high. Trace element deficiencies are common. The water table is at or above the surface for extended periods, under natural conditions. This soil ponds in fall, winter, and spring and during other extended wet periods. It has low strength and high compressibility. When dry, the surface is subject to soil blowing and fire.

This soil is used as cropland. Corn, potatoes, and specialty crops are commonly grown. In a few areas the soil is mined for humus. It has high potential for these uses. Artificial drainage is essential for the production of crops on this soil. Outlets for subsurface drains are difficult to establish in most areas. Ditchbanks are unstable. Subsidence or shrinkage occurs as a result of oxidation of the organic material after the soil is drained, causing displacement of subsurface drains. Pump drainage systems are used in some areas. Control of the water table helps reduce subsidence, burning, and soil blowing. Planting winter cover crops and windbreaks helps reduce soil blowing. This soil is easily tilled. The surface layer commonly needs compaction rather than loosening to create a good seedbed. This soil easily absorbs water, nutrients, and pesticides because of the very high content of organic matter. It will not support narrow wheeled equipment when wet. Subirrigation through tile lines by controlling the water table is an effective practice. Because this soil is in low positions on the landscape, plants are more susceptible to frost than those on most nearby mineral soils.

In undrained areas this soil is well suited to use as habitat for wetland wildlife. It is covered by cattails, sedges, and reeds. This soil is poorly suited to trees. Wetness severely limits the use of logging equipment.

This soil is generally not suited to use as a site for buildings and septic tank absorption fields.

This soil is in capability subclass IIIw and in woodland suitability subclass 4w.

Cm—Chagrin silt loam, rarely flooded. This is a deep, nearly level, well drained soil on low stream terraces in major stream valleys. The terraces are flooded on rare occasions. Slope is 0 to 2 percent. Most areas are 20 to 80 acres in size and are in a distinct banded pattern.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is dark brown, firm silt loam and friable loam about 38 inches thick. It is mottled below a depth of about 30 inches. The underlying material to a depth of about 60 inches is dark brown and grayish brown, friable stratified fine sand and silt loam. In some areas the subsoil has more sand. A few areas are occasionally flooded. In some areas the soil is moderately well drained, and in other areas the surface layer is darker colored and has more organic matter.

Included with this soil in mapping are small areas of Shoals, Sloan, Belmore, Tuscola, and Haney soils. Shoals and Sloan soils are on flood plains and low stream terraces; and the Belmore, Tuscola, and Haney soils are on slight rises and knolls. The included soils make up less than 10 percent of most areas.

Runoff is slow. About once in 20 years stream overflow covers this soil for a few days, usually during the dormant season. Ice jams or other blockage of the channel is often the cause of these high water levels. Permeability and the content of organic matter are moderate. The available water capacity is high. The root zone is deep. Reaction in the root zone is medium acid to neutral. A seasonal high water table is below a depth of 4 feet late in winter, early in spring, and during other extended wet periods.

In most areas this soil is cultivated. It has high potential for crops. Corn, soybeans, wheat, and hay are commonly grown. This soil is also suited to small fruits and to specialty crops, for example, tomatoes, cucumbers, and potatoes. The subsoil drains freely and natural drainage is good. Land grading in a few areas would allow surface water to drain faster after floods. Keeping stream channels free of obstructions such as log jams helps reduce flooding. This soil is suited to no-till planting and to irrigation. Deep-rooted perennial crops, for example, alfalfa, grow well on this soil.

In a few areas this soil is used as woodland. Woodlands are mainly deciduous hardwoods. This soil is well suited to trees and to use as habitat for wildlife. Tree seedlings make good growth if competing vegetation is controlled or removed by spraying, mowing, or disking.

This soil is generally not suited to use as a site for buildings. However, it is suited to use as septic tank absorption fields. Structures such as roads, bridges, or recreation facilities need special design to prevent flood damage. Elevating the structure above the known high water level helps reduce damage. Fill for roads should not block the flow of floodwaters. Levees are used to protect the soil in a few areas, but these levees tend to increase the water level on unprotected land nearby.

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

Co—Colwood silt loam. This is a deep, very poorly drained, nearly level soil on outwash plains and along the margins of glacial lake plains. It receives runoff from the higher adjacent soils and is subject to ponding. Slope is 0 to 2 percent. Most areas are 5 to 40 acres in size and are circular in shape.

Typically, the surface layer is very dark grayish brown, friable silt loam about 11 inches thick. The subsoil is grayish brown and dark grayish brown, mottled, friable and firm silty clay loam, silt loam, loam, and clay loam about 35 inches thick. The underlying material to a depth of about 60 inches is grayish brown and gray, friable and firm fine sandy loam and silt loam. In some areas the surface layer is thinner. In some areas the surface layer is sandy loam or loam and the subsoil has gravel, less sand, and more silt.

Included with this soil in mapping are small areas of Bono soils in small depressions and Pewamo soils near breaks to the uplands. The included soils make up 10 to 15 percent of most areas.

Runoff is very slow or ponded. The content of organic matter is high. Surface crusting seldom restricts seedling emergence. The surface layer and subsoil are slightly acid to mildly alkaline. The root zone is deep. Permeability is moderate. The available water capacity is high. A water table is near or above the surface during the dormant season and after prolonged rainy periods.

In most areas this soil is drained and used for crops. This soil has high potential for use as cropland. Corn, soybeans, and wheat are grown in rotation, and some fields are returned to hay occasionally. This soil is suited to growing row crops year after year if optimum management is applied. Wetness is the main limitation for farming. Unless adequate drainage is provided, poor stands of wheat and oats can be expected in most years. Surface and subsurface drains remove surface water and lower the seasonal high water table. Tillage that leaves a rough or ridged surface and partly covers the crop residue increases infiltration, reduces runoff, and improves soil structure. Fall tillage is less likely to cause compaction than spring tillage because the soil is usually drier in the fall. In some areas the surface layer is alkaline, and the soil is deficient in manganese. Overliming can increase the deficiency.

In a few areas this soil is in trees. Woodlands are mainly second growth stands of native swamp forest. Species selected for planting should be tolerant of wetness. Wetness limits the use of planting and harvesting equipment in winter and spring. Plant competition can be reduced by spraying, mowing, disking, or girdling.

This soil is poorly suited as a site for buildings and is generally not suited to use as septic tank absorption fields. Ponding is a severe limitation. Agricultural drains generally are not adequate to handle storm water runoff from residential areas. Extra reinforcement is needed in foundations. Excavation is limited in winter and spring because of seasonal wetness and sloughing of banks.

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

DeA—Del Rey silt loam, 0 to 2 percent slopes. This is a deep, somewhat poorly drained, nearly level soil in basins of former glacial lakes. It is commonly on slight rises. Most areas are 2 to 320 acres in size and are irregular or convoluted in shape.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is brown, olive brown, and yellowish brown, mottled, firm silty clay loam about 35 inches thick. The underlying material to a depth of about 60 inches is dark grayish brown, firm silty clay loam. In a few small areas the underlying material is glacial till. In a few places the surface layer is silty clay loam. In some areas very strongly acid layers are in the subsoil.

Included with this soil in mapping are small areas of Milford, Bono, Haskins, Kibbie, and Shinrock soils. Milford and Bono soils are very poorly drained and are in depressions. Haskins and Kibbie soils are on ridges and knolls and have a loamy surface layer. Shinrock soils are in dissected areas. The included soils make up less than 10 percent of most areas.

Runoff is slow. The content of organic matter is moderate. The surface layer crusts after hard rains. Permeability is slow. The root zone is moderately deep to deep. The available water capacity is moderate or high. The subsoil is strongly acid to slightly acid in the upper part and medium acid to moderately alkaline in the lower part. The potential frost action is high.

In most areas this soil is used as cropland. It has medium potential for use as cropland. Soybeans, corn, wheat, and hay are commonly grown. Seasonal wetness and slow permeability are the main limitations for farming. Wetness delays planting and limits the choice of crops. Surface and subsurface drains are used in removing excess surface water and lowering the perched seasonal high water table. Fall tillage is less likely to cause compaction than spring tillage because the subsoil is usually drier in the fall. However, erosion is a greater hazard from fall tillage. Adequately drained areas are suited to no-till planting.

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

This soil is moderately well suited to building site development and poorly suited to use as septic tank absorption fields. Because of seasonal wetness, this soil is better suited to houses without basements than to houses with basements. Ditches and subsurface drains are used to improve drainage. Building sites should be landscaped for good surface drainage away from foundations. Foundations should be designed to prevent structural drainage from swelling of the soil. Foundations should be backfilled with soil material that has a low shrink-swell potential. Wetness and slow permeability severely limit the use of this soil for septic tank absorption fields. Perimeter drains are used around septic tank absorption fields to lower the seasonal high water table.

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

DeB—Del Rey silt loam, 2 to 6 percent slopes. This deep, gently sloping, somewhat poorly drained soil is at the head of drainageways on glacial lake plains. Most areas are 5 to 80 acres in size and are convoluted or ribbon shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is brown and yellowish brown, mottled, firm silty clay loam about 35 inches thick. The underlying material to a depth of about 60 inches is dark grayish brown, mottled, firm silty clay loam. In some areas that are eroded, the surface layer is silty clay loam. In some places the subsoil has less clay and more sand or silt. In some areas the underlying material is glacial till. In a few areas very strongly acid layers are in the subsoil.

Included with this soil in mapping are small areas of Milford, Pewamo, and Shinrock soils. The very poorly drained Milford and Pewamo soils are in shallow depressions and along drainageways; and the moderately well drained Shinrock soils are on knolls and on the upper part of side slopes. Included soils make up less than 10 percent of most areas.

Runoff is medium. The surface layer crusts after heavy rains, and infiltration is reduced. The content of organic matter is moderate. Permeability is slow. A seasonal water table is in the upper part of the subsoil during the dormant season and after prolonged rainy periods. The available water capacity is moderate or high. The root zone is moderately deep to deep. The subsoil is strongly acid to slightly acid in the upper part and medium acid to moderately alkaline in the lower part. The shrink-swell potential is moderate. Potential frost action is high.

In most areas this soil is used as cropland. It has medium potential for use as cropland. Corn, soybeans, and wheat are commonly grown in rotation. Some fields are occasionally returned to hay. Management concerns for crop production are improving drainage, controlling erosion, and improving nutrient availability. Erosion can be reduced by planting winter cover crops and using no-till, contour tillage, and grassed waterways. Infiltration can be increased by returning crop residue and delaying final tillage until immediately before planting. Subsurface drains are used to lower the seasonal high water table. Deep-rooted crops grown in the rotation, for example, alfalfa, improve soil structure and increase water infiltration.

Woodland mainly consists of second-growth stands of native hardwoods. Species selected for planting should be tolerant of the high content of clay in the subsoil and some wetness. Plant competition can be reduced by spraying, mowing, or disking.

This soil is moderately well suited to building site development and poorly suited to septic tank absorption fields. Buildings should be located on the upper part of slopes. Because of seasonal wetness, this soil is better suited to houses without basements than to houses with basements. Placing drains at the base of footings and coating the exterior basement walls help prevent wet basements. Foundations should be designed to prevent structural damage caused by the shrinking and swelling of the soil and backfilled with soil material that has a low shrink-swell potential.

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

DgA—Digby loam, 0 to 3 percent slopes. This is a deep, nearly level, somewhat poorly drained soil on stream terraces and outwash plains. Most areas are 2 to 20 acres in size and are irregular in shape.

Typically, the surface layer is dark grayish brown, friable loam about 10 inches thick. The subsoil is about 38 inches thick. The upper part is grayish brown and yellowish brown, mottled, friable loam and clay loam, and the lower part is yellowish brown, mottled, firm gravelly clay loam. The underlying material to a depth of about 60 inches is gray, loose gravelly loamy sand. In some areas the surface layer is darker and has more organic matter. In some areas the underlying material is firm, dense glacial till. A few areas near streams are subject to rare flooding.

Included with this soil in mapping are small areas of Millgrove, Colwood, Mermill, Haney, Belmore, Bennington, Blount, and Shoals soils. The very poorly drained Millgrove, Colwood, and Mermill soils are in swales and depressions. The moderately well drained Haney soils and well drained Belmore soils are in slightly elevated positions. The Bennington and Blount soils are on uplands on the periphery of areas of the Digby soil. Shoals soils are on flood plains. The included soils make up less than 15 percent of most areas.

Permeability is moderate in the subsoil and rapid in the underlying material. The available water capacity is moderate. Runoff is slow. The root zone is deep. The subsoil is strongly acid to neutral in the upper part and slightly acid to mildly alkaline in the lower part. A seasonal high water table is in the upper part of the subsoil in winter and spring and during other extended wet periods. The content of organic matter is moderate.

In most areas this soil is drained and is used as cropland. It has medium potential for use as cropland. Corn, soybeans, small grains, and hay are commonly grown. Seasonal wetness is the main limitation for farming. Surface and subsurface drains are commonly used to remove excess water. Minimizing tillage and planting deep-rooted crops help improve natural drainage. Incorporating crop residue and other organic matter into the surface layer increases the infiltration rate and improves tilth and fertility. Tillage and harvesting should be done at the optimum moisture level using equipment that minimizes soil compaction. In adequately drained areas this soil is suited to no-till planting.

This soil is well suited to trees and other vegetation grown as habitat for wildlife. Species that can tolerate some wetness should be selected for new planting.

This soil is moderately well suited to building site development and poorly suited to septic tank absorption fields. Seasonal wetness and the hazard of pollution of underground water supplies are limitations. Subsurface drains are effective in reducing the wetness in most areas. Placing drains at the base of footings and coating the exterior walls help keep basements dry. Building sites should be landscaped for good surface drainage away from the foundations. Excavations are limited during winter and spring because of the high water table and sloughing of banks. Perimeter drains around septic tank absorption fields are effective in lowering the seasonal high water table.

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

EtA—Elliott silt loam, 0 to 3 percent slopes. This is a deep, nearly level, somewhat poorly drained soil on concave landforms between knolls or low swells. It is also in swales and depressions on end moraines. Most areas are 5 to 40 acres in size and are irregular in shape.

Typically, the surface layer is black, very friable silt loam about 11 inches thick. The subsoil is yellowish brown, mottled, firm and very firm silty clay loam about 24 inches thick. The underlying material to a depth of about 60 inches is yellowish brown, very firm silty clay loam glacial till. In some areas the subsoil is thicker. In many areas the subsoil has less clay. In some areas the surface layer is thinner or lighter in color.

Included with this soil in mapping are areas of the very poorly drained Milford soils in depressions. The included soils make up less than 15 percent of most areas.

Runoff is slow. The content of organic matter is high. A seasonal water table is perched in the upper part of the subsoil late in winter and in spring and during other extended wet periods. Permeability is slow. The available water capacity is high. The root zone is moderately deep to deep and is slightly acid to mildly alkaline.

This soil is used mainly as cropland. It has high potential for use as cropland. Corn, soybeans, and wheat are commonly grown in rotation. Some fields are occasionally used for hay.

This soil responds well to management that improves drainage, maintains balanced fertility, and reduces compaction during tillage. Subsurface drains are used to lower the water table. Deep-rooted perennial crops grown in rotation, for example, alfalfa, help improve soil structure, resulting in faster water movement to subsurface drains. Fall tillage is less likely to cause compaction than spring tillage because the subsoil is usually drier in the fall. Tillage that leaves a rough or ridged surface and partly covers the crop residue increases infiltration, reduces runoff, and hastens drying. In adequately drained areas this soil is suited to no-till planting.

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

This soil is moderately well suited to building site development and poorly suited to septic tank absorption fields. Seasonal wetness limits the use of this soil as a site for buildings. This limitation can be partially overcome by providing surface and subsurface drainage. Storm and foundation drains are needed, especially where basements are installed. Drains installed for agricultural production are generally inadequate for residential use. Perimeter drains are used around septic tank absorption fields to lower the seasonal high water table.

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

FcA—Fitchville silt loam, 0 to 2 percent slopes. This is a deep, nearly level, somewhat poorly drained soil on flats and on slight swells or rises. Most areas are 5 to 40 acres in size and are roughly circular or irregular in shape.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is dark brown and yellowish brown, mottled, firm and friable silt loam and silty clay loam about 36 inches thick. The underlying material to a depth of about 60 inches is yellowish brown and brown mottled, very firm and firm laminated silty clay loam. In some areas gravelly loam or sandy loam layers are in the lower part of the subsoil and in the underlying material. In a few areas the surface layer is darker colored fine sandy loam.

Included with this soil in mapping are areas of very poorly drained Colwood, Luray, and Milford soils in depressions and drainageways. The included soils make up less than 15 percent of most areas.

A seasonal high water table is in the upper part of the subsoil in winter and spring and during other extended wet periods. Permeability is moderately slow. The available water capacity is high. Runoff is slow. The content of organic matter is moderate. The surface layer crusts after hard rains, and infiltration is reduced. The root zone is deep. The subsoil is very strongly acid to medium acid in the upper part and medium acid to neutral in the lower part.

In most areas this soil is drained and is used as cropland. It has medium potential for use as cropland. Corn, soybeans, wheat, and hay are commonly grown in drained areas. Seasonal wetness is the main limitation. Wetness delays planting in undrained areas. Both surface and subsurface drains are used to improve drainage. Tillage that leaves a rough or ridged surface and crop residue partially covered increases infiltration and reduces surface crusting. In drained areas this soil is suited to no-till planting.

In a few areas this soil is in woodland consisting of second-growth stands of mixed native hardwoods. It is suited to use as woodland and as habitat for openland and woodland wildlife. Species selected for planting should be tolerant of some wetness. Plant competition can be reduced by spraying, mowing, or disking.

This soil is poorly suited to building site development and to use as septic tank absorption fields. Because of seasonal wetness, it is better suited to houses without basements than to houses with basements. Building sites should be landscaped for good surface drainage away from foundations. Drains installed for crop production usually need to be deepened and enlarged to handle excess water in residential areas. Increasing the size of absorption fields and using perimeter drains help increase the absorption of effluent in septic tank absorption fields.

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

FcB—Fitchville silt loam, 2 to 6 percent slopes. This is a deep, gently sloping, somewhat poorly drained soil on low ridges and the lower part of toe slopes near minor natural drainageways. Most areas are 5 to 40 acres in size and are irregular in shape.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is dark brown and yellowish brown, mottled, friable and firm silt loam and silty clay loam about 36 inches thick. The underlying material to a depth of about 60 inches is yellowish brown, mottled, very firm laminated silty clay loam. In some areas loam or gravelly sandy loam layers are below a depth of 4 feet. In a few areas the surface layer is black or very dark gray. In other areas the surface layer is fine sandy loam.

Included with this soil in mapping are small areas of Luray, Milford, Colwood, Lykens, and Glenford soils. The very poorly drained Luray, Milford, and Colwood soils are in depressions and natural drainageways; and the moderately well drained Lykens and Glenford soils are on the tops of some of the higher knolls. The included soils make up less than 15 percent of most areas.

A seasonal high water table is in the upper part of the subsoil in winter and spring and during other extended wet periods. Permeability is moderately slow. The available water capacity is high. Runoff is medium. The surface layer crusts after hard rains. The root zone is deep. The subsoil is very strongly acid to medium acid in the upper part and medium acid to neutral in the lower part.

In most areas this soil is drained and is used as cropland. It has medium potential for use as cropland. In drained areas this soil is commonly used for corn, soybeans, wheat, and hay. It responds well to practices that reduce erosion, lower the seasonal water table, increase infiltration, reduce soil compaction, and improve nutrient availability. Planting cover crops, including close-growing crops in the rotation, and using contour tillage help reduce erosion. Grassed waterways also help reduce erosion. Infiltration can be increased by returning crop residue to the soil. Tillage methods that only partially cover crop residue and leave a rough or ridged surface increase infiltration. Subsurface drains are effective in lowering the perched seasonal high water table. In drained areas this soil is suited to no-till planting.

In a few areas this soil is in woodland consisting mainly of second-growth stands of native mixed hardwoods. It is suited to use as woodland and as habitat for openland and woodland wildlife. Species selected for planting should be tolerant of some wetness. Plant competition can be reduced by spraying, mowing, or disking.

This soil is poorly suited to building site development and to use as septic tank absorption fields. Buildings should be located on the upper part of slopes. Because of seasonal wetness, this soil is better suited to houses without basements than to houses with basements. Installing drains at the base of footings and coating the exterior basement walls help prevent wet basements. To increase the absorption of effluent in septic tank absorption fields, it is necessary to increase the size of the field and to use perimeter drains.

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

FuA—Fulton silty clay loam, 0 to 2 percent slopes. This is a deep, nearly level, somewhat poorly drained soil on lake plains. It is on slightly elevated rises in areas of generally flat relief. Most areas are 5 to 320 acres in size and are lobed or irregular in shape.

Typically, the surface layer is grayish brown, friable silty clay loam about 8 inches thick. The subsoil is yellowish brown and dark brown, mottled, firm silty clay about 29 inches thick. The underlying material to a depth of about 60 inches is dark grayish brown, mottled, very firm silty clay lake sediment. In a few areas along drainageways and at the edge of lake basins slopes are 2 to 6 percent. In some areas the subsoil has silt loam or silty clay loam. In some places the entire soil formed in glacial till. In many areas the surface layer is darker.

Included with this soil in mapping are narrow strips of very poorly drained Latty and Paulding soils in drainageways and depressions. Also included are areas of moderately well drained soils on low slope breaks at the margin of lake plains. The included soils make up 10 to 25 percent of most areas.

Runoff is slow. The surface layer crusts after hard rains, resulting in reduced infiltration and retarded seedling emergence. The content of organic matter is moderate. Permeability is slow or very slow. A seasonal high water table is in the upper part of the subsoil in winter and spring and during other extended wet periods. The available water capacity is moderate. The root zone is mainly moderately deep. The subsoil is strongly acid to mildly alkaline in the upper part and slightly acid to mildly alkaline in the lower part. The shrink-swell potential is high.

In most areas this soil is used as cropland. It has medium potential for use as cropland. Corn, soybeans, and hay are commonly grown. Management concerns are the crusting of the surface layer, seasonal wetness, and slow or very slow permeability. Subsurface drains are used in most cultivated areas. However, movement of water into these drains is slow. Subsurface drains are generally closely spaced. Surface drains are used in some areas to remove excess surface water. Deep-rooted crops, for example, alfalfa, leave pathways that increase the movement of water into subsurface drains. This soil is subject to compaction, surface crusting, and hard clodding if tillage or harvesting is done when the soil is wet. Tillage that leaves a rough surface and that partly covers the crop residue reduces runoff, increases infiltration, and hastens drying. This soil is not well suited to no-till planting.

In undrained areas this soil is suited to use as woodland. In a few areas it is in mixed second-growth stands of native hardwoods. Species selected for planting should be tolerant of the high content of clay in the subsoil and some wetness.

The soil is poorly suited to building site development and to use as septic tank absorption fields. The high shrink-swell potential and seasonal wetness limit the use of this soil as a site for buildings. It is better suited to houses without basements than to houses with basements. Ditches and subsurface drains are used to improve drainage. However, good drainage outlets are not available in some areas. Building sites should be landscaped for good surface drainage away from foundations. Foundation and basement excavations should be backfilled with soil material that has a low shrink-swell potential or strongly reinforced with steel to reduce damage from the shrinking and swelling of the soil. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements.

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

Ge—Genesee silt loam, occasionally flooded. This is a deep, well drained, nearly level soil on flood plains of major streams. Active meandering of the streams has left channel scars, oxbows, and stranded channels that often interfere with cultivation of the soil. Brief flooding usually occurs late in fall, in winter, and early in spring. Flooding occasionally occurs during the growing season (fig. 2). Slope is 0 to 2 percent. Most areas are 11 to 80 acres in size and are crescent shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsurface layer is dark brown, firm silt loam about 3 inches thick. The substratum to a depth of about 60 inches is dark brown, friable silt loam and loam. In some areas the surface layer is sandy loam, loam, or fine sandy loam. In other areas the surface layer is darker. In many areas gravelly sandy loam is below a depth of about 3 feet. A few areas are rarely flooded.

Included with this soil in mapping are small areas of somewhat poorly drained Shoals and very poorly drained Sloan soils along old meander channels. Also included are Medway soils that have a darker surface layer and are in slightly higher positions. Where bedrock outcrops in streambanks, the soil has more stones, and bedrock is at a depth of 3 to 5 feet. The included soils make up 20 to 30 percent of most areas.

Runoff is slow. Permeability is moderate. The available water capacity is high. The root zone is deep and is neutral or mildly alkaline. The content of organic matter is moderate.

In most of the broader areas this soil is used as cropland. In the narrower valleys it is used for pasture or as woodland. This soil has high potential for crop production. Corn and soybeans are commonly grown. Winter grain crops are limited by the hazard of flooding. Natural drainage is generally adequate for farming. Small levees have been constructed in some areas to reduce flooding. Surface drains help remove floodwater in a few low-lying areas. Streambank erosion is a major source of sediment and the resulting water pollution. Stabilizing eroding streambanks is difficult in most places. However, clearing the channel of debris and planting willows on the streambanks are effective in some areas.

The surface layer is friable, and infiltration is good even when the surface is crusted. Weed control is a

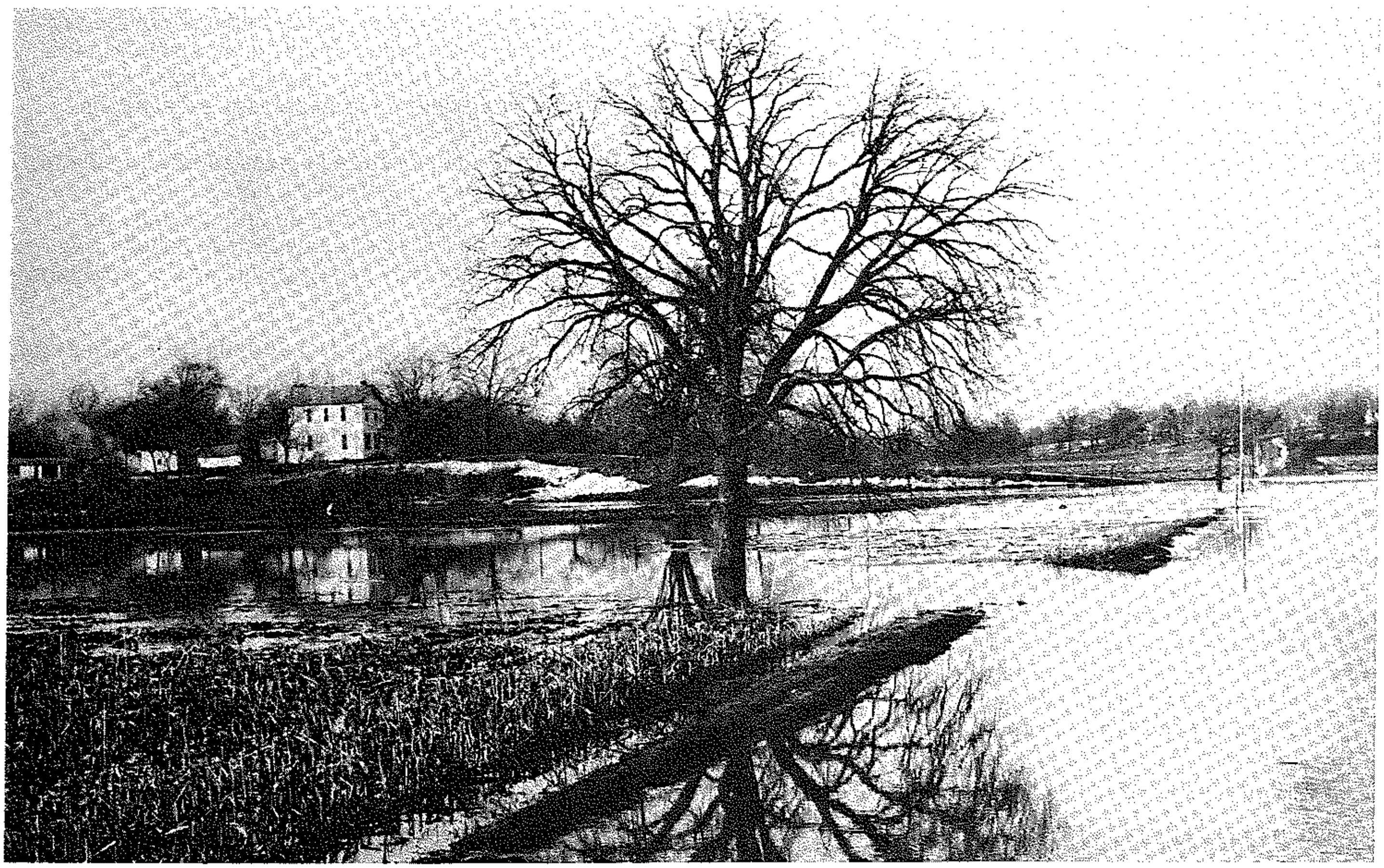

Figure 2.—Flooding on Genesee silt loam, occasionally flooded, along the Sandusky River. Morley and Belmore soils are on the slope breaks in the background.

problem on this soil because weed seeds are carried in by floodwater. Fall tillage that partially covers crop residue and leaves a rough surface helps reduce loss of the residue by floodwaters. Winter cover crops protect the soil from scouring. In some areas, grass-lined floodwater channels are needed to handle peak flow and reduce damage to cropland. Diversions at the base of slope breaks to the uplands or terraces help reduce flash flooding.

This soil is well suited to trees and to use as habitat for openland and woodland wildlife. Species selected for planting should be able to withstand flooding. Plant competition can be reduced by spraying, mowing, or disking.

This soil is generally not suited as a site for buildings and septic tank absorption fields. Construction for these purposes can partially block the natural floodway and increase the level of flooding upstream. This soil is well suited to some recreation uses and to open space.

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

GfB—Glenford silt loam, 2 to 6 percent slopes. This is a deep, moderately well drained, gently sloping soil on the margin of lake plains. Slopes are irregular and convex. The areas are 5 to 160 acres in size and are irregular in shape.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is yellowish brown and dark yellowish brown, friable and firm silty clay loam and silt loam about 31 inches thick. It is mottled below a depth of about 16 inches. The underlying material to a depth of about 60 inches is yellowish brown, firm laminated fine sandy loam and silt loam. In some areas the soil is eroded. In many areas well drained soils are on the crest of knolls. In a few areas glacial till is at a depth of 30 to 40 inches.

Included with this soil in mapping are small areas of Fitchville, Tiro, Luray, Shinrock, and Del Rey soils. The somewhat poorly drained Fitchville and Tiro soils are at the base of slopes and in less sloping areas; the very poorly drained Luray soils are along minor drainageways; the Shinrock and Del Rey soils are where silty materials are stratified with more clayey lake sediments. The included soils make up about 15 percent of most areas.

Runoff is medium. The surface layer crusts after hard rains, resulting in reduced infiltration and retarded seedling emergence. The content of organic matter is moderate. Permeability is moderately slow. The available water capacity is moderate or high. The root zone is deep. The subsoil is very strongly acid to medium acid in the upper part and medium acid to neutral in the lower part. A seasonal high water table is perched in the lower part of the subsoil in winter and spring and during other extended wet periods.

In most areas this soil is used as cropland. It has medium potential for crop production. Corn, soybeans, and wheat are grown in rotation. Some fields are occasionally returned to hay. Reducing erosion and surface crusting and maintaining fertility and the content of organic matter are the main management concerns. Tillage that partially covers crop residue, cover crops, small grain forage crops grown in rotation, contour tillage, and grassed waterways help reduce runoff and erosion. This soil is well suited to no-till planting. It is suited to deep-rooted perennials, for example, alfalfa. Random subsurface drains may be needed in areas of the included wetter soils.

This soil is well suited to use as woodland and as habitat for openland and woodland wildlife. Plant competition can be reduced by spraying, mowing, or disking.

This soil is moderately well suited to building site development and septic tank absorption fields. Because of seasonal wetness, it is better suited to houses without basements than to houses with basements. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. The moderately slow permeability limits the effectiveness of septic tank absorption fields. This limitation can be partially overcome by increasing the size of the absorption area.

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

GwB—Glynwood silt loam, 2 to 6 percent slopes. This is a deep, gently sloping, moderately well drained soil on low knolls and ridges on hummocky end moraines and on ground moraines. Most areas are 5 to 80 acres in size and are roughly circular or ribbon shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 27 inches thick. The upper part is dark brown, mottled, firm clay, and the lower part is yellowish brown, mottled, firm silty clay and silty clay loam. The underlying material to a depth of about 60 inches is brown, calcareous, very firm clay loam. In some areas the subsoil has a more variable texture and less clay. In a few areas the surface layer is eroded. In some areas the soil is well drained, and sand and gravel are at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Blount, Haney, Pewamo, and Pandora soils. The somewhat poorly drained Blount soils are on the lower part of slopes and in nearly level areas. The Haney soils are in some hummocky areas. The very poorly drained Pewamo soils and the poorly drained Pandora soils are along drainageways and in depressions. The included soils make up less than 20 percent of most areas.

Permeability is slow. The available water capacity is moderate. Runoff is medium. The content of organic matter is moderate. A seasonal high water table is perched in the lower part of the subsoil in winter and spring and during other extended wet periods. The root zone is mainly moderately deep to compact glacial till. The subsoil is very strongly acid to medium acid in the upper part and slightly acid to mildly alkaline in the lower part.

In most areas this soil is used as cropland. It has high potential for use as cropland. Corn, soybeans, small grains, and hay are commonly grown. Natural drainage of this soil is generally adequate for crop production. Controlling erosion, reducing compaction, and adding plant nutrients are the main concerns in management. No-till, minimum tillage, or tillage that leaves a rough surface partially covered by plant residue increases infiltration and reduces soil loss by erosion. Including close growing crops in the cropping system also reduces erosion.

This soil is suited to use as woodland. In a few areas it is in native mixed hardwoods. Plant competition can be reduced by spraying, mowing, or disking. Species selected for planting should be tolerant of the clay in the subsoil.

The soil is suited to building site development and poorly suited to septic tank absorption fields. Many desirable homesites with gently sloping terrain and nearby streams are on this soil. Erosion is a hazard during construction. Stockpiling and later spreading the surface soil during final grading hasten reestablishment of plant cover. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Foundation walls need to be strengthened with additional reinforcing or backfilled with material that has a lower shrink-swell potential. The slow permeability of the subsoil and substratum limits the use of this soil for septic tank absorption fields. This limitation can be partially overcome by increasing the size of the absorption area.

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

GwB2—Glynwood silt loam, 2 to 6 percent slopes, eroded. This is a deep, gently sloping, moderately well drained soil at the head of intermittent drainageways where water accumulates as concentrated runoff. It is also on convex ridges and knolls in hummocky areas. Erosion has removed part of the original surface layer. The present surface layer contains subsoil material that has more clay than the original surface layer. Slopes are generally short and interspersed with slight swales. Most areas are 5 to 40 acres in size and are ribbon or roughly funnel shaped.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is dark brown and yellowish brown, mottled, firm silty clay, clay, and silty clay loam about 27 inches thick. The underlying material to a depth of about 60 inches is brown, calcareous, very firm clay loam. In some areas the subsoil has more variable texture and less clay. In a few areas the surface layer is loam, sandy loam, or silty clay loam. In some areas the soil is severely eroded, and the solum is thinner.

Included with this soil in mapping are small areas of Tuscola, Belmore, Pewamo, Pandora, Blount, and Shoals soils. The Tuscola and Belmore soils formed in stratified sediment and glacial outwash near beach ridges. The very poorly drained Pewamo soils and the poorly drained Pandora soils are along drainageways and in depressions at the base of slopes. The somewhat poorly drained Blount soils are on the longer slopes and at the base of some slopes. The somewhat poorly drained Shoals soils are along waterways. The included soils make up less than 15 percent of most areas.

Runoff is medium. The silt loam surface layer crusts after hard rains. The content of organic matter is moderately low. Permeability is slow. A seasonal high water table is perched in the lower part of the subsoil during wet seasons. The root zone is mainly moderately deep to compact glacial till. The available water capacity is moderate. The subsoil is very strongly acid to medium acid in the upper part and slightly acid to mildly alkaline in the lower part.

In most areas this soil is used as cropland. It has medium potential for use as cropland. Controlling erosion, reducing compaction, and improving fertility are the main concerns of management. The high content of clay in the surface layer makes the soil difficult to manage. Erosion has decreased the depth to the perched seasonal high water table and the thickness of the root zone. No-till, minimum tillage, or tillage that leaves a rough surface partially covered with plant residue increases infiltration and reduces erosion (fig. 3). Grassed waterways help prevent erosion where runoff water collects in concentrated flow. Including close growing crops in the cropping system helps reduce erosion.

This soil is suited to use as woodland. In a few areas it is used for this purpose. Species selected for planting should be tolerant of the high content of clay in the subsoil. Where new tree plantings are made, plant competition from grasses and shrubs can be reduced by spraying, mowing, or disking.

This soil is suited to building site development and poorly suited to use as septic tank absorption fields. This soil has many desirable homesites that are on rolling terrain and have streams nearby. Erosion is a hazard during construction. Stockpiling and later spreading the surface soil during final grading help hasten reestablishment of cover after construction. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. The slow permeability of the subsoil and substratum is a limitation to the use of this soil for septic tank absorption fields. This limitation can be partially overcome by increasing the size of the absorption area.

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

GwC2—Glynwood silt loam, 6 to 12 percent slopes, eroded. This is a deep, sloping, moderately well drained soil on fairly short slopes along small streams where it receives runoff from adjacent soils. It is also on convex slopes in the hummocky areas of end moraines. In those areas it receives very little runoff from other soils. Erosion has removed part of the original surface layer (fig. 4). The present surface layer consists in part of subsoil material. It has more clay than the original surface layer. Most areas are 5 to 40 acres in size and are ribbon shaped.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is dark brown and yellowish brown, mottled, firm clay, silty clay, and silty clay loam. The underlying material to a depth of about 60 inches is brown, calcareous, very firm clay loam. In some severely eroded areas the surface layer is silty clay loam, and the subsoil is thinner. In a few areas on knolls and ridges on moraines, the subsoil is loam or silt loam, and the underlying material is silt loam.

Included with this soil in mapping are small areas of Blount, Tuscola, Belmore, Haney, Pewamo, and Pandora soils. The somewhat poorly drained Blount soils are on the long slopes and at the base of slopes. The Tuscola, Belmore, and Haney soils formed in stratified sediment and glacial outwash and are near beach ridges and on terraces. The very poorly drained Pewamo soils and the poorly drained Pandora soils are along drainageways and in depressions. Also included are areas at the base of slopes along waterways where 10 to 24 inches of alluvial sediment is on the surface. The included soils make up less than 15 percent of most areas.

Permeability is slow. The available water capacity is moderate. Runoff is rapid. The content of organic matter is moderately low. A seasonal high water table is in the lower part of the subsoil in winter and spring and during the extended wet periods. The root zone is mainly moderately deep to compact glacial till. The subsoil is very strongly acid to medium acid in the upper part and slightly acid to mildly alkaline in the lower part.

Figure 3.—Glynwood silt loam, 2 to 6 percent slopes, eroded, is well suited to no-till planting. Crop residue on the surface reduces runoff and erosion.

In most areas this soil is used as cropland. Corn, small grains, soybeans, and hay are commonly grown. Natural drainage is generally adequate for crop production, except for the small included areas of wetter soils. Controlling erosion, conserving moisture, and improving fertility are major management concerns. Although the available water capacity is moderate, shallow-rooted plants show moisture stress during extended dry periods because of water loss through runoff. The high content of clay in the surface layer makes the soil difficult to manage. No-till planting and grassed waterways are good management practices. Including small grain and forage crops in the rotation helps reduce soil loss by erosion.

This soil is suited to trees and to use as habitat for openland and woodland wildlife. In a few areas it is in native stands of mixed hardwoods. Trees selected for planting should be tolerant of a high content of clay in the subsoil.

This soil is suited to building site development. However, it is poorly suited to use as septic tank absorption fields. The rolling terrain and the streams make many areas of this soil desirable as homesites. Building sites should be out of the line of runoff from adjacent soils. Cover should be maintained on the site as much as possible during construction to reduce soil loss by erosion. Placing drains at the base of footings and coating the exterior basement walls help prevent wet basements. The distribution lines in septic tank absorption fields should be on the contour to reduce seepage of effluent to the soil surface.

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

HaA—Haney loam, 0 to 2 percent slopes. This is a deep, moderately well drained, nearly level soil on shorelines of former glacial lakes and on outwash plains and terraces. It is on flat plains, slight rises, and knolls.

Figure 4.—Sheet and rill erosion on Glynwood silt loam, 6 to 12 percent slopes, eroded. The field was used for soybeans that were planted up and down the slope.

Most areas are 2 to 20 acres in size and are long and narrow in shape.

Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is dark brown and yellowish brown, mottled, firm loam, clay loam, and gravelly clay loam about 26 inches thick. The underlying material to a depth of about 60 inches is dark grayish brown, loose, gravelly sandy loam. In some areas the soil is well drained. In other areas it is not gravelly. In a few areas the surface layer is darker, or it is gravelly loam.

Included with this soil in mapping are small areas of Digby, Haskins, Millgrove, and Colwood soils. The somewhat poorly drained Digby and Haskins soils are on flats. The very poorly drained Millgrove and Colwood soils are in wet spots and along drainageways. In many of the included areas glacial till is at a depth of 3 to 5 feet. The till reduces the internal movement of water. The included soils make up 10 to 15 percent of most areas.

Runoff is slow. The surface layer crusts after hard rains. However, the crusting does not significantly reduce infiltration. The content of organic matter is moderate. Permeability is moderate in the subsoil and rapid in the underlying material. A seasonal high water table is at a depth of 24 to 42 inches in winter and spring and during other extended wet periods. The available water capacity is moderate. Plants show moisture stress during extended dry periods. The root zone is deep. The subsoil is strongly acid to slightly acid in the upper part and slightly acid to mildly alkaline in the lower part.

In most areas this soil is used as cropland. It has medium potential for crop production. Corn, soybeans, wheat, oats, hay, and pasture are commonly grown. The surface layer can be worked within a fairly wide range of moisture content. This soil is well suited to irrigation and no-till planting. Using minimum tillage and planting cover crops increase infiltration and reduce erosion.

This soil is well suited to trees. In a few areas it is in native mixed hardwoods. Most of the woodland is second growth. Plant competition can be reduced by spraying, cutting, girdling, or mowing.

This soil is suited to building site development and septic tank absorption fields. Because of seasonal wetness and the apparent water table, this soil is better suited to houses without basements than to houses with basements. Building sites should be landscaped for good surface drainage away from foundations. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Sloughing is a hazard in excavations. Seepage from sewage lagoons, sanitary landfills, and septic absorption fields can contaminate underground water supplies.

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

HaB—Haney loam, 2 to 6 percent slopes. This is a deep, moderately well drained, gently sloping soil on shorelines of former glacial lakes and on outwash plains and stream terraces. Most areas are 2 to 20 acres in size and are lense shaped or long and narrow.

Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is dark brown and yellowish brown, mottled, firm loam, clay loam, and gravelly clay loam about 26 inches thick. The underlying material to a depth of about 60 inches is dark grayish brown, loose, gravelly sandy loam. In some areas glacial till is at a depth of 3 to 5 feet. In many areas the surface layer is darker. In other areas the surface layer is gravelly loam. In some areas on stream terraces the soil is well drained.

Included with this soil in mapping are a few small areas of Digby, Haskins, Colwood, and Millgrove soils. The somewhat poorly drained Digby and Haskins soils are in low spots. The very poorly drained Colwood and Millgrove soils are along drainageways. The included soils make up less than 10 percent of most areas.

Permeability is moderate in the subsoil and rapid in the underlying material. Runoff is medium. The available water capacity is moderate. A seasonal high water table is at a depth of 24 to 42 inches in winter and spring and during other extended wet periods. The root zone is deep. The subsoil is strongly acid to slightly acid in the upper part and slightly acid to mildly alkaline in the lower part.

In most areas this soil is used as cropland. It has medium potential for use as cropland. Corn, soybeans, small grains, and hay are commonly grown. The surface layer can be worked within a fairly wide range of moisture content. Natural drainage is generally adequate for crop production. However, randomly spaced subsurface drains may be needed in areas of the included wetter soils. Using minimum tillage and planting cover crops increase infiltration and reduce erosion. This soil receives surface water from adjacent soils. Grassed waterways help prevent gully erosion where runoff water collects in a concentrated flow. Including small grain and forage crops in the rotation reduces erosion. This soil is suited to no-till planting.

This soil is well suited to trees. Plant competition can be reduced by spraying, mowing, disking, or girdling.

This soil is suited as a site for buildings and septic tank absorption fields. Because of seasonal wetness and the apparent water table, this soil is better suited to houses without basements than to houses with basements. Buildings should be located on the upper part of slopes for better natural drainage. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Sloughing is a hazard in excavations. Seepage from sewage lagoons, sanitary landfills, and septic tank absorption fields can contaminate underground water supplies. Cover should be maintained on the site as much as possible during construction to reduce runoff and soil loss by erosion.

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

HkA—Haskins loam, 0 to 2 percent slopes. This is a deep, nearly level, somewhat poorly drained soil on benches and ridges, beach ridges, glacial meltwater terraces, and outwash plains. Most areas are 5 to 40 acres in size and are long and narrow in shape.

Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is about 22 inches thick. The upper and middle parts are grayish brown and dark brown, mottled firm loam and gravelly clay loam; and the lower part is yellowish brown, mottled, firm clay loam. The underlying material to a depth of about 60 inches is yellowish brown, mottled, very firm clay loam glacial till. In some areas the surface layer is darker. In a few areas the soil is moderately well drained.

Included with the soil in mapping are small areas of Mermill, Belmore, Digby, Haney, Blount, Del Rey, Fulton, Lykens, and Tuscola soils. The Mermill soils are in slight depressions. The Belmore, Digby, and Haney soils are where the underlying material is glacial outwash. Blount, Del Rey, Fulton, Lykens, and Tuscola soils are near the edges of till plains and lake plains. The included soils make up 10 to 30 percent of most areas.

Runoff is slow. The upper part of the subsoil is saturated during the dormant season and after prolonged rainy periods. The content of organic matter is moderate. Permeability is moderate in the upper and middle parts of the subsoil and slow in the lower part and in the underlying material. The root zone is moderately deep to deep. The available water capacity is moderate and is generally adequate for the crops commonly grown. The root zone is strongly acid to mildly alkaline. The more acid layers are commonly in the upper part of the subsoil.

In most areas this soil is used for crops. It has medium potential for use as cropland. Soybeans, corn, and wheat are commonly grown in rotation. Some fields are occasionally used for hay. Seasonal wetness is the major limitation. In some years it delays planting. Subsurface drainage is effective in lowering the seasonal water table. In some areas surface drains are needed to remove excess surface water. Fall tillage is less likely to cause compaction of subsoil layers than spring tillage because the subsoil is usually drier in the fall. Tillage that partially covers crop residue and leaves a rough or ridged surface reduces runoff and hastens drying in spring. In adequately drained areas this soil is suited to no-till planting.

This soil is suited to trees. In a few areas it is in woodland. Species selected for planting should be tolerant of some wetness. Plant competition can be reduced by spraying, mowing, or disking.

The soil is moderately well suited to building site development and poorly suited to use as septic tank absorption fields. Seasonal wetness seriously limits the use of this soil as a site for buildings. However, this limitation can be partially overcome by providing surface and subsurface drainage. Agricultural drainage outlets are generally not adequate in size or depth to handle excess water from residential areas. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Using perimeter drains and expanding the size of the absorption field improve the absorption of effluent in septic tank absorption fields.

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

HkB—Haskins loam, 2 to 6 percent slopes. This is a deep, gently sloping, somewhat poorly drained soil on benches and ridges, beach ridges, glacial meltwater terraces, and outwash plains. Most areas are 2 to 20 acres in size and are crescent or oblong shaped.

Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is about 22 inches thick. The upper and middle parts are grayish brown and dark brown, mottled, firm loam and gravelly clay loam; and the lower part is yellowish brown, mottled, firm clay loam. The underlying material to a depth of about 60 inches is yellowish brown, very firm clay loam glacial till. In some small areas the surface layer is darker. In a few areas the soil is moderately well drained.

Included with this soil in mapping are small areas of Belmore, Haney, Del Rey, Fulton, Lykens, and Tuscola soils. The Belmore and Haney soils are in areas where the underlying material is glacial outwash. The Del Rey, Fulton, Lykens, and Tuscola soils are on small knobs and ridges near the edges of till plains and lake plains. The included soils make up 10 to 30 percent of most areas.

Runoff is medium. The content of organic matter is moderate. Permeability is moderate in the upper and middle parts of the subsoil and slow in the lower part of the subsoil and in the underlying material. The available water capacity is moderate. The root zone is moderately deep to deep. It is strongly acid to mildly alkaline. The more acid layers are commonly in the upper part of the subsoil. A seasonal water table is in the upper part of the subsoil in the dormant season and after prolonged rainy periods.

In most areas this soil is used as cropland. It has medium potential for use as cropland. Soybeans, corn, and wheat are commonly grown in rotation. Some fields are occasionally used for hay. Lowering the seasonal water table, reducing runoff, erosion, and soil compaction, and providing balanced fertility are concerns of management. Subsurface drains are effective in lowering the seasonal water table. Minimum tillage, cover crops, and contour tillage can be used to reduce sheet and rill erosion. Grassed waterways should be used to reduce gully erosion. Tillage that leaves a rough or ridged surface and crop residue partially covered reduces runoff and hastens drying in spring. In adequately drained areas this soil is suited to no-till planting.

This soil is suited to trees. In a few areas it is used as woodland. Species selected for planting should be tolerant of some wetness. Plant competition can be reduced by spraying, mowing, or disking.

This soil is moderately well suited to building site development. It is poorly suited to use as septic tank absorption fields. Seasonal wetness seriously limits the use of this soil as a site for buildings. However, this limitation can be partially overcome by providing subsurface drainage. Building sites should be located on the higher parts of ridges. Agricultural drainage outlets are generally not adequate in size or depth to handle excess water from residential areas. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Using perimeter drains and expanding the size of the absorption field improve the absorption of effluent in septic tank absorption fields.

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

KbA—Kibbie fine sandy loam, till substratum, 0 to 2 percent slopes. This is a deep, somewhat poorly drained, nearly level soil on the margins of large former glacial lake basins or in areas of former shallow glacial lakes. Most areas are 5 to 40 acres in size and roughly circular or oval in shape.

Typically, the surface layer is very dark grayish brown, friable fine sandy loam about 9 inches thick. The subsoil is yellowish brown, mottled, friable sandy clay loam and loam and firm silty clay loam about 24 inches thick. The underlying material to a depth of about 60 inches is stratified yellowish brown, mottled, firm silty clay loam and sandy loam over yellowish brown, mottled, very firm silty clay loam glacial till. In some areas the surface layer is silt loam, loam, sandy loam, or loamy fine sand. Where this soil is on lake plains, it is generally underlain at a depth of 4 to 6 feet by lake sediment that is finer than the typical underlying material. In many areas the surface layer is lighter in color.

Included with this soil in mapping are small areas of Colwood, Luray, Bennington, Blount, Del Rey, Lykens, Cardington, Glynwood, and Tuscola soils. The very poorly drained Colwood and Luray soils are in depressions and drainageways. The somewhat poorly drained Bennington, Blount, and Del Rey soils are intermingled with this Kibbie soil in some areas. The moderately well drained Lykens, Cardington, Glynwood, and Tuscola soils are on knolls. The included soils make up less than 15 percent of most areas.

The content of organic matter is moderate. Permeability is moderate in the subsoil and moderately slow or slow in the underlying material. The available water capacity is high. The root zone is mainly deep. The subsoil is medium acid to neutral. A seasonal high water table is in the upper part of the subsoil in winter and spring and during other prolonged rainy periods.

In most areas this soil is artificially drained and is used as cropland. It has medium potential for use as cropland. Corn, soybeans, wheat, and grass-legume hay are commonly grown. Wetness is the main limitation. Both surface and subsurface drains are used to remove excess water. This soil is easy to till. Minimizing tillage and planting deep-rooted cover crops help to improve drainage. Incorporating crop residue or other organic matter into the surface layer increases the rate of water infiltration and improves tilth and fertility. In adequately drained areas this soil is suited to no-till planting.

In a few areas this soil is in woodland. Most of the woodland is second-growth stands of mixed native hardwoods. Species selected for planting should be tolerant of some wetness.

This soil is moderately well suited to building site development and to use as septic tank absorption fields. This soil is better suited to houses without basements than to houses with basements. Building sites should be landscaped for good surface drainage away from foundations. In most areas artificial drains are effective in reducing wetness. Drains at the base of footings and coatings on exterior basement walls help keep basements dry. Perimeter drains are needed around septic tank absorption fields to lower the seasonal high water table. Sloughing is a hazard in excavations.

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

KbB—Kibbie fine sandy loam, till substratum, 2 to 6 percent slopes. This is a deep, gently sloping, somewhat poorly drained soil near the margins of former glacial lakes. Most areas are 5 to 40 acres in size and are roughly circular or oval in shape.

Typically, the surface layer is very dark grayish brown, friable fine sandy loam about 9 inches thick. The subsoil is yellowish brown, mottled, friable sandy clay loam and loam and firm silty clay loam about 24 inches thick. The underlying material to a depth of about 60 inches is yellowish brown, mottled, stratified, very firm silty clay loam and sandy loam over yellowish brown, mottled very firm silty clay loam glacial till. In some areas the surface layer is silt loam, loam, sandy loam, or loamy fine sand. In a few areas this soil is subject to occasional flooding. In a few areas the subsoil and underlying material have less clay. In other areas the subsoil has some gravel.

Included with this soil in mapping are small areas of Haney, Belmore, Glynwood, Martinsville, Lykens, and Tuscola soils on knolls. Also included are small areas of somewhat poorly drained Del Rey and Blount soils in positions similar to those of this Kibbie soil. The included soils make up about 15 percent of most areas.

Runoff is slow. The content of organic matter is moderate. Permeability is moderate in the subsoil and moderately slow or slow in the underlying material. The root zone is mainly deep. The subsoil is medium acid to neutral. The available water capacity is high. A seasonal high water table is in the upper part of the subsoil in winter and spring and during other prolonged rainy periods.

In most areas this soil is artificially drained and is used as cropland. It has medium potential for crops. Corn, soybeans, and wheat are commonly grown. Controlling erosion and reducing wetness are the main concerns of management. Both surface and subsurface drains are used to remove excess water. This soil has good infiltration even when the surface crusts. However, it erodes very easily. It is easy to till. Erosion can be reduced by planting winter cover crops and using no-till, contour tillage, or grassed waterways. Incorporating crop residue or other organic matter into the surface layer increases the rate of water infiltration and improves tilth and fertility. In adequately drained areas this soil is suited to no-till planting.

In a few areas this soil is used as woodland. Most of the woodland is second-growth stands of mixed hardwoods. Species selected for planting should be tolerant of some wetness. Plant competition can be reduced by spraying, mowing, disking, or girdling.

This soil is moderately well suited for building site development and to use as septic tank absorption fields. Because of seasonal wetness, this soil is better suited to houses without basements than to houses with basements. Artificial drains are effective in reducing wetness and improving soil strength. Perimeter drains are needed around septic tank absorption fields to lower the seasonal high water table. Drains are needed at the base of footings, and coatings are needed on exterior basement walls to help keep basements dry. Sloughing is a hazard in excavations.

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

KcA—Kibbie-Blount complex, 0 to 2 percent slopes. This complex consists of deep, nearly level, somewhat poorly drained Kibbie and Blount soils on very low ridges and knolls on lake plains and moraines. The areas of the individual soils are so intricately mixed or are so small that mapping them separately was not practical. The mapped areas of this complex consist of about 40 percent Kibbie fine sandy loam and 35 percent Blount silt loam. The areas vary considerably in size, but most are 5 to 40 acres in size and are irregular in shape.

Typically, the surface layer of the Kibbie soil is very dark grayish brown, friable fine sandy loam about 9 inches deep. The subsoil is yellowish brown, mottled, friable sandy clay loam and loam and firm silty clay loam about 24 inches thick. The underlying material to a depth of about 60 inches is stratified yellowish brown, mottled, firm silty clay loam and sandy loam over yellowish brown, mottled, very firm silty clay loam glacial till. In many areas the surface layer is lighter in color and has less organic matter than is typical, and in some areas it is loam or silt loam. In some areas the underlying material is stratified silty clay loam and silt loam sediment.

Typically, the Blount soil has a surface layer of dark grayish brown, friable silt loam about 9 inches thick. The subsoil is multicolored, firm silty clay loam and silty clay about 25 inches thick. The underlying material to a depth of about 60 inches is dark grayish brown, mottled, very firm silty clay loam glacial till. In many areas the surface layer and upper part of the subsoil are loam, sandy loam, or fine sandy loam. The surface layer in these areas is less susceptible to crusting.

Included with these soils in mapping are small areas of Pewamo, Milford, Colwood, Pandora, Glynwood, and Tuscola soils. The very poorly drained Pewamo, Milford, and Colwood soils and the poorly drained Pandora soils are in drainageways and slight depressions. The Glynwood and Tuscola soils are on knolls and on slope breaks along drainageways. The included soils make up about 25 percent of most areas.

Permeability is moderate in the subsoil of the Kibbie soil and moderately slow or slow in the underlying material. Permeability is slow or moderately slow in the Blount soil. In both soils, the high water table is in the upper part of the subsoil in winter and spring and during other extended wet periods. The content of organic matter of both soils is moderate. The root zone is mainly deep in the Kibbie soil and moderately deep in the Blount soil. The available water capacity is high in the Kibbie soil and moderate in the Blount soil. The subsoil is medium acid to neutral in the Kibbie soil. The subsoil of the Blount soil is medium acid to very strongly acid in the upper part and slightly acid to mildly alkaline in the lower part.

In most areas these soils are used as cropland. They have medium potential for crops. Corn and soybeans are commonly grown. Both surface and subsurface drains are used to remove excess water. The Kibbie soil is easier to till and is not so susceptible to surface crusting as the Blount soil. Leaving the surface rough or ridged and returning crop residue to the soil reduce crusting. In adequately drained areas these soils are suited to no-till planting.

These soils are suited to use as woodland and as habitat for openland and woodland wildlife. In a few areas they are in woodland. Most of the woodland is second-growth stands of mixed native hardwoods. Species selected for planting should be tolerant of some wetness and of the high content of clay in the subsoil of the Blount soil.

These soils are moderately well suited to building site development and moderately well suited to poorly suited to use as septic tank absorption fields. Because of the seasonal wetness, these soils are better suited to houses without basements than to houses with basements. Artificial drains are effective in reducing the wetness in most areas. Building sites should be landscaped for good surface drainage away from foundations. Drains at the base of footings and coatings on exterior basement walls help keep basements dry. Perimeter drains around septic tank absorption fields help lower the perched seasonal high water table. On the Kibbie soil, sloughing is a hazard in excavations.

These soils are in capability subclass IIw. The Kibbie soil is in woodland suitability subclass 2o, and the Blount soil is in subclass 3c.

KcB—Kibbie-Blount complex, 2 to 6 percent slopes. This complex consists of deep, gently sloping, somewhat poorly drained Kibbie and Blount soils on ridges and knolls on lake plains and ground moraines. The areas of the individual soils are so intricately mixed or so small that mapping them separately was not practical. The mapped areas of this complex consist of about 40 percent Kibbie fine sandy loam and 35 percent Blount silt loam. Most areas are 5 to 640 acres in size and are irregular in shape.

Typically, the surface layer of the Kibbie soil is dark grayish brown, friable fine sandy loam about 9 inches thick. The subsoil is yellowish brown, mottled, friable sandy clay loam and loam and firm silty clay loam about 24 inches thick. The underlying material to a depth of about 60 inches is stratified yellowish brown, mottled, firm silty clay loam and sandy loam over yellowish brown, mottled, very firm silty clay loam glacial till. In some areas the underlying material is stratified silty clay loam and silt loam sediment.

Typically, the surface layer of the Blount soil is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is multicolored, firm silty clay loam and silty clay about 25 inches thick. The underlying material to a depth of about 60 inches is dark grayish brown, mottled, firm silty clay loam glacial till. In many areas the surface layer and upper part of the subsoil are loam, sandy loam, or fine sandy loam. The surface layer in these areas is less susceptible to crusting. In some areas the subsoil is thicker than is typical, and in a few areas it has less clay.

Included with these soils in mapping are narrow strips of very poorly drained Pewamo, Milford, and Colwood soils and poorly drained Pandora soils in drainageways and slight depressions. Also included are small areas of the moderately well drained Glynwood and Tuscola soils on the crest of knolls and on slope breaks along drainageways. The included soils make up about 25 percent of most areas.

Permeability is moderate in the subsoil of the Kibbie soil and moderately slow or slow in the underlying material. Permeability is slow or moderately slow in the Blount soil. In both soils, the high water table is in the upper part of the subsoil in winter and spring and during other extended wet periods. The content of organic matter of both soils is moderate. The root zone is mainly deep in the Kibbie soil and moderately deep to compact glacial till in the Blount soil. The available water capacity is high in the Kibbie soil and moderate in the Blount soil. The subsoil is medium acid to neutral in the Kibbie soil. The subsoil of the Blount soil is medium acid to very strongly acid in the upper part and slightly acid to mildly alkaline in the lower part.

In most areas these soils are artificially drained and are used as cropland. They have medium potential for crops. Soybeans, corn, wheat, and grass-legume hay are commonly grown. These soils respond well to management that reduces surface runoff and erosion, lowers the seasonal water table, increases infiltration, prevents soil compaction, and improves nutrient availability. Both surface and subsurface drains are used to remove excess water. The Kibbie soil is easier to till and is not so susceptible to surface crusting as the Blount soil. Leaving the surface rough or ridged and returning crop residue to the soil reduce crusting and reduce soil loss by erosion. Planting winter cover crops and using no-till, contour tillage, and grassed waterways reduce erosion. In adequately drained areas these soils are suited to no-till planting.

These soils are suited to use as woodland and as habitat for openland and woodland wildlife. In a few areas they are used as woodland. The trees are mainly second-growth mixed native hardwoods. Species selected for planting should be tolerant of some wetness and of the high content of clay in the Blount soil.

These soils are moderately well suited to use as a site for buildings and septic tank absorption fields. Because of seasonal wetness, they are better suited to houses without basements than to houses with basements. Artificial drains are effective in reducing wetness and improving soil strength. Buildings should be located on the higher part of the landscape for good surface drainage. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Perimeter drains are needed around septic tank absorption fields to lower the seasonal high water table. These fields can also be improved by increasing the size of the absorption area. On the Kibbie soil, sloughing is a hazard in excavations.

These soils are in capability subclass IIe. The Kibbie soil is in woodland suitability subclass 2o, and the Blount soil is in subclass 3c.

Lb—Latty silty clay loam. This is a deep, nearly level, very poorly drained soil on broad flats on lake-modified glacial till plains. It receives runoff from adjacent soils and is subject to ponding. Slope is 0 to 2 percent. Most areas are 20 to 320 acres in size and irregular in shape.

Typically, the surface layer is dark grayish brown, firm silty clay loam about 9 inches thick. The subsoil is dark gray, grayish brown, and dark grayish brown mottled, firm silty clay about 41 inches thick. The underlying material to a depth of about 60 inches is brown, mottled, very firm silty clay loam glacial till. In a few areas the subsoil has less clay. In other areas the surface layer is silty clay. In a few areas the underlying material has lacustrine sediment.

Included with this soil in mapping are small areas of Bono, Milford, Blount, Fulton, Nappanee, Del Rey, and Kibbie soils. The very poorly drained Bono and Milford soils have a darker surface layer. The somewhat poorly drained Blount, Fulton, Nappanee, Del Rey, and Kibbie soils are on slight rises and low ridges and knolls. The included soils make up 5 to 15 percent of most areas.

Runoff is very slow or ponded. The content of organic matter is moderate. Permeability is very slow. The available water capacity is moderate. A seasonal high water table is near or above the surface in winter and spring and during prolonged rainy periods. The root zone is deep. The subsoil is medium acid to mildly alkaline. The shrink-swell potential is high.

This soil is used mainly as cropland. It has medium potential for use as cropland. In drained areas this soil is suited to corn, soybeans, wheat, and hay. Very poor drainage and very slow permeability are the main limitations to crop production. Surface and subsurface drains are used to remove excess water. Subsurface drains must be closely spaced for uniform drainage because the movement of water into these drains is slow. Tillage that leaves a rough or ridged surface and crop residue partially covered increases infiltration, reduces runoff, and hastens drying. Deep-rooted forage crops improve soil structure and leave pathways for water movement to surface drains. Tillage and harvesting should be done at the optimum moisture content to minimize soil compaction and clodding.

In a few areas this soil is in woodland. Most of the woodland is second-growth stands of swamp forest. Wetness and competition from grasses and shrubs reduce seedling survival in new plantings. Species that can tolerate wetness should be selected for planting. Plant competition can be reduced by spraying, mowing, or disking.

This soil is generally not suited to building site development or to use as septic tank absorption fields.

Ponding, very slow permeability, and the high shrink-swell potential are severe limitations.

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

Lc—Latty silty clay. This is a deep, nearly level, very poorly drained soil in slight depressions on glacial lake plains. It receives runoff from the adjacent soils and is subject to ponding. Slope is 0 to 2 percent. Most areas are 40 to 640 acres in size and are irregular in shape.

Typically, the surface layer is dark grayish brown, firm silty clay about 8 inches thick. The subsoil is dark gray and grayish brown, mottled, firm clay about 50 inches thick. The underlying material to a depth of about 60 inches is gray, mottled, firm clay. In some areas the surface layer is darker colored.

Included with this soil in mapping are spots of Bono and Milford soils in local depressions. Small areas of the somewhat poorly drained Fulton and Nappanee soils on low knolls are also included. The included soils make up 10 to 25 percent of most areas.

Permeability and runoff are very slow. The available water capacity is moderate. This soil is subject to ponding. A water table is near or above the surface in winter and spring and during other extended wet periods. The high content of clay causes the surface layer to be plastic when wet and hard when dry. The surface layer crusts after rains, reducing infiltration and restricting seedling emergence. The content of organic matter is moderate. The root zone is deep. The subsoil ranges from medium acid to mildly alkaline. The shrink-swell potential is high.

In most areas this soil is cultivated. It has medium potential for use as cropland. The main crops are soybeans, corn, and wheat. In most areas of cropland the soil has been drained. Surface and subsurface drains effectively remove excess water if adequate outlets are provided. Subsurface drains must be closely spaced for uniform drainage because movement of water into these drains is slow. Fall tillage that leaves a rough or ridged surface and partly covers the crop residue allows the soil to dry quicker in the spring. On this soil, a heavy surface mulch, like that left with no tillage, slows soil drying and warming and reduces crop yields. Ridge tillage is used in some areas. This soil is subject to compaction and hard clodding if tillage or harvesting is done when the soil is wet. Tillage and harvesting should be done when the soil is at optimum moisture content. Including forage crops in a crop rotation helps maintain soil structure.

Most areas of woodland consist of second-growth stands of native hardwoods. Species selected for planting should be tolerant of wetness. Logging and planting can be done during the drier part of the year. This soil is well suited to use as habitat for wetland wildlife.

This soil is generally not suited to building site development or to use as septic tank absorption fields. Ponding, the high shrink-swell potential, and very slow permeability are severe limitations for these uses.

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

Lk—Lindside silt loam, occasionally flooded. This is a deep, moderately well drained, nearly level soil on flood plains. It is on the higher parts of flood plains in broad stream valleys and is the dominant soil in some valleys. Brief flooding usually occurs late in fall, in winter, and early in spring. Occasionally flooding occurs during the growing season. Slope is 0 to 2 percent. Most areas are 10 to 80 acres in size and are crescent shaped or narrow and winding.

Typically, the surface layer is dark grayish brown, very friable silt loam about 8 inches thick. The subsoil is about 25 inches thick. The upper part is dark brown, friable silt loam, and the lower part is dark brown, mottled, firm silty clay loam. The underlying material to a depth of about 60 inches is yellowish brown, mottled, friable silt loam and loam and loose stratified sandy loam and fine sandy loam. In some areas in narrow stream valleys the subsoil has layers of sandy loam, and the surface layer is loam or fine sandy loam. In many areas gravelly sand or loamy sand is below a depth of 3 feet. In some areas the soil is on elevated benches and is better drained.

Included with this soil in mapping are small areas of the somewhat poorly drained Shoals soils and very poorly drained Sloan soils in depressions and former meander channels. Also included are small areas of rarely flooded phases of Shoals and Chagrin soils on low stream terraces. The included soils make up less than 25 percent of most areas.

Permeability is moderate or moderately slow. The available water capacity is high. Runoff is slow. The root zone is deep and is medium acid to mildly alkaline. A seasonal high water table is in the lower part of the subsoil. This soil crusts after heavy rains. Crusting reduces infiltration and retards seedling emergence.

In most of the broader areas this soil is used as cropland. In the narrower valleys it is used for pasture or as woodland. It has high potential for row crops, corn and soybeans, for example. Winter grain crops are limited because of the hazard of flooding. Surface drains are used to remove surface water in low-lying areas. Subsurface drains are needed in areas of the included wetter soils. Fall tillage that partially covers crop residue and leaves a rough surface reduces loss of residue by floodwaters. Winter cover crops protect the soil from scouring. Grassed channels help remove peak flow of floodwaters and reduce erosion damage. Diversions at the base of slope breaks to uplands or terraces reduce flash flooding. Weed control is difficult on this soil because weed seeds are carried in by floodwaters. This soil is well suited to irrigation.

This soil is well suited to trees and to use as habitat for openland and woodland wildlife. Woodland consists of mixed hardwoods. Species selected for planting should be able to withstand flooding.

This soil is generally not suited to building site development and to use as septic tank absorption fields. It is severely limited for these uses by the hazard of flooding and some seasonal wetness. Construction can partially block the natural floodway and increase the level of flooding upstream. This soil is suited to some recreation uses and to use as open space.

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

Lu—Luray silty clay loam. This is a deep, nearly level, very poorly drained soil on broad flats and in slightly depressional areas in shallow former glacial lakes. It receives runoff from the higher adjacent soils and is subject to ponding. Slope is 0 to 2 percent. Most areas are 5 to 80 acres in size and are sinuous or band shaped.

Typically, the surface layer is very dark gray, friable silty clay loam about 8 inches thick. The subsoil is about 42 inches thick. It is very dark grayish brown and dark gray, mottled, firm silty clay loam in the upper part and dark brown and yellowish brown, mottled, firm silty clay loam and silt loam in the lower part. The underlying material to a depth of about 60 inches is grayish brown, mottled, friable fine sandy loam and sandy loam. In some areas the surface layer is silty clay or silt loam, and the subsoil has more clay or less clay. In a few areas the dark surface layer is thinner than is typical.

Included with this soil in mapping are small areas of the somewhat poorly drained Fitchville, Kibbie, Tuscola, and Tiro soils on slightly elevated knolls and ridges and the very poorly drained Bono and Olentangy soils in small depressions. The included soils make up less than 10 percent of most areas.

Runoff is very slow. This soil is subject to ponding. The content of organic matter is high. The surface crusts after hard rains. Permeability is moderately slow. The available water capacity is high. The root zone is deep and is slightly acid or neutral. A seasonal high water table is perched near or above the surface during the dormant season and after prolonged rainy periods.

In most areas this soil is artificially drained and is used for crops. It has high potential for use as cropland. Corn, soybeans, and wheat are commonly grown in rotation. Some fields are occasionally returned to hay. Wetness and soil compaction are the major management concerns. Surface and subsurface drainage are used to remove surface water and lower the seasonal high water table. Drainage outlets are difficult to establish and maintain in some areas. Grassed waterways are used in a few areas. Fall tillage is less likely to compact the soil than spring tillage because the subsoil is usually drier in the fall. Tillage that leaves a rough or ridged surface and crop residue partially covered reduces runoff, increases infiltration, and hastens drying.

In undrained areas this soil is used mainly as woodland. Most of the woodland is second-growth swamp forest. Species that tolerate wetness should be selected for planting. Logging operations are limited to the drier part of the year. Plant competition can be reduced by spraying, mowing, or disking.

This soil is poorly suited to building site development and to use as septic tank absorption fields. Ponding and the moderately slow permeability are severe limitations. Ditches, subsurface drains, and storm sewers improve drainage. Agricultural drains usually need to be deepened and enlarged to carry storm water runoff from residential areas. Drains at the base of footings and coatings on exterior basement walls help keep basements dry.

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

LyA—Lykens silt loam, 0 to 2 percent slopes. This is a deep, nearly level, moderately well drained soil near the margins of bedrock ridges, generally at the base of slopes, or in broad level areas on till plains between the ridges. Most areas are 6 to 20 acres in size and are wide and ribbon shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is yellowish brown, firm and very firm silty clay loam about 28 inches thick. It is mottled below a depth of about 18 inches. The underlying material to a depth of about 60 inches is yellowish brown and dark grayish brown, mottled, calcareous, very firm and firm clay loam and loam glacial till. In a few areas, bedrock is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Milton, Tiro, and Mermill soils. The Milton soils have bedrock at a depth of 20 to 40 inches. The somewhat poorly drained Tiro soils are on flats, and the very poorly drained Mermill soils are in depressions. The included soils make up 10 to 20 percent of most areas.

Runoff is slow. The surface layer crusts after heavy rains. The content of organic matter is moderate. Permeability is moderately slow. Dolomitic limestone bedrock is at a depth of 5 to 10 feet in most areas. A seasonal high water table is perched in the lower part of the subsoil in winter, early in spring, and during other extended wet periods. The root zone is moderately deep or deep to compact glacial till. The available water capacity is moderate. The subsoil is very strongly acid to medium acid in the upper part and strongly acid to mildly alkaline in the lower part.

Nearly all of the acreage of this soil is used as cropland. The soil has high potential for crops. Soybeans, corn, and wheat are commonly grown in rotation. In some areas the soil is used for hay or as woodland. Natural drainage is generally adequate for crop production. This soil is suited to irrigation and no-till planting. Growing deep-rooted perennial crops, for example, alfalfa, in the rotation increases the movement of water through the soil. Subsurface drainage may be needed to remove excess water in areas of the included wetter soils.

This soil is suited to use as woodland and as habitat for openland and woodland wildlife. Most of the woodland consists of mixed hardwoods. Plant competition can be reduced by spraying, mowing, or disking.

This soil is well suited to building site development and moderately well suited to use as septic tank absorption fields. Seasonal wetness and the moderate shrink-swell potential in the upper part of the subsoil limit the use of this soil as a site for buildings. Bedrock may be encountered in excavations deeper than 5 feet. Building sites should be graded so that the surface drains away from the foundation. Placing drains at the base of footings and coating the exterior basement walls help prevent wet basements. Local roads and streets can be improved by providing artificial drainage and a suitable base material.

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

LyB—Lykens silt loam, 2 to 6 percent slopes. This is a deep, gently sloping, moderately well drained soil on till plains along the margins of former glacial lakes. Most areas are in the highest positions of the local relief on a relatively smooth landscape. The areas are 5 to 40 acres in size and are deeply lobed or lense shaped.

Typically, the surface layer is dark brown, friable silt loam about 9 inches thick. The subsurface layer is brown, friable silt loam about 3 inches thick. The subsoil is about 30 inches thick. The upper part is yellowish brown, mottled, firm silt loam, and the lower part is dark brown and dark yellowish brown, mottled, firm loam and clay loam. The underlying material to a depth of about 60 inches is yellowish brown, mottled, very firm clay loam glacial till. In a few areas the soil is eroded. In other areas the surface layer and subsoil are fine sandy loam. In some areas the entire soil formed in glacial till, and the subsoil has more clay.

Included with this soil in mapping are small areas of Luray, Oshtemo, Bennington, Fitchville, and Tiro soils. The Luray soils are along drainageways. The Oshtemo soils are on low knolls. The somewhat poorly drained Bennington, Fitchville, and Tiro soils are in low spots and around the base of knolls. The included soils make up less than 20 percent of most areas.

Permeability is moderately slow or slow. The available water capacity is moderate. The surface crusts after hard rains. A seasonal high water table is perched in the lower part of the subsoil in winter, early in spring, and during other extended wet periods. The root zone is mainly moderately deep or deep to compact glacial till. The subsoil is very strongly acid to medium acid in the upper part and strongly acid to mildly alkaline in the lower part. The content of organic matter is moderate. Runoff is medium.

In most areas this soil is used as cropland. It has medium potential for use as cropland. Corn, soybeans, wheat, and oats are commonly grown. Erosion is a moderate hazard if the soil is cultivated. Using minimum tillage, forage crops or small grains in the rotation, and sod waterways help to control erosion. Subsurface drainage is needed in some areas of the included wetter soils. This soil is well suited to no-till planting.

In a few areas this soil is used as woodland. It is suited to use as woodland and as habitat for openland and woodland wildlife. Most of the woodland consists of mixed hardwoods. Plant competition can be reduced by spraying, mowing, or disking.

This soil is suited to building site development and moderately well suited to use as septic tank absorption fields. Because of the seasonal wetness, this soil is better suited to houses without basements than to houses with basements. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Basement walls should be backfilled with material that has a low shrink-swell potential. Local roads and streets can be improved by providing artificial drainage and a suitable base material.

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

LzB—Lykens-Milton silt loams, 2 to 6 percent slopes. This map unit consists of deep, moderately well drained Lykens soil and moderately deep, well drained Milton soil on convex ridges and knolls. These soils are gently sloping. The areas of the individual soils are so intricately mixed or so small that mapping them separately was not practical. The mapped areas consist of about 50 percent Lykens silt loam and 30 percent Milton silt loam. Most areas are 6 to 40 acres in size and are wide and ribbon shaped.

Typically, the surface layer of the Lykens soil is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is yellowish brown, firm silty clay loam and clay loam about 29 inches thick and is mottled below a depth of about 15 inches. The underlying material to a depth of about 60 inches is brown, mottled, firm clay loam glacial till.

Typically, the surface layer of the Milton soil is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 27 inches thick. The upper part is brown, friable silty clay loam and dark brown, firm silty clay and clay; and the lower part is yellowish brown, friable loam. The underlying material is light gray, loose sandy loam over massive, dense, dolomitic limestone at a depth of about 38 inches. In some areas the surface layer is sandy loam. In a few areas where the soil is deep and well drained, dolomitic limestone is at a depth of 40 to 60 inches.

Included with these soils in mapping are small areas of Ritchey soils that have bedrock at a depth of 10 to 20 inches. Also included are small areas of Blount, Elliott, and Pewamo soils on foot slopes and flats and in slight depressions. The included soils make up about 20 percent of most areas.

Surface runoff is medium. The surface layer crusts after rains. The content of organic matter of both soils is moderate. Permeability is moderately slow in the Lykens soil and moderate or moderately slow in the Milton soil. The available water capacity is moderate in the Lykens soil and low in the Milton soil. The Lykens soil has a seasonal high water table in the lower part of the subsoil. The subsoil of the Lykens soil is medium acid in the upper part and medium acid to mildly alkaline in the lower part. The subsoil of the Milton soil is very strongly acid to neutral in the upper part and slightly acid to mildly alkaline in the lower part.

These soils are used mainly as cropland. They have medium potential for use as cropland. Soybeans, corn, and wheat are commonly grown in rotation. If the soils are irrigated, they are suited to orchards, vineyards, and vegetables. Surface crusting reduces infiltration and retards seedling emergence. Planting winter cover crops and using small grain and forage crops in rotation, contour tillage, minimum tillage, and no-till increase infiltration and reduce runoff and erosion. Grassed waterways are needed in some areas where runoff collects and forms channels. Tillage that leaves a rough or ridged surface and partly covers crop residue reduces erosion, increases infiltration, and hastens drying of the soils in spring.

In some areas these soils are used for hay or as woodland.

These soils are suited to use as a site for buildings and poorly suited or moderately well suited to use as septic tank absorption fields. Site planning for buildings and roads should consider the seasonal high water table in the lower part of the subsoil of the Lykens soil and the bedrock at a depth of 20 to 40 inches in the Milton soil. To avoid blasting the bedrock, buildings with basements should be located on the Lykens soil. Final grading to provide good surface drainage away from foundations and drains at the base of foundations help prevent wet basements. The Lykens soil is better suited to septic tank absorption fields than the Milton soil. The effluent from sanitary facilities may move through fissures in the dolomitic limestone under the Milton soil and pollute underground water supplies. Foundations placed on the dolomitic limestone under the Milton soil support very high loads.

These soils are in capability subclass IIe and in woodland suitability subclass 2o.

MaB—Martinsville fine sandy loam, 2 to 6 percent slopes. This is a deep, well drained, gently sloping soil on knolls and ridges along the shorelines of former glacial lakes. It is usually on the highest elevations in the local areas. Most areas are 5 to 40 acres in size and are oval or ribbon shaped.

Typically, the surface layer is dark brown, friable fine sandy loam about 8 inches thick. The subsoil is about 39 inches thick. The upper part is dark brown and brown, friable and firm sandy loam and loam; and the lower part is yellowish brown and brown, very friable fine sandy loam. The underlying material to a depth of about 60 inches is yellowish brown, loose, loamy fine sand. In a few areas the soil has more silt and less sand throughout. In small areas on the higher knolls and ridges the soil has layers that have some gravel. In some small areas the soil is moderately well drained.

Included with this soil in mapping are small areas of Lykens, Kibbie, Fitchville, and Luray soils. The very poorly drained Luray soils are in depressions and lower lying areas. The moderately well drained Lykens soils are on knolls. The somewhat poorly drained Kibbie and Fitchville soils are in minor drainageways. The included soils make up less than 20 percent of most areas.

Runoff is medium. The content of organic matter is moderately low. Crusting is generally not a problem. Permeability is moderate. The available water capacity is high. The root zone is deep. The subsoil ranges from neutral to strongly acid. The water table is typically below a depth of 6 feet.

In most areas this soil is used as cropland. It has high potential for use as cropland. Corn, soybeans, wheat, and grass-legume hay are commonly grown. This soil is especially well suited to crops that mature early and to deep-rooted perennials, for example, alfalfa and orchard trees. Planting, tilling, and harvesting are seldom delayed by wetness. The surface layer can be worked within a wide range of moisture content. Planting winter cover crops and using grassed waterways, contour tillage, and minimum tillage reduce erosion. This soil is well suited to no-till planting and to irrigation. Random subsurface drains are needed in areas of the included wetter soils.

In a few areas this soil is used as woodland. It is suited to a wide variety of hardwood species. Competing vegetation can be controlled or removed by cutting, spraying, girdling, or mowing.

This soil is well suited to building site development and to use as septic tank absorption fields. It has good natural drainage for such uses. Sloughing is a hazard in excavations. Cover should be maintained on the site as much as possible during construction to reduce soil loss by erosion.

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

Md—Medway silt loam, rarely flooded. This is a deep, nearly level, moderately well drained soil on low stream terraces along major streams. It is subject to rare flooding about once in 20 years. Slope is 0 to 2 percent. Most areas are 10 to 80 acres in size and are roughly circular in shape.

Typically, the surface layer is very dark grayish brown, friable silt loam about 10 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 6 inches thick. The subsoil is brown and yellowish brown, mottled, friable silt loam about 34 inches thick. The underlying material to a depth of about 60 inches is yellowish brown, mottled, loose and very friable stratified loam, sandy loam, and silt loam. In some areas the subsoil is more silty. In other areas the surface layer is loam. In some areas along large streams the soil is well drained. In a few areas the surface layer is lighter in color than is typical.

Included with this soil in mapping are small areas of Shoals, Sloan, Digby, and Haney soils. The somewhat poorly drained Shoals soils and the very poorly drained Sloan soils are in old stream channels and drainageways. The Digby and Haney soils have more gravel throughout the soil and are on narrow stream terraces. Also included are areas of soils that are subject to occasional flooding. These soils are on narrow flood plains. The included soils make up 10 to 25 percent of most areas.

Runoff is slow. This soil receives little water from the surrounding higher soils except during rare periods of heavy runoff. The content of organic matter is high. The hazard of erosion is slight. Permeability is moderate. The available water capacity is high. During the growing season soil moisture is usually adequate to prevent moisture stress in crops. The root zone is deep and is slightly acid to mildly alkaline. A seasonal high water table is between depths of 18 and 36 inches in winter and spring and during other extended wet periods.

In most areas this soil is cultivated. Corn, soybeans, and wheat are the main crops. This soil is suited to growing row crops year after year. It is also suited to hay and pasture. It is well suited to tomatoes, potatoes, alfalfa, and small fruits. Rare flooding and wetness delay planting in some years. Flooding can be reduced by clearing log jams and other obstructions in stream channels. This soil is well suited to no-till planting. Fall tillage that leaves a rough or ridged surface and crop residue partially covered increases infiltration and hastens drying. Subsurface drains are needed in areas of the included wetter soils. The alkalinity in the upper part of the soil may cause manganese deficiency in soybeans. This soil is well suited to irrigation. However, in most years soil moisture is adequate for crops.

Although this soil is well suited to use as woodland, it is used for this purpose in very few areas. Plant competition can be reduced by spraying, mowing, or disking.

This soil is rarely used as a site for buildings because of the hazard of flooding. It is generally not suited to building site development and is poorly suited to use as septic tank absorption fields. Structures such as roads, bridges, farm buildings, or recreation facilities need special design to avoid damage from flooding. Elevating the structure by filling above the known high-water level reduces damage. Seepage from sanitary landfills and sewage lagoons can pollute underground water supplies. This soil is suited to recreation uses, for example, picnic areas and paths and trails.

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

Mf—Mermill loam. This is a deep, nearly level, very poorly drained soil in slight depressions and on flats on glacial lake deltas and outwash terraces. It receives runoff from the higher adjacent soils and is subject to ponding. Slope is 0 to 2 percent. Most areas are 5 to 80 acres in size and are long and narrow in shape.

Typically, the surface layer is very dark gray, friable loam about 9 inches thick. The subsoil is about 33 inches thick. The upper and middle parts are dark grayish brown, grayish brown, and dark gray, mottled, firm and friable clay loam and gravelly sandy clay loam; and the lower part is grayish brown, mottled, very firm silty clay loam. The underlying material to a depth of about 60 inches is grayish brown, mottled, firm silty clay loam. In a few areas the underlying material is stratified sand and gravel. In some areas the surface layer is lighter in color than is typical, or it is sandy loam. In other areas the surface layer is darker and is thicker than is typical.

Included with this soil in mapping are small areas of Haskins, Del Rey, Blount, Milford, and Pewamo soils. The somewhat poorly drained Haskins, Del Rey, and Blount soils are on slight rises. The Milford and Pewamo soils have more clay and slower permeability in the subsoil. The included soils make up 10 to 15 percent of most areas.

A seasonal high water table is near or above the surface in winter and spring and during other extended wet periods. The content of organic matter is high. Permeability is moderate in the upper and middle parts of the subsoil and slow in the lower part of the subsoil and in the underlying material. The root zone is moderately deep to deep and has a moderate available water capacity. Runoff is very slow or ponded. The shrink-swell potential is moderate. The potential frost action is high. The subsoil is medium acid to neutral in the upper and middle parts and neutral to moderately alkaline in the lower part.

This soil is used mainly for grain crops. It has high potential for use as cropland. In drained areas this soil is well suited to corn and soybeans. Seasonal wetness is the main limitation. Planting, tillage, and harvesting are delayed in undrained areas. Surface drains can be used to remove excess surface water. Subsurface drains are commonly used to lower the seasonal high water table.

These drains are more effective if they are placed on or above the slowly permeable glacial till or lacustrine material in the lower part of the subsoil. In drained areas the soil can be tilled within a wide range of moisture content. Fall tillage is less likely to cause compaction than spring tillage because the subsoil is usually drier in fall. Tillage that leaves a rough or ridged surface and partly covers the crop residue increases infiltration, reduces runoff, and hastens drying.

This soil is suited to trees that are tolerant of wetness. Competing grasses and shrubs can be controlled or removed by spraying, mowing, or disking. Wetness limits the use of planting and harvesting equipment in winter and spring.

This soil is poorly suited to use as a site for buildings and septic tank absorption fields. Ponding and slow permeability are severe limitations. Surface drains, subsurface drains, and storm sewers are used to improve drainage. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Building sites should be landscaped for good surface drainage away from the foundation. Excavations are limited in winter and spring because of wetness.

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

Mg—Mermill silty clay loam. This is a deep, nearly level, very poorly drained soil in low areas between bedrock ridges. It receives runoff from the higher adjacent soils and is subject to ponding. Slope is 0 to 2 percent. Most areas are 40 to 160 acres in size and are oblong or irregular in shape.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 9 inches thick. The subsoil is about 28 inches thick. The upper and middle parts of the subsoil are dark gray and grayish brown, mottled, firm clay loam and loam; and the lower part is grayish brown, mottled, firm clay loam. The underlying material to a depth of about 60 inches is dark grayish brown and dark gray, mottled, firm clay loam glacial till. In some areas the surface layer is thicker than is typical. In other areas it is lighter in color. In a few areas the surface layer is sandy loam, and the underlying material is more loamy. In some areas dolomitic limestone is at a depth of less than 5 feet.

Included with this soil in mapping are small areas of Randolph, Tiro, and Millsdale soils. The somewhat poorly drained Randolph and Tiro soils are on low knolls and ridges. The Millsdale soils are in areas where bedrock is at a depth of 20 to 40 inches. The included soils make up 10 to 15 percent of most areas.

Runoff is very slow or ponded. The content of organic matter is high. Permeability is moderate in the upper and middle parts of the subsoil and slow in the lower part of the subsoil and in the underlying material. The available water capacity is moderate. The root zone is moderately deep to deep and is slightly acid to mildly alkaline. Dolomitic bedrock is usually at a depth of 5 to 10 feet.

In most areas this soil is used as cropland. It has high potential for cultivated crops. Corn and soybeans are commonly grown. Seasonal wetness is the main limitation. Good drainage outlets are not available in some areas. In most areas the soil has been drained by ditches and subsurface drains. Planting, tillage, and harvesting are delayed in some years by excess soil moisture. Fall tillage is less likely to cause compaction than spring tillage because the subsoil is usually drier in fall. Tillage that leaves a rough or ridged surface and crop residue partially covered increases infiltration, reduces runoff, and hastens drying. Tillage should be done within a limited range of moisture content because this soil becomes compacted and cloddy if worked when wet and sticky.

This soil is well suited to trees and to vegetation grown as habitat for wetland wildlife. Species that can tolerate wetness should be selected for new plantings. Plant competition can be reduced by spraying, mowing, or disking. Wetness limits the use of planting and harvesting equipment in winter and spring.

This soil is poorly suited to use as building site development and septic tank absorption fields. Ponding and slow permeability are severe limitations. Surface drains, subsurface drains, and storm sewers are used to improve drainage. Drains at the base of footings and coatings on exterior basement walls help keep basements dry. Building sites should be landscaped for good surface drainage away from the foundation. Excavations are limited in winter and spring because of wetness.

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

Mh—Milford silty clay loam. This is a deep, nearly level, very poorly drained soil on broad flats, in shallow closed depressions, and along minor waterways on glacial lake plains. It receives runoff from the higher adjacent soils and is subject to ponding. Slope is 0 to 2 percent. Most areas are 2 to 640 acres in size and irregular in shape.

Typically, the surface layer is black, friable silty clay loam about 10 inches thick. The subsurface layer is black, friable silty clay loam about 4 inches thick. The subsoil is dark gray and dark grayish brown, mottled, firm silty clay loam about 40 inches thick. The underlying material to a depth of about 60 inches is dark grayish brown, firm silty clay loam and silt loam. In a few areas the surface layer is thinner, and the subsoil is more acid. In a few areas the underlying material is glacial till. In some areas the surface layer is silty clay.

Included with this soil in mapping are small areas of Blount, Del Rey, Olentangy, Kibbie, and Tiro soils. The somewhat poorly drained Blount and Del Rey soils are on low knolls and ridges. The Olentangy soils are in the center of depressions. The somewhat poorly drained Kibbie and Tiro soils are on low ridges and knolls. The included soils make up 10 to 15 percent of most areas.

Runoff is slow. This soil is occasionally ponded. The surface layer crusts after hard rains. Crusting reduces infiltration. The content of organic matter is high. The subsoil is slightly acid or neutral in the upper part and neutral or mildly alkaline in the lower part. Permeability is moderately slow. A seasonal high water table is near or above the surface during the dormant season and after prolonged rainy periods. The available water capacity is high.

In most areas this soil is artificially drained and is used as cropland. It has high potential for use as cropland. Corn, soybeans, wheat, and hay are the common crops. Wetness is the major management concern. Surface and subsurface drains are used to improve drainage. Grassed waterways are used in a few areas where water flow is concentrated in channels. Fall tillage is less likely to compact the soil than spring tillage because the subsoil is usually drier in fall. Tillage that leaves a rough or ridged surface and crop residue partially covered reduces runoff, increases infiltration, and hastens drying. Deep-rooted crops, for example, alfalfa, leave pathways that increase movement of water to subsurface drains.

In a few undrained areas this soil is used for trees. It is suited to trees. Most of the woodland consists of second-growth swamp forest. Species selected for planting should be tolerant of wetness.

This soil is poorly suited to use as a site for buildings and septic tank absorption fields. Ponding and the moderately slow permeability are severe limitations. Surface drains, subsurface drains, and storm sewers can be used to improve drainage. Building sites should be landscaped for good surface drainage away from the foundation. Drains at the base of footings and coatings on exterior basement walls help keep basements dry.

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

Mk—Millgrove silt loam. This is a deep, very poorly drained, nearly level soil on outwash plains, terraces, and beach ridges. In the lower areas in depressions it is subject to ponding from runoff from the adjacent higher soils. Slope is 0 to 2 percent. Most areas are 5 to 40 acres in size and are oval in shape.

Typically, the surface layer is very dark gray, friable silt loam about 11 inches thick. The subsoil is gray, mottled, firm loam and clay loam about 33 inches thick. The underlying material to a depth of about 60 inches is dark gray, loose loamy coarse sand. In some areas the underlying material has glacial till or lacustrine sediment. In some areas the subsoil has more clay and less sand and gravel. In other areas the surface layer is silty clay loam. In a few areas along streams the soil is subject to rare flooding.

Included with this soil in mapping are small areas of soils similar to Luray or Milford soils that have glacial outwash in the underlying material. Also included are areas of the somewhat poorly drained Digby soils and the moderately well drained Haney soils on slightly elevated knolls and ridges. The included soils make up 10 to 15 percent of most areas.

Permeability is moderate. The available water capacity is moderate. However, plants seldom show moisture stress. Runoff is very slow or ponded. The root zone is deep. The subsoil is slightly acid to mildly alkaline. The content of organic matter is high. A seasonal water table is near or above the surface in winter and spring and during other extended wet periods.

In most areas this soil is artificially drained and is used as cropland. It has high potential for cultivated crops. It is suited to continuous row crops, for example, corn and soybeans, and to small grains and special crops. Wetness is the main limitation. Surface and subsurface drains are very effective in lowering the seasonal high water table. Tillage that leaves a rough or ridged surface and crop residue partially covered hastens drying. Minimizing tillage and planting cover crops are good management practices, especially if this soil is used for continuous row crops.

This soil is well suited to trees and to use as habitat for wetland wildlife. Species that can tolerate wetness should be selected for new plantings. Seedlings make good growth if competing vegetation is controlled or removed by cutting, spraying, girdling, or mowing.

This soil is poorly suited to building site development and to use as septic tank absorption fields. Ponding and seepage are limitations. Surface drains, subsurface drains, and storm sewers improve drainage. Building sites should be landscaped for good surface drainage away from the foundation. Excavations are limited in winter and spring because of ponding and sloughing of banks. Underground water supplies can become contaminated by seepage from sewage lagoons, sanitary landfills, or other sanitary facilities.

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

Mm—Millsdale silty clay loam. This is a moderately deep, nearly level, very poorly drained soil in depressions between bedrock-controlled ridges. It receives runoff from the adjacent higher soils and is subject to ponding. Slope is 0 to 2 percent. Most areas are 5 to 80 acres in size and are irregular in shape.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 11 inches thick. The subsoil is dark grayish brown and grayish brown, mottled, firm silty clay loam and clay loam about 25 inches thick. The underlying material below a depth of about 36 inches is light gray and pale yellow, dense, massive, coarse grained dolomitic limestone. In some areas bedrock is at a depth of 40 to 60 inches, and in a few areas it is at a depth of less than 20 inches. In some areas the surface layer is silt loam or loam.

Included with this soil in mapping are small areas of Mermill, Milford, Pewamo, Tiro, Randolph, Milton, Lykens, Shoals, and Sloan soils. The Mermill, Milford, and Pewamo soils are deep to bedrock. The somewhat poorly drained Tiro and Randolph soils, the well drained Milton soils, and the moderately well drained Lykens soils are on low knobs and ridges. The Shoals and Sloan soils are on flood plains. Also included are a few areas along streams where the soil is subject to occasional flooding. The included soils make up less than 10 percent of most areas.

Runoff is slow. A seasonal high water table is near or above the surface in winter and spring and during other extended wet periods. The content of organic matter is high. Permeability is moderately slow. The root zone is moderately deep. The available water capacity is moderate. The root zone is slightly acid to mildly alkaline. The subsoil has high shrink-swell potential. The potential frost action is high.

In most areas this soil is used as cropland. It has high potential for use as cropland. Seasonal wetness is the main limitation. In drained areas this soil is suited to corn, soybeans, hay, and pasture. Drainage outlets are difficult to locate in many areas because of bedrock at a depth of 20 to 40 inches. In most areas the soil has been drained by ditches and subsurface drainage systems. Some crops show moisture stress during prolonged dry periods because the root zone is only moderately deep. However, seepage from the adjoining soils usually supplies sufficient moisture for plant growth. Tillage should be done within a limited range of moisture content because this soil becomes compacted and cloddy if worked when wet and sticky. Fall tillage is less likely to compact the soil than spring tillage because the subsoil is usually drier in fall.

This soil is well suited to trees and other vegetation grown as habitat for wetland wildlife. Species that can tolerate wetness should be selected for new plantings. Plant competition can be reduced by spraying, mowing, or disking. Wetness limits the use of planting and logging equipment in winter and spring.

This soil is poorly suited to building site development and is generally not suited to septic tank absorption fields. Ponding, moderate depth to bedrock, moderately slow permeability, and high shrink-swell potential are limitations. Building sites should be landscaped for good surface drainage away from the foundation. Because of the seasonal wetness, the bedrock at a depth of 20 to 40 inches, and the lateral movement of water above the bedrock, this soil is better suited to houses without basements than to houses with basements.

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

MoA—Milton silt loam, 0 to 2 percent slopes. This is a well drained, moderately deep, nearly level soil on till plains. In a few areas it is on lake plains. Slopes are uniform and long. Most areas are 10 to 80 acres in size and are roughly circular or long and narrow in shape.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 25 inches thick. It is brown, yellowish brown, and dark brown, friable loam and silty clay loam and firm clay and silty clay. The underlying material is loose sandy loam over massive light brownish gray dolomitic limestone. Bedrock is at a depth of about 38 inches. In many areas the subsoil has slightly less clay and more sand. In some areas the subsoil has layers of loamy sand. In some areas the surface layer is very dark grayish brown, and in other areas it is sandy loam.

Included with this soil in mapping are small areas of Mermill, Millsdale, Lykens, Tiro, and Randolph soils. The deep, very poorly drained Mermill soils and the deep, moderately well drained Millsdale soils are in depressions and along drainageways. The Lykens soils are in similar positions on the landscape as this Milton soil. The deep, somewhat poorly drained Tiro soils and the moderately deep Randolph soils are on flats. Also included are areas on stream terraces where the soil is subject to rare flooding. The included soils make up less than 10 percent of most areas.

Runoff is slow. The content of organic matter is moderate. Permeability is moderate or moderately slow. The subsoil is very strongly acid to neutral in the upper part and slightly acid to mildly alkaline in the lower part. The available water capacity is low.

In most areas this soil is used as cropland. It has medium potential for use as cropland. Corn, soybeans, wheat, and grass-legume hay are the main crops. Because of the low moisture capacity of the soil, conservation of moisture is important for plant growth. This soil is well suited to irrigation and to no-till planting. The surface layer can be worked within a fairly wide range of moisture content. Incorporating crop residue or other organic matter into the surface layer increases the water-holding capacity and the rate of water infiltration.

This soil is suited to building site development and poorly suited to use as septic tank absorption fields. Because of the hard bedrock at a depth of 20 to 40 inches, this soil is better suited to houses without basements than to houses with basements. Blasting of bedrock is generally needed before a basement can be constructed. The effluent from sanitary facilities can move through fissures in the limestone bedrock and pollute underground water supplies. Central sewage systems should be used. Some septic tank absorption fields have been installed on elevated mounds that have a filtering zone of 4 feet above the bedrock.

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

MoB—Milton silt loam, 2 to 6 percent slopes. This is a well drained, moderately deep, gently sloping soil in bedrock-controlled areas on uplands. Slopes are long and uniform. In most areas this soil receives runoff from the adjacent higher soils. Most areas are 10 to 160 acres in size and irregular in shape.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is brown, yellowish brown, and dark brown, friable loam and silty clay loam and firm clay and silty clay about 25 inches thick. The underlying material is light gray, mottled, loose sandy loam over dolomitic limestone. Bedrock is at a depth of about 38 inches. In some areas the surface layer is sandy loam. In other areas the subsoil has layers of loamy sand. In a few areas the surface layer is very dark grayish brown. In other areas the soil is eroded, or bedrock is at a depth of less than 20 inches.

Included with this soil in mapping are small areas of Mermill, Millsdale, Lykens, Tiro, and Randolph soils. The deep, very poorly drained Mermill and Millsdale soils are in low-lying areas or long drainageways. The deep, moderately well drained Lykens soils are in similar positions on the landscape as this Milton soil. The deep, somewhat poorly drained Tiro soils and the moderately deep Randolph soils are on flats. Also included are areas on stream terraces where the soil is subject to rare flooding. The included soils make up less than 20 percent of most areas.

Runoff is medium. The surface layer crusts after hard rains. The content of organic matter is moderate. Permeability is moderate or moderately slow. The subsoil is very strongly acid to neutral in the upper part and slightly acid to mildly alkaline in the lower part. The available water capacity is low.

In most areas this soil is intensively farmed. It has medium potential for use as cropland. Corn, soybeans, wheat, and grass-legume hay are the main crops. This soil is well suited to full-season row crops, early-season crops, and deep-rooted perennials, for example, alfalfa. It is also well suited to berries and orchard crops. Because of the low moisture capacity, conservation of moisture is important for plant growth. This soil is well suited to irrigation and to no-till planting. The hazard of erosion is moderate. Adding crop residue, barnyard manure, or other organic matter helps maintain soil structure, increase infiltration, reduce crusting, and increase the capacity of the soil to hold water.

This soil is suited to building site development and poorly suited to use as septic tank absorption fields. Because of the hard bedrock at a depth of 20 to 40 inches, this soil is better suited to houses without basements than to houses with basements. Blasting of bedrock is generally needed before a basement can be constructed. The effluent from sanitary facilities can move through fissures in the limestone bedrock and pollute underground water supplies. Central sewage systems should be used. Some septic tank absorption fields have been installed on elevated mounds that have a filtering zone of 4 feet above the bedrock. Keeping cover on the soil as much as possible during construction reduces soil loss by erosion.

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

MrC2—Morley silt loam, 6 to 12 percent slopes, eroded. This is a deep, well drained, sloping soil on irregular slopes on hills and on isolated knobs in the hummocky areas of end moraines. In a few areas it is on side slopes along streams. Erosion has removed part of the original surface layer. The present surface layer contains subsoil material that has more clay than the original surface layer. Most areas are 6 to 40 acres in size and are oval or kidney shaped.

Typically, the surface layer is dark grayish brown, very friable silt loam about 7 inches thick. The subsoil is yellowish brown, firm silty clay loam about 28 inches thick. The underlying material to a depth of about 60 inches is dark yellowish brown, very firm silty clay loam. In a few narrow strips near the base of slopes the soil is moderately well drained. In some areas, especially where the slopes are uneven, the subsoil has loam and silt loam, and the substratum has sandy loam, gravelly loam, loamy sand, and fine sand.

Included with this soil in mapping are small areas of Blount, Pewamo, and Tuscola soils. The somewhat poorly drained Blount soils are on the lower part of some slopes. The very poorly drained Pewamo soils are along waterways. The Tuscola soils are in areas of loamy and silty lacustrine sediment. Also included are a few areas where the soil is severely eroded and has gullies. The plow layer in these areas is mostly subsoil material and has poor tilth. Also included are a few springs and seep spots. The included soils make up less than 25 percent of most areas.

The surface layer crusts after rains. The content of organic matter is moderately low. Runoff is rapid. The root zone is moderately deep or deep and has a moderate available water capacity. It is strongly acid or medium acid in the upper part and slightly acid to mildly alkaline in the lower part. Permeability is moderately slow or slow.

In most areas this soil has been cleared and is farmed. It has low potential for use as cropland because of erosion. Corn, soybeans, wheat, and grass-legume hay are commonly grown. Controlling erosion, conserving moisture, and improving fertility are management concerns. Erosion has made this soil difficult to manage. Tillage that leaves part of the crop residue on the soil surface reduces erosion and increases infiltration. No-till, contour tillage, and the use of small grains and forage crops in the rotation reduce sheet and rill erosion. This soil is well suited to no-till planting. Grassed waterways are very effective. This soil is droughty in most summers because of water lost as runoff.

This soil is suited to use as woodland and as habitat for openland and woodland wildlife. In a few areas it is in native mixed hardwoods. The included severely eroded spots are difficult to revegetate.

This soil is suited to use as a site for buildings and poorly suited to use as septic tank absorption fields. It has many desirable residential sites that are on rolling terrain, and streams are nearby. Building sites should be carefully selected to avoid runoff from adjacent soils. The distribution lines in septic tank absorption fields should be on the contour to reduce seepage of effluent to the soil surface. Cover should be maintained on the site as much as possible during construction to reduce soil loss by erosion. Many areas are good sites for ponds.

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

MrD2—Morley silt loam, 12 to 18 percent slopes, eroded. This is a deep, well drained, moderately steep soil in hummocky areas on end moraines and on side slopes of dissected valleys. Erosion has removed part of the original surface layer. The present surface layer contains subsoil material that is high in clay. Most areas are 5 to 20 acres in size and are lobed or forked in shape.

Typically, the surface layer is dark grayish brown, very friable silt loam about 5 inches thick. The subsoil is about 30 inches thick. It is brown and yellowish brown, firm and very firm silty clay loam that has mottles in the lower 3 inches. The underlying material to a depth of about 60 inches is dark yellowish brown, mottled, calcareous, very firm silty clay loam. In a few areas near the base of slopes and along drainageways the soil is moderately well drained. In most of the wooded areas the soil is slightly eroded. In some areas the subsoil has layers of loam or silt loam that are more permeable than the typical subsoil, and the substratum has loam, silt loam, sandy loam, and gravelly loam.

Included with this soil in mapping are small areas of Blount, Pewamo, and Pandora soils. The somewhat poorly drained Blount soils are at the base of slopes, in seepage spots, and in concave areas on hillsides. The very poorly drained Pewamo soils and the poorly drained Pandora soils are along small natural drainageways. Also included are some small areas on knolls and on the steeper parts of hillsides where the soil is severely eroded and the surface layer is silty clay loam. Also included are a few springs and seep spots. The included soils make up less than 15 percent of most areas.

Permeability is moderately slow or slow. The available water capacity is moderate. Runoff is rapid. The root zone is mainly moderately deep to compact glacial till. The subsoil is strongly acid or medium acid in the upper part and slightly acid to mildly alkaline in the lower part. The content of organic matter is moderately low.

In most areas this soil is used as woodland and pasture. It has low potential for use as cropland. Safely operating farm machinery, controlling erosion, reducing runoff, and increasing infiltration are management concerns. Grassed waterways are used to reduce runoff where water is concentrated in natural channels. Using minimum and contour tillage and winter cover crops, small grains, and forage crops in the rotation reduces soil loss by erosion and increases infiltration. This soil is suited to no-till planting.

This soil is suited to use as woodland and as habitat for openland and woodland wildlife. Logging roads and skid trails should be protected against erosion by water bars or other practices.

This soil is poorly suited to building site development and septic tank absorption fields. Slope and the slow or moderately slow permeability are severe limitations. Extensive land shaping is generally necessary to prepare an area for these uses. Runoff channels should be protected from erosion by grass or a stone riprap lining. Subsurface drains are needed in areas of the included wetter soils to intercept lateral movement of water. The distribution lines in septic tank absorption fields should be on the contour to reduce seepage of effluent to the soil surface.

This soil has many small watershed sites suitable for ponds. It also has scenic areas suited to recreational uses.

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

MrF2—Morley silt loam, 18 to 50 percent slopes, eroded. This is a deep, well drained, steep and very steep soil on hillsides along streams. Areas are strongly dissected by stream undercutting and headward erosion of tributaries. Local relief ranges from 30 to 50 feet. Tributary streams and waterways flowing from the uplands to the valley floor form V-shaped ravines. Slope ranges from 18 to 50 percent and averages about 40 percent. Most areas are 2 to 10 acres in size and are narrow and winding in shape.

Typically, the surface layer is dark grayish brown, friable silt loam about 4 inches thick. The subsoil is brown and yellowish brown, firm and very firm silty clay loam about 28 inches thick. The underlying material to a depth of about 60 inches is dark yellowish brown, very firm silty clay loam glacial till. A few narrow strips of moderately well drained soils that formed in colluvium are at the base of some slopes. In these soils the subsoil is thicker. In a few areas the subsoil has silt loam or loam. In other areas the soil is slightly eroded.

Included with this soil in mapping are small areas of Shoals soils along small streams and somewhat poorly drained Blount soils at the base of slopes and in seepage spots. Small outcroppings of dolomitic limestone are included at the base of some slopes. Also included are areas where the soil is severely eroded. Also included are a few springs and seep spots. The included soils make up about 15 percent of most areas.

The root zone is mainly moderately deep to compact glacial till. The available water capacity is moderate. The subsoil is strongly acid or medium acid in the upper part and slightly acid to mildly alkaline in the lower part. Permeability is moderately slow or slow. Runoff is very rapid. The content of organic matter is moderately low.

In most areas this soil is wooded or is used for pasture. It is suited to use as woodland and as habitat for woodland wildlife. The slope severely limits the use of planting and logging equipment. Logging roads and skid trails should be protected against erosion by water bars or other practices. This soil has low potential for use as cropland because of the steep and very steep slopes.

This soil is generally not suited to building site development. Slope severely limits the use of this soil as a site for buildings. Erosion is a severe hazard if ground cover is not maintained. Hillside slippage is common around included seep areas and in areas of cutting and filling. This soil has areas of scenic and recreational value. Careful planning of access to areas used for scenic and recreational purposes is needed to protect native vegetation and prevent erosion along trails. Paths that follow the contour are less susceptible to erosion.

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

NpB—Nappanee silt loam, 2 to 6 percent slopes. This is a deep, gently sloping, somewhat poorly drained soil on long slopes on end moraines. Most areas are 20 to 160 acres in size and convoluted in shape.

Typically, the surface layer is dark brown, friable silt loam about 6 inches thick. The subsurface layer is pale brown, mottled, firm silty clay loam about 4 inches thick. The subsoil is dark brown, mottled, firm and very firm silty clay and clay about 18 inches thick. The underlying material to a depth of about 60 inches is dark brown, mottled, very firm silty clay glacial till. In a few areas the surface layer is silty clay loam or silty clay. In some areas the underlying material has lacustrine silty clay loam. In other areas the subsoil has layers that are very strongly acid.

Included with this soil in mapping are small areas of very poorly drained Latty soils in small depressions and drainageways. Also included are a few areas of moderately well drained soils on knolls. The included soils make up less than 10 percent of most areas.

Runoff is medium. The content of organic matter is moderate. The surface layer crusts after hard rains. Crusting reduces infiltration. Permeability is very slow. A seasonal high water table is in the upper part of the subsoil in winter and spring and during other extended wet periods. The root zone is mainly moderately deep to compact glacial till. The available water capacity is low or moderate. The shrink-swell potential is moderate.

This soil is used as cropland, pasture, and woodland. It has low potential for use as cropland. Corn, soybeans, and wheat are commonly grown in rotation. Some rotations include grass-legume hay or pasture. Seasonal wetness, the very slow permeability, and the hazard of erosion are the main management concerns. Wetness delays planting and limits the choice of crops. Subsurface drains are used to lower the seasonal high water table. However, movement of water into subsurface drains is slow. Drainage lines must be closely spaced for uniform drainage. Deep-rooted crops, for example, alfalfa, leave pathways that facilitate movement of water to subsurface drains. Using small grains and forage crops in the rotation, leaving crop residue on the surface, and using minimum and contour tillage help reduce erosion and runoff. Fall tillage is less likely to cause compaction than spring tillage because the subsoil is usually drier in fall. However, the hazard of erosion is greater from fall tillage. Using grassed waterways is a good practice.

Wooded areas consist mainly of second-growth stands of native hardwoods that can tolerate the clay in the subsoil and some wetness. Use of planting and harvesting equipment is limited during extended wet periods. Plant competition can be reduced by spraying, mowing, or disking.

This soil is moderately well suited to use as a site for buildings and poorly suited to use as septic tank absorption fields. Seasonal wetness and the clay in the subsoil limit the use of this soil as a site for buildings. These limitations can be partially or fully overcome by using special design. Ditches and subsurface drains are used to improve drainage. Foundations should be designed to prevent structural damage caused by the shrinking and swelling of the soil and backfilled with soil material that has a low shrink-swell potential. Perimeter drains around septic tank absorption fields help lower the seasonal high water table.

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

NtA—Nappanee silty clay loam, 0 to 2 percent slopes. This is a deep, nearly level, somewhat poorly drained soil in large areas on slightly elevated rises on uplands. Most areas are 20 to 160 acres in size and irregular in shape.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 8 inches thick. The subsoil is dark brown, mottled, firm and very firm silty clay and clay about 21 inches thick. The underlying material to a depth of about 60 inches is dark brown, mottled, very firm silty clay glacial till. In some areas the subsoil or underlying material is lakebed sediment. In a few areas the surface layer is silt loam or silty clay. In other areas the subsoil has layers that are very strongly acid. In some areas the surface layer is slightly darker.

Included with this soil in mapping and making up less than 10 percent of most areas are small areas of Latty soils on flats.

The content of organic matter is moderate. Runoff is slow. The surface layer crusts after hard rains. Crusting reduces infiltration. Permeability is very slow. A seasonal high water table is in the upper part of the subsoil in winter and spring and during other extended wet periods. The available water capacity is low or moderate. The root zone is mainly moderately deep to compact glacial till. The subsoil is strongly acid to mildly alkaline. The shrink-swell potential is moderate.

In drained areas this soil is used mainly as cropland. In undrained areas it is used as pasture or woodland. This soil has low potential for use as cropland. Improving drainage, maintaining tilth, and reducing surface crusting are the major management concerns. Wetness delays tillage, planting, and harvesting. Fall tillage is less likely to cause compaction than spring tillage because the subsoil is usually drier in fall. Tillage that leaves a rough or ridged surface and crop residue partially covered reduces runoff, increases infiltration, and hastens drying. Surface drains are used in some areas to remove excess surface water. Subsurface drains are used to lower the seasonal high water table. However, movement of water into subsurface drains is slow. Drainage lines must be closely spaced for uniform drainage. Deep-rooted crops, for example, alfalfa, leave pathways that facilitate the movement of water to subsurface drains.

Wooded areas consist mainly of second-growth stands of native hardwoods that can tolerate the clay in the subsoil and some wetness. Use of planting and harvesting equipment is limited during extended wet periods. Plant competition can be reduced by spraying, mowing, or disking. This soil is suited to use as habitat for woodland and wetland wildlife.

This soil is moderately well suited to use as a site for buildings and poorly suited to use as septic tank absorption fields. Seasonal wetness and the clay in the subsoil limit the use of this soil as a site for buildings. Ditches and subsurface drains are used to improve drainage. Building sites should be landscaped for good surface drainage away from the foundation. Foundations should be designed to prevent structural damage caused by the shrinking and swelling of the soil and backfilled with soil material that has a low shrink-swell potential. The silty clay loam surface layer is sticky and slippery when wet. Perimeter drains around septic tank absorption fields help lower the seasonal high water table.

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

NtB2—Nappanee silty clay loam, 2 to 6 percent slopes, eroded. This is a deep, somewhat poorly drained, gently sloping soil on convex ridges and knolls on hummocky terrain. In some areas it is at the head of small drainageways. The landform has been partially dissected by water courses. Erosion has reduced the thickness of the surface layer, and plowing has mixed subsoil material into the surface layer. Most areas are 5 to 40 acres in size and are circular or ribbon shaped.

Typically, the surface layer is dark brown, friable silty clay loam about 6 inches thick. The subsoil is dark brown, mottled, firm silty clay loam and silty clay about 20 inches thick. The underlying material to a depth of about 60 inches is dark brown, very firm silty clay. In many areas the surface layer is silt loam and is less eroded than the typical surface layer. In some areas the underlying material has layers of silty clay loam.

Included with this soil in mapping are small areas of the very poorly drained Latty soils and the poorly drained Pandora soils in depressions and on flats. Also included are a few areas of soils that are moderately well drained. The included soils make up 10 to 15 percent of most areas.

The content of organic matter is moderately low. The surface layer crusts after hard rains. Permeability is very slow. The available water capacity is low or moderate. The subsoil is strongly acid to mildly alkaline. A seasonal high water table is perched in the upper part of the subsoil in winter and spring and during other extended wet periods. The shrink-swell potential is moderate.

This soil is used mainly as cropland. This soil has low potential for use as cropland. Controlling erosion, improving drainage, and reducing crusting are management concerns. Erosion is a severe hazard if the soil is cultivated. The effects of erosion have made this soil difficult to manage. Using minimum tillage, grassed waterways, contour tillage, winter cover crops, and small grains or forage in the crop rotation reduces erosion and increases infiltration. The movement of water into subsurface drains is slow. Drainage lines must be closely spaced for uniform drainage. Deep-rooted perennial crops, for example, alfalfa, leave pathways that facilitate the movement of water to subsurface drains.

In a few areas this soil is used as woodland. Trees selected for planting should be tolerant of the clay in the subsoil and of some wetness. Use of planting and harvesting equipment is limited during extended wet periods. Plant competition can be reduced by spraying, mowing, or disking.

This soil is moderately well suited to building site development and poorly suited to use as septic tank absorption fields. Site planning for dwellings or roads should consider the hazard of erosion and the moderate shrink-swell potential. Final grading should divert surface water away from the foundation. Preseeding to grasses helps reduce erosion. Installing drains at the base of footings, coating exterior basement walls, and backfilling along basement walls with granular material help prevent wet basements and reduce the possibility of basement walls cracking. Perimeter drains around septic tank absorption fields help lower the seasonal high water table. This soil has numerous sites suitable for ponds.

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

NtC2—Nappanee silty clay loam, 6 to 12 percent slopes, eroded. This is a deep, somewhat poorly drained, sloping soil on knolls and ridges on hummocky parts of end moraines and on side slopes along small streams. Erosion has removed part of the original surface layer. The present surface layer contains subsoil material that has more clay than the original surface layer. Most areas are 5 to 40 acres in size and are branching or lobed shaped.

Typically, the surface layer is dark brown, friable silty clay loam about 6 inches thick. The subsoil is dark brown, mottled, firm silty clay loam and silty clay about 20 inches thick. The underlying material to a depth of about 60 inches is dark brown, very firm silty clay glacial till. In some areas the soil is less eroded, and the surface layer is silt loam. In other areas the subsoil and underlying material have less clay.

Included with this soil in mapping are many small areas of moderately well drained soils. Also included are narrow strips of the poorly drained Pandora soils along drainageways and narrow strips of the somewhat poorly drained Shoals soils along streams. The included soils make up about 20 percent of most areas.

Runoff is rapid. The content of organic matter is moderately low. The surface layer crusts after hard rains. Permeability is very slow. The available water capacity is low or moderately low. The root zone is mainly moderately deep to compact glacial till. The subsoil is strongly acid to mildly alkaline. A seasonal high water table is perched in the upper part of the subsoil in winter and spring and during other extended wet periods. The shrink-swell potential and potential frost action are moderate.

This soil is used as woodland, pasture, and cropland. It has low potential for use as cropland. Controlling erosion, maintaining tilth, and improving drainage are management concerns. Erosion is a very serious hazard if this soil is cultivated. The effects of erosion have made the soil difficult to manage. Tillage should be done at the optimum moisture content because this soil becomes cloddy if tilled when wet. Minimum tillage, grassed waterways, contour tillage, winter cover crops, and small grains or forage in the crop rotation help reduce runoff and soil loss by erosion. In adequately drained areas this soil is suited to no-till planting. Subsurface drains must be closely spaced for uniform drainage because movement of water into these drains is slow. Deep-rooted perennial crops, for example, alfalfa, leave pathways that facilitate the movement of water to subsurface drains.

This soil is suited to use as woodland and as habitat for openland and woodland wildlife. Trees selected for planting should be tolerant of the clay in the subsoil and of some wetness. Seedling mortality can be reduced by mulching.

This soil is moderately well suited to building site development and poorly suited to use as septic tank absorption fields. Seasonal wetness, slope, and the moderate shrink-swell potential limit the use of this soil as a site for buildings. Placing drains at the base of footings and coating the exterior basement walls help prevent wet basements. Excavations along basement walls should be backfilled with material that has a low shrink-swell potential. The distribution lines in septic tank absorption fields should be on the contour to reduce seepage of effluent to the soil surface. Cover should be maintained on the site as much as possible during construction to reduce soil loss by erosion.

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

On—Olentangy mucky silt loam. This is a deep, level, very poorly drained soil in depressions. It is commonly along the margins of large glacial lake basins and in the center of small depressions or potholes. This soil is subject to ponding in fall, winter, and spring. Slope is 0 to 2 percent. Most areas are 5 to 80 acres in size and are roughly circular in shape.

Typically, the surface layer is black, very friable mucky silt loam about 14 inches thick. The layer below that, to a depth of about 40 inches, is dark grayish brown and dark gray, mottled, firm and friable mucky silt loam and silt loam that has mottles between depths of 20 and 28 inches. The underlying material to a depth of about 60 inches is dark gray, friable silt loam. In a few areas about 12 inches of sediment is on top of the original surface layer.

Included with this soil in mapping are a few small areas of Carlisle, Bono, Milford, Luray, Pewamo, and Sloan soils. The Carlisle soils are in the lowest positions. The Bono, Milford, Luray, and Pewamo soils are along the margins of depressions. The Sloan soils are along streams. Also included are a few small areas where the organic material has been burned and a reddish yellow silty residue remains. The included soils make up 5 to 10 percent of most areas.

Permeability is moderate in the subsoil and slow in the underlying material. The root zone is moderately deep or deep to compact glacial till or lacustrine material. The available water capacity and the content of organic matter are very high. The surface layer and subsoil are extremely acid to mildly alkaline. A seasonal high water table is above or near the surface in fall, winter, and spring and during extended wet periods. Runoff is very slow. Soil blowing is moderate. This soil has low strength and high compressibility. Trace element deficiencies are common.

This soil is used mainly as cropland. It has medium potential for row crops, specialty crops, and sod production. In most areas used as cropland the soil has been artificially drained. Both surface and subsurface drainage are needed for crop production. Outlets for subsurface drains are difficult to construct and maintain in most areas. Ditchbanks are unstable. After the soil is drained, subsidence or shrinkage occurs as a result of oxidation of organic matter, and subsurface drainage lines are displaced. Pump drainage systems are used in some areas. Cover crops and windbreaks control soil blowing. Controlled drainage in areas where the water table can be raised or lowered reduces shrinkage and soil blowing. This soil is easy to till. The surface layer commonly needs compacting rather than loosening to create a good seedbed. Because of the very high content of organic matter, this soil is very absorbent of water, nutrients, and pesticides. This soil is soft and highly compressible, and when wet it commonly cannot support narrow-wheeled equipment. During dry periods the risk of fire is a major concern. Because this soil is in low positions, plants are more susceptible to frost than those on most of the nearby mineral soils.

In undrained areas this soil is well suited to use as habitat for wetland wildlife and very poorly suited to trees. In these areas the soil supports some water-tolerant trees and cattails, reeds, and sedges. Wetness seriously limits the use of logging equipment.

This soil is generally not suited to use as a site for buildings and septic tank absorption fields because of ponding, low strength, excess humus, and slow permeability. Local roads can be improved by removing the surface layer and subsoil and replacing them with a suitable base material and by providing drainage.

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

OsB—Oshtemo fine sandy loam, 1 to 6 percent slopes. This is a deep, well drained, nearly level and gently sloping soil on uplands. It is in the highest positions on the local landscape. Most areas are 6 to 160 acres in size and are irregular in shape.

Typically, the surface layer is dark brown, friable fine sandy loam about 9 inches thick. The subsurface layer is dark brown, friable fine sandy loam about 7 inches thick. The subsoil is about 50 inches thick. The upper part is dark brown, friable fine sandy loam and sandy loam; and the middle and lower parts are dark yellowish brown, friable coarse sandy loam. The underlying material to a depth of about 70 inches is light yellowish brown, calcareous, loose, gravelly loamy coarse sand. In some areas the surface layer is sandy loam, loam, or loamy sand. In some areas where the soil is nearly level, the surface layer is darker, and a seasonal high water table is in the lower part of the subsoil for brief periods. In many areas the subsoil has more gravel and slightly more clay.

Included with this soil in mapping are small areas of soils that have thin layers of silt, fine sand, or clay in the subsoil. These soils are in areas where this Oshtemo soil is associated with Fitchville, Tuscola, or Shinrock soils. The layers of silt, fine sand, or clay in these soils cause seepage zones at the base of slopes. Also included are small areas of the somewhat poorly drained Digby soils and the very poorly drained Millgrove soils in depressions, minor drainageways, and seepage spots. Also included are small areas of the moderately well drained Tuscola soils on foot slopes. The included soils make up 10 to 20 percent of most areas.

Runoff is slow or medium. The content of organic matter is moderately low. Permeability is moderately rapid in the subsoil and very rapid in the underlying material. The available water capacity is moderate. The root zone is deep. The subsoil is strongly acid to neutral. The most acid layers are commonly in the upper part of the subsoil.

This soil is used mainly as cropland. It has medium potential for use as cropland. The main crops are corn, wheat, and grass-legume hay. This soil is well suited to orchard and truck crops if it is irrigated. Droughtiness and erosion are the main management concerns. Because the available water capacity is limited, this soil is better suited to crops that mature early in summer than to crops that mature late in summer. It is well suited to no-till planting and to irrigation. Soil blowing is a moderate hazard where slopes are near 6 percent. In other areas erosion is a slight hazard. Plants often show moisture stress in summer. Using minimum tillage or contour tillage, winter cover crops, and small grains and forage in the crop rotation increases infiltration and reduces erosion and runoff. Returning crop residue to the soil and applying barnyard manure increase infiltration. The surface layer can be worked within a wide range of moisture content. Leaching of plant nutrients, especially nitrogen, is moderately rapid. This soil generally responds better to small, frequent applications of fertilizer and lime than to one large application. Random subsurface drains are needed in a few seep areas.

This soil is suited to use as woodland. In a few areas it is used for this purpose. Seedlings are difficult to establish during dry periods in summer. Competing vegetation can be controlled or removed by cutting, spraying, girdling, or mowing.

This soil is suited to use as a site for buildings and septic tank absorption fields. Droughtiness is a problem on lawns during extended dry periods. If lawns are seeded during the drier part of the year, they should be mulched and watered. Sloughing is a hazard in excavations.

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

OsC2—Oshtemo fine sandy loam, 6 to 18 percent slopes, eroded. This is a deep, well drained, sloping and moderately steep soil on hillsides. It is commonly in the higher positions on the local landscape. The relief is irregular and hummocky, and slopes are short and complex. Erosion has removed part of the original surface layer. Most areas are 6 to 20 acres in size and are roughly kidney shaped.

Typically, the surface layer is brown, friable fine sandy loam about 8 inches thick. The subsoil is about 58 inches thick. The upper part is dark brown, friable sandy loam and fine sandy loam; and the lower part is dark yellowish brown, friable coarse sandy loam. The underlying material to a depth of about 70 inches is yellowish brown, calcareous, loose gravelly loamy coarse sand. In some areas the surface layer is sandy loam, loamy sand, or loam. In a few areas where the soils are moderately well drained and less eroded, slopes are 6 to 10 percent. In many areas the subsoil has more gravel and slightly more clay.

Included with this soil in mapping are small areas of soils that have layers of silt loam, fine sand, or silty clay in the subsoil. Also included are small areas of the somewhat poorly drained Digby soils and the very poorly drained Millgrove soils in depressions, intermittent drainageways, and seepage spots. The included soils make up less than 20 percent of most areas.

Runoff is medium or rapid. Although slopes are short, sheet and rill erosion is common because soil particles are easily detached. The content of organic matter is low. Permeability is moderately rapid in the subsoil and very rapid in the underlying material. The available water capacity is moderate. The subsoil is strongly acid to neutral.

In most areas this soil is used for crops. However, it has low potential for use as cropland. Wheat, corn, soybeans, and grass-legume hay are the main crops. Erosion is a moderate or severe hazard. This soil responds well to management practices that reduce erosion and surface runoff, increase infiltration, and add plant nutrients. Plants often show moisture stress in summer. Because the available water capacity is limited, this soil is better suited to crops that mature early than to crops that mature late in summer. It is well suited to no-till planting. Using minimum tillage and contour tillage, winter cover crops, and small grains and forage in the crop rotation increases infiltration and reduces erosion and runoff. Returning crop residue to the soil and applying barnyard manure increase infiltration. Leaching of plant nutrients, especially nitrogen, is moderately rapid. Grassed waterways reduce erosion where runoff water collects in a concentrated flow. This soil generally responds better to small and frequent applications of fertilizer and lime than to one large application. Random subsurface drains are needed in a few seep spots.

In a few areas this soil is used as woodland. Most of the woodland consists of native hardwoods. Seedlings are difficult to establish during dry periods in summer. Competing vegetation can be controlled or removed by cutting, spraying, girdling, or mowing.

This soil is suited to use as a site for buildings and septic tank absorption fields. Slope is a moderate limitation. Buildings should be designed to conform to the natural slope of the land. Land shaping is needed in some areas. Leach lines in septic tank absorption fields should be across the slope to reduce seepage of effluent to the soil surface. Sloughing is a hazard in excavations. Cover should be maintained on the site as much as possible during construction to reduce soil loss by erosion. Stockpiling the surface soil and using it to blanket the surface during final grading helps reestablish plant cover.

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

OsE—Oshtemo fine sandy loam, 18 to 35 percent slopes. This is a deep, well drained, steep and very steep soil on hillsides. Most areas are 2 to 10 acres in size and are narrow and winding in shape.

Typically, the surface layer is dark brown, friable fine sandy loam about 4 inches thick. The subsoil is about 50 inches thick. The upper part is dark brown, friable sandy loam and fine sandy loam; and the lower part is dark yellowish brown, friable coarse sandy loam. The underlying material to a depth of about 70 inches is yellowish brown, loose, gravelly loamy coarse sand. In some areas the surface layer is sandy loam, loam, or loamy sand. In some areas the surface layer and upper part of the subsoil are very strongly acid. In a few cultivated areas the soil is severely eroded. In many areas the subsoil has more gravel and clay.

Included with this soil in mapping are small areas of soils that have layers of silt loam, fine sand, or silty clay in the subsoil. Also included are areas of somewhat poorly drained Digby soils in seep spots, and many areas on the lower part of slopes of Morley soils that formed in glacial till. Also included are some areas adjacent to streams where slopes are 35 to 60 percent. The included soils make up less than 20 percent of most areas.

Runoff is rapid. The content of organic matter is low. Permeability is moderately rapid in the subsoil and very rapid in the underlying material. The available water capacity is moderate. The surface layer and subsoil are strongly acid to neutral.

In most areas this soil is used as woodland or pasture. It has low potential for use as cropland. Steep and very steep slopes and the very severe hazard of erosion limit the use of this soil for cultivated crops. However, in some areas where slopes are 18 to 25 percent this soil is suited to adapted grasses and legumes for hay and pasture. Erosion is a serious hazard if pasture is reseeded or if adequate vegetative cover is not maintained. Reseeding pasture using no-till seeding reduces runoff and erosion. Pasture rotation and timely deferment of grazing are good management practices.

This soil is suited to use as woodland and as habitat for woodland wildlife. The use of logging and planting equipment is moderately limited by the slope. Seedlings are difficult to establish during extended dry periods. Logging roads and skid trails should be protected against erosion and constructed on the contour if possible.

Steep and very steep slopes severely limit the use of this soil as a site for buildings and sanitary facilities. It is poorly suited to these uses. Soil slippage occurs where streams undercut the hillside. Buildings should be designed to conform to the natural slope of the land. Land shaping is needed in some areas. Sloughing is a hazard in excavations. Leach lines in septic tank absorption fields should be across the slope to reduce seepage of effluent to the soil surface. Cover should be maintained on the site as much as possible during construction to reduce the hazard of erosion. In some scenic areas this soil is suited to recreational purposes.

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

Pa—Pandora silty clay loam. This is a deep, nearly level, poorly drained soil on flats and in low-lying areas on glacial till plains. It receives runoff from the adjacent higher soils and is subject to ponding. Most areas are 5 to 160 acres in size and winding in shape.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 8 inches thick. The subsoil is dark grayish brown and yellowish brown, mottled, firm and very firm silty clay loam, silty clay, and clay loam about 55 inches thick. The underlying material to a depth of about 70 inches is dark yellowish brown, very firm silty clay loam glacial till. In some areas the surface layer is black and is higher in organic matter. In other areas the surface layer is silt loam or silty clay. In a few areas on low knolls and ridges the soil is somewhat poorly drained. In some areas along streams it is occasionally flooded. In a few areas the subsoil is 10 to 20 percent gravel, and in other areas it is more acid.

Included with this soil in mapping are small areas of Milford and Bono soils in depressions and along drainageways. The included soils make up 10 percent of most areas.

A seasonal high water table is near or above the surface in winter and spring and during other extended wet periods. The subsoil is slightly acid to mildly alkaline. Permeability is slow. The available water capacity is moderate. However, plants seldom show signs of moisture stress.

In most areas this soil is artificially drained and is used as cropland. It has high potential for use as cropland. Wetness and soil compaction are the major management concerns. Surface drains are used to remove excess surface water. Subsurface drains are effective in lowering the seasonal high water table if adequate outlets are available. Grassed waterways may be needed where surface water flows in channels. This soil is subject to crusting after hard rains. Fall tillage is less likely to cause compaction than spring tillage because the subsoil is usually drier in fall. Tillage that leaves a rough or ridged surface and that partly covers the crop residue increases infiltration, reduces runoff, and hastens drying. Deep-rooted crops, for example, alfalfa, leave pathways that facilitate the movement of water to subsurface drains.

This soil is suited to use as woodland. In some undrained areas it is in second-growth stands of native hardwoods. Wetness limits the use of planting and harvesting equipment in winter and spring. Logging can be performed during the drier part of the year. Tree species that can tolerate wetness should be used in new plantings. Competing vegetation can be reduced by spraying, mowing, or disking.

This soil is poorly suited to use as a site for buildings and septic tank absorption fields. Ponding and the slow permeability are severe limitations. Agricultural drains usually need to be deepened and enlarged to handle storm water in residential areas. Building sites should be landscaped to provide good surface drainage away from the foundation. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. This soil is better suited to houses without basements than to houses with basements. Perimeter drains around septic tank absorption fields lower the seasonal high water table.

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

Pd—Paulding clay. This is a deep, level, very poorly drained soil on large flat glacial lake plains. It is subject to ponding. Slope is 0 to 2 percent.

Typically, the surface layer is dark gray, firm clay about 7 inches thick. The subsoil is multicolored very firm clay about 48 inches thick. The underlying material to a depth of about 60 inches is grayish brown, mottled, very firm clay. In many areas the surface layer is very dark gray and has more organic matter than is typical. In a few small areas near the margin of the lake basin the soil is underlain by glacial till or stratified silty clay loam and silty clay lacustrine sediment. In some areas the surface layer is silty clay, and the subsoil has less clay.

Included with this soil in mapping are small areas of Fulton and Bono soils. The somewhat poorly drained Fulton soils are on rises, and the Bono soils are along the margin of lake plains in finger-shaped areas that extend into the surrounding landscape. The included soils make up less than 10 percent of most areas.

A seasonal high water table is near or above the surface in winter and spring and during other prolonged rainy periods. Runoff is very slow or ponded. The content of organic matter is moderate. This soil crusts after heavy rains. Deep cracks commonly form when the soil is very dry. Infiltration is rapid if cracks are visible. However, if the soil is saturated, infiltration is very slow. Permeability is very slow. The available water capacity is moderate. The root zone is deep and is slightly acid or neutral in the upper part and neutral or mildly alkaline in the lower part. This soil has a high shrink-swell potential. It is highly plastic and soft when wet, very firm when moist, and very hard when dry.

This soil has low potential for use as cropland, even if it is adequately drained. In most areas it is partially drained by surface ditches. Ponding, the clayey surface layer and subsoil, and the very slow permeability make this soil very difficult to manage. Planting and harvesting are often delayed by wetness, even in adequately drained areas. Surface drains and land leveling are more effective than subsurface drains in removing excess water. Subsurface drains must be closely spaced for uniform drainage because movement of water into these drains is slow. Meadow crops in the rotation improve soil structure and internal movement of water. Fall tillage that leaves a rough or ridged surface and partly covers the crop residue allows the winter freeze-thaw cycle to break up compacted clods, hastens drying in spring, and reduces runoff. Compaction is a serious problem if the soil is tilled, planted, or harvested when wet. Ridge planting has been used effectively. Ridges dry out more quickly after rainy periods. This soil is not suited to no-till planting. The clay in the surface layer makes the soil difficult to till. Nitrogen applied in fall is commonly lost by denitrification during winter and spring.

This soil is suited to use as woodland and well suited to use as habitat for wetland wildlife. In large areas it is used for waterfowl nesting and feeding. Tree species selected for planting should be tolerant of wetness. Logging can be done during the drier part of the year.

This soil is generally not suited to use as a site for buildings and septic tank absorption fields. It is poor foundation material.

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

Pm—Pewamo silty clay loam. This is a deep, nearly level, very poorly drained soil on broad flats, in closed depressions, and along intermittent drainageways on ground moraines and end moraines. It receives runoff from the adjacent higher soils and is subject to ponding. Slope is 0 to 2 percent. Most areas are 2 to 320 acres in size and irregular in shape.

Typically, the surface layer is very dark gray, friable silty clay loam about 11 inches thick. The subsoil is about 54 inches thick. The upper part is dark gray and gray, mottled, firm silty clay; the middle part is olive gray, mottled, firm silty clay loam; and the lower part is brown, mottled, firm clay loam. The underlying material to a depth of about 70 inches is dark grayish brown, mottled, very firm clay loam. In some areas the surface layer is thicker than is typical. In other areas it is thinner or lighter in color and has less organic matter. In a few areas the surface layer is silt loam or loam. In a few small areas along drainageways slopes are 3 or 4 percent.

Included with this soil in mapping are small areas of Blount, Bennington, Olentangy, Sloan, and Luray soils. The somewhat poorly drained Blount and Bennington soils are on slight rises. The Olentangy soils are in the center of the larger depressions. The Sloan soils are along drainageways. The Luray soils formed in lacustrine sediment and are in positions similar to those of this Pewamo soil. The included soils make up less than 15 percent of most areas.

Permeability is moderately slow. The available water capacity is high. Runoff is very slow or ponded. A seasonal high water table is near or above the soil surface. The content of organic matter is high. Tilth is generally good although in some areas the soil becomes cloddy if plowed when wet. The root zone is deep. It is slightly acid to mildly alkaline. Erosion is a slight problem except where water flows along furrows or in drainageways.

In most areas this soil is artificially drained and is used for corn, soybeans, and small grains. It has high potential for use as cropland. It responds well to practices that improve drainage and control soil compaction. Surface and subsurface drainage are used to remove excess surface water and lower the seasonal water table. Fall tillage is less likely to compact the soil than spring tillage because the subsoil is usually drier in fall. Tillage that leaves a rough or ridged surface and partly covers the crop residue reduces runoff, increases infiltration, and hastens drying. Grassed waterways are needed in some areas. Deep-rooted crops, for example, alfalfa, leave pathways that facilitate the movement of water to subsurface drains.

In a few undrained areas this soil is used as woodland. Most of the woodland is second-growth, and swamp forest species are dominant. Trees that tolerate wetness should be selected for planting. Plant competition can be reduced by spraying, mowing, or disking.

This soil is poorly suited to use as a site for buildings and septic tank absorption fields. Landscaping of building sites helps drain surface water away from the foundation. Drains at the base of footings help prevent wet basements and reduce damage from the shrinking and swelling of the soil. Coatings on exterior basement walls also help prevent wet basements. Agricultural drains generally need to be deepened and enlarged to carry storm water runoff from residential areas. Perimeter drains around septic tank absorption fields help lower the seasonal high water table.

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

Ps—Pits, gravel. This map unit consists of open excavations from which gravel and sand have been removed. Gravel pits are typically in areas of hummocky relief and on stream terraces where they are associated with Belmore, Glynwood, Lykens, Morley, Oshtemo, and Martinsville soils. Slopes are very irregular because of spoil piles, overburden, and unmined banks. Clay loam glacial till is at the base of many of the pits.

Gravel pits vary considerably in size and depth. Most are 1 to 50 acres in size. Pits smaller than 1 acre are identified by a spot symbol on the soil map. Many of the smaller pits have not been recently used. Most areas are barren. However, the soil is being slowly revegetated by natural plant succession of weeds and grasses, shrubs, and drought-tolerant tree species.

The stripped soil material making up the spoil banks varies in thickness and composition within a short distance. It has poor physical properties and is commonly droughty, gravelly and sandy, and poorly suited to plants. It is subject to erosion and is a potential source of siltation.

Most abandoned gravel pits are used as habitat for wildlife or as pasture. Some have stands of second-growth timber. Pits have low potential for use as cropland because of the irregular slope, shallow root zone, and low fertility. These areas are suited to use as habitat for wildlife and to some recreation uses. Some pits have been used as local dumps. However, they are poorly suited to this use because of the hazard of polluting underground water supplies. Onsite investigation is needed to determine the suitability of pits as sites for buildings and sanitary facilities.

Establishing plant cover on abandoned sites reduces the hazard of erosion and siltation. Grasses and trees that can tolerate droughtiness and the somewhat unfavorable soil properties should be selected for seeding and planting.

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

Pu—Pits, quarry. These are areas where dolomitic limestone has been surface mined for construction and agricultural uses. Limestone has been removed from the Greenfield, Lockport, and Tymochtee Formations. Quarries are commonly on uplands and are associated with Milton and Ritchey soils. Actively mined quarries are continually being enlarged. Most quarries have a high wall on one or more sides.

Included with this unit in mapping are small stockpiles of overburden, loose and processed stone, and processing plants.

Prior to quarrying, the overburden, including the original soil, is usually removed and stockpiled or is used as earthfill. The material below the original soil is generally calcareous. It is very low in organic matter, and the available water capacity is variable. It is highly susceptible to erosion.

Areas that are no longer being mined should be reclaimed to reduce the risk of erosion. Resurfacing with topsoil aids in the establishment and maintenance of plant cover. Plants that are tolerant of a fairly low available water capacity and the unfavorable soil properties should be selected for planting.

Some quarries contain water and can be developed for use as wildlife habitat or for recreation. They are very poorly suited to use as sites for sanitary landfills because of the hazard of polluting ground water aquifers.

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

RaA—Randolph silt loam, 0 to 3 percent slopes. This is a nearly level, moderately deep, somewhat poorly drained soil on long slopes on glacial till plains. Most areas are 10 to 80 acres in size and are irregular in shape.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is multicolored, firm silt loam and silty clay loam about 26 inches thick. The underlying material is light gray, mottled, loose channery sandy loam over dolomitic limestone. Bedrock is at a depth of about 36 inches. In some areas the soil is moderately well drained or has more sand and less clay. In a few areas the soil is deep to bedrock.

Included with this soil in mapping are small areas of Lykens, Milton, and Ritchey soils near the crest of ridges and knobs and Millsdale and Mermill soils in drainageways and slight depressions. Also included are narrow strips along Reevhorn Run and Little Tymochtee Creek where the soil is occasionally flooded. The included soils make up 5 to 10 percent of most areas.

Runoff is slow. The content of organic matter is moderate. The surface layer is fairly high in silt. It crusts after hard rains. Permeability is moderately slow. A seasonal high water table is in the upper part of the subsoil in winter and spring and during other extended wet periods. The root zone is moderately deep to dolomitic limestone bedrock. The root zone is strongly acid to mildly alkaline. The available water capacity is low. The potential frost action is high.

In most areas this soil has been drained and is used as cropland. It has medium potential for use as cropland. It is suited to corn, soybeans, wheat, hay, and pasture. Seasonal wetness and crusting are the major management concerns. Subsurface drains are effective in lowering the seasonal high water table. However, the underlying bedrock is a barrier to the installation of subsurface drains in most areas. Using minimum tillage, planting winter cover crops, and incorporating crop residue or other organic material into the surface layer reduce erosion and crusting and increase infiltration. Timely tillage is important to reduce soil compaction. In adequately drained areas this soil is suited to no-till planting. Because of the low available water capacity, crop yields are reduced in some years.

In a few areas this soil is in trees. It is well suited to trees that tolerate some wetness and to use as habitat for openland and woodland wildlife. Seedlings of adapted species survive and make good growth if competing vegetation is controlled or removed by cutting, spraying, or mowing.

This soil is poorly suited to use as a site for buildings and septic tank absorption fields. Moderate depth to bedrock, the seasonal high water table, moderately slow permeability, and high shrink-swell potential in the subsoil are limitations. This soil is better suited to houses without basements than to houses with basements because of wetness and the need for blasting bedrock in most areas before a basement can be constructed. Drainage ditches and subsurface drains are used to lower the seasonal high water table. Building sites should be landscaped for good surface drainage away from the foundation. The effluent from sanitary facilities can move through fissures in the limestone bedrock and pollute underground water supplies. Central sewage systems should be used in this soil although the bedrock makes installation difficult. Local roads can be improved by using a suitable base material and providing artificial drainage.

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

RhB—Ritchey silt loam, 1 to 6 percent slopes. This is a shallow, nearly level and gently sloping, well drained soil on long gentle slopes on bedrock-controlled ridges. Stone fragments are scattered over the soil surface. Areas are 20 to 640 acres in size and irregular in shape.

Typically, the surface layer is brown, friable silt loam about 5 inches thick. The subsoil is brown, firm clay, friable channery clay loam, and loose channery sandy clay loam about 14 inches thick. The underlying material below a depth of about 19 inches is light gray, porous, dense dolomitic limestone. In some areas the surface layer is darker. In a few areas the soil is shallower to bedrock, and in other areas, especially where the bedrock is fractured, it is deeper to bedrock.

Included with this soil in mapping are small areas of Randolph, Tiro, and Lykens soils. The somewhat poorly drained Randolph soils are in drainageways and in slight depressions. The Tiro and Lykens soils are in areas that are deep to bedrock. The included soils make up less than 20 percent of most areas.

Runoff is medium. The content of organic matter is moderately low. Permeability is moderate. The available water capacity is low because of the shallowness to bedrock. The root zone is slightly acid to moderately alkaline.

This soil is mainly used as cropland. It has low potential for use as cropland unless it is irrigated. Wheat, oats, grass-legume hay, and corn are the common crops. This soil warms early in spring. It is droughty. It is better suited to wheat and oats, which are little affected by the droughtiness, than to corn and soybeans. Early cuttings of hay are generally good. However, in later cuttings yields are sharply reduced. Tillage that leaves a ridged surface and crop residue partially covered reduces runoff and increases infiltration. Contour cultivation also reduces runoff. Small stone fragments can interfere with tillage and harvesting. Grassed waterways are used in some areas. This soil is well suited to no-till planting. Returning crop residue to the soil and adding barnyard manure help reduce crust formation, improve soil structure, and increase infiltration. Applications of lime are seldom needed. Deficiency of some trace elements, especially manganese where soybeans are grown, is a problem in areas where the surface layer is alkaline.

In a few areas this soil is in trees. Because the available water capacity is low, seedlings should be planted early in spring. To reduce windthrow damage, shallow-rooted species should be selected for planting.

This soil is moderately well suited to use as a site for buildings and poorly suited to use as septic tank absorption fields. Blasting is generally required in excavations for basements and to install underground utilities. The soil is better suited to houses without basements than to houses with basements. Foundations placed directly on the bedrock can support very heavy loads. Onsite filtration of waste water is limited by the shallowness to bedrock. The effluent from sanitary facilities can move through fissures in the bedrock and pollute underground water supplies. Septic tank absorption fields should be installed on elevated mounds that have a filtering zone of at least 4 feet above the bedrock. Loamy soil material should be used in these mounds.

This soil is in capability subclass IIIe and in woodland suitability subclass 5d.

RhC—Ritchey silt loam, 6 to 12 percent slopes. This is a well drained, shallow soil on long slopes on bedrock-controlled ridges. Small stone fragments are scattered over the soil surface. Areas are 2 to 20 acres in size and are roughly kidney or lense shaped.

Typically, the surface layer is brown, friable silt loam about 5 inches thick. The subsoil is brown, firm clay, friable clay loam, and loose channery sandy clay loam about 14 inches thick. The underlying material below a depth of about 19 inches is light gray, porous, dense dolomitic limestone. In a few areas bedrock is at a depth of less than 10 inches or more than 20 inches. In some areas the surface layer is channery silt loam. In other areas the subsoil has more sand and less clay.

Included with this soil in mapping are small areas of Lykens and Randolph soils. The moderately well drained, deep Lykens soils have bedrock at a depth of more than 40 inches. The Randolph soils are in drainageways. The included soils make up less than 20 percent of most areas.

Runoff is rapid. The content of organic matter is moderately low. Permeability is moderate. The available water capacity is low. The root zone is shallow to dolomitic limestone. It is slightly acid to moderately alkaline.

This soil is used as cropland. It has low potential for use as cropland. Wheat, oats, grass-legume hay, and corn are the main crops. This soil warms early in spring. It is droughty. This soil is better suited to early season crops, for example, wheat and oats, that are little affected by the droughtiness than to corn and soybeans. Good yields are generally obtained from early cuttings of hay. However, yields from later cuttings are sharply reduced. Erosion is a serious hazard. Contour tillage or tillage that leaves a ridged surface and crop residue partially covered reduces runoff and increases infiltration. Small stone fragments can interfere with tillage and harvesting. Grassed waterways are used in some areas. This soil is well suited to no-till planting. Returning crop residue to the soil and adding barnyard manure help reduce crust formation, improve soil structure, and increase infiltration. Applications of lime are seldom needed. Deficiencies of some trace elements, especially manganese where soybeans are grown, are a problem if the surface layer is alkaline.

In a few areas this soil is used for trees. Because the available water capacity is low, seedlings should be planted early in spring. Shallow-rooted species should be selected for planting to reduce windthrow damage.

This soil is moderately well suited to use as a site for buildings and poorly suited to use as septic tank absorption fields. Blasting is usually required in excavations for basements and to install underground utilities. Slope is also a limitation. This soil is better suited to houses without basements than to houses with basements. Foundations placed directly on the bedrock can support very heavy loads. Onsite filtration of waste water is limited by the bedrock at a depth of 10 to 20 inches and by slope. The effluent from sanitary facilities can move through fissures in the bedrock and pollute underground water supplies. Septic tank absorption fields should be installed on elevated mounds that have a filtering zone of at least 4 feet above the bedrock. Loamy soil material should be used in these mounds. Cover should be maintained on the site as much as possible to reduce runoff and soil loss by erosion.

This soil is in capability subclass IVe and in woodland suitability subclass 5d.

SeB2—Shinrock silt loam, 2 to 6 percent slopes, eroded. This is a deep, moderately well drained, gently sloping soil around the heads of minor streams. This soil receives water from the adjacent higher soils. Slopes are generally short. Erosion has removed part of the original surface layer. The present surface layer contains subsoil material that has more clay. Most areas are 5 to 40 acres in size and are convoluted or ribbon shaped.

Typically, the surface layer is dark brown, friable silt loam about 9 inches thick. The subsoil is about 28 inches thick. The upper part is dark yellowish brown, firm silty clay loam; the middle part is yellowish brown and dark brown, mottled, firm silty clay loam and silty clay; and the lower part is dark brown, mottled, friable silt loam. The underlying material to a depth of about 60 inches is dark brown, friable silt loam and very firm silty clay loam. In some areas the underlying material is glacial till. In a few areas the soil is slightly eroded or severely eroded.

Included with this soil in mapping are small areas of Del Rey, Fitchville, Colwood, Luray, Milford, Blount, Martinsville, and Tuscola soils. The somewhat poorly drained Del Rey and Fitchville soils are on flats and foot slopes. Colwood, Luray, and Milford soils are along intermittent drainageways. The included soils make up less than 20 percent of most areas.

Runoff is medium. The content of organic matter is moderately low. Permeability is moderately slow. The available water capacity is moderate. The subsoil is strongly acid to slightly acid in the upper part and medium acid to mildly alkaline in the lower part. A seasonal high water table is in the lower part of the subsoil during the dormant season and other extended wet periods.

In most areas this soil is used as cropland. It has medium potential for farming if erosion is controlled. Corn, soybeans, wheat, and grass-legume hay are commonly grown. Controlling erosion, reducing compaction, and improving fertility are the main management concerns. Tillage that partially covers crop residue and leaves a rough or ridged surface increases infiltration and reduces erosion. This soil is well suited to no-till planting. Grassed waterways are needed where runoff collects in concentrated flow. Minimum tillage, winter cover crops, contour tillage, and small grains or forage in the crop rotation help reduce erosion.

In a few areas this soil is used as woodland. Most of the woodland consists of second-growth stands of native hardwoods. Plant competition can be reduced by spraying, mowing, or disking. Species selected for planting should be tolerant of the high content of clay in the subsoil.

This soil is moderately well suited to use as a site for buildings and poorly suited to use as septic tank absorption fields. Erosion is a hazard during construction. Stockpiling topsoil and then spreading it during final grading hastens reestablishment of plant cover. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Backfilling along basement walls with material that has a low shrink-swell potential reduces damage from the shrinking and swelling of the soil. Installing perimeter drains and enlarging the leaching area in septic tank absorption fields increases the absorption of effluent. This soil has many good sites for ponds.

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

SeC2—Shinrock silt loam, 6 to 12 percent slopes, eroded. This is a deep, moderately well drained, sloping soil around the heads of minor streams where water becomes concentrated in watercourses. Slopes are generally short. Erosion has removed part of the original surface layer. The present surface layer contains subsoil material that has more clay than the original surface layer. Most areas are 5 to 40 acres in size and are branching, lobed, or ribbon shaped.

Typically, the surface layer is dark brown, friable silt loam about 9 inches thick. The subsoil is about 28 inches thick. The upper part is dark yellowish brown, firm silty clay loam; the middle part is yellowish brown and dark brown, mottled, firm silty clay loam and silty clay; and the lower part is dark brown, mottled, friable silt loam. The underlying material to a depth of about 60 inches is dark brown, friable silt loam and very firm silty clay loam. In some areas the underlying material is glacial till. In a few areas the soil is slightly eroded.

Included with this soil in mapping are small areas of Blount, Colwood, Luray, Milford, Martinsville, Tuscola, Del Rey, and Fitchville soils. The somewhat poorly drained Blount soils are on the lower part of some slopes. The Colwood, Luray, and Milford soils are along minor waterways. Areas of the Martinsville and Tuscola soils are intermingled with areas of this Shinrock soil. The somewhat poorly drained Del Rey and Fitchville soils are on foot slopes. Also included are areas where the soil is severely eroded, the surface layer is silty clay loam, and tilth is poor. The included soils make up less than 20 percent of most areas.

Runoff is rapid. The content of organic matter is moderately low. Permeability is moderately slow. The available water capacity is moderate. The subsoil is strongly acid to slightly acid in the upper part and medium acid to mildly alkaline in the lower part. A seasonal high water table is in the lower part of the subsoil during the dormant season and other extended wet periods.

In most areas this soil is used as cropland. However, it has low potential for use as cropland. The main crops are corn, soybeans, wheat, and grass-legume hay. Controlling erosion, conserving moisture, and improving fertility are major management concerns. Erosion has made this soil difficult to manage. Although the available water capacity is moderate, shallow-rooted plants show moisture stress during extended dry periods because of water lost as runoff. Tillage that partially covers crop residue and leaves a rough or ridged surface reduces erosion and runoff. This soil is well suited to no-till planting. Grassed waterways are used where runoff water collects in concentrated flow. Planting cover crops, using contour tillage, and including small grains and forage in the crop rotation reduce erosion and runoff.

In a few areas this soil is used as woodland. Most of the woodland consists of second-growth stands of native hardwoods. Plant competition can be reduced by spraying, mowing, or disking. Species selected for planting should be tolerant of the high content of clay in the subsoil.

This soil is moderately well suited to use as a site for buildings and poorly suited to use as septic tank absorption fields. Buildings should be designed to conform to the natural slope of the land. Erosion is a hazard during construction. Stockpiling topsoil and then spreading it during final grading hastens reestablishment of plant cover. Drains at the base of footings and coatings on exterior basement walls help prevent wet basements. Backfilling along basement walls with material that has a low shrink-swell potential reduces damage from the shrinking and swelling of the soil. Septic tank absorption fields should be laid out across the slope to reduce seepage to the soil surface. This soil has many good sites for ponds.

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

SfC2—Shinrock-Martinsville complex, 6 to 12 percent slopes, eroded. This complex consists of a moderately well drained Shinrock soil and a well drained Martinsville soil. These are deep, sloping soils on the edge of former glacial lake basins. The areas are mildly dissected. Erosion has removed part of the original surface layer. The areas of the individual soils are so small or so intricately mixed that mapping them separately was not practical. The mapped areas of this complex consist of about 30 percent Shinrock silt loam, 30 percent Martinsville fine sandy loam, and 40 percent other soils. Most of the areas are 5 to 40 acres in size and are branching, lobed, or ribbon shaped.

Typically, the Shinrock soil has a dark brown, friable silt loam surface layer about 9 inches thick. The subsoil is multicolored, firm silty clay loam and friable silt loam about 28 inches thick. It is mottled in the middle and lower parts. The underlying material to a depth of about 60 inches is dark brown, friable silt loam and firm silty clay loam. In a few areas the soil is slightly eroded, and in others it is severely eroded. Where the soil is severely eroded, the surface layer is silty clay loam.

Typically, the Martinsville soil has a dark brown, friable fine sandy loam surface layer about 8 inches thick. The subsoil is about 39 inches thick. The upper part is brown and yellowish brown, friable sandy loam, and the middle and lower parts are dark brown, mottled, firm loam and very friable fine sandy loam. The underlying material to a depth of about 60 inches is yellowish brown, laminated, friable loam, sandy loam, and silt loam. In some areas the soil is slightly eroded, and in others it is severely eroded. In a few areas there is glacial till in the underlying material.

Included with these soils in mapping are small areas of Glenford, Oshtemo, Milford, Luray, Colwood, Del Rey, Fitchville, and Kibbie soils. Glenford soils are intermingled with the major soils; the Oshtemo soils are on the upper part of some slopes; the very poorly drained Milford, Luray, and Colwood soils are in drainageways and depressions; and the somewhat poorly drained Del Rey, Fitchville, and Kibbie soils are on the lower part of slopes. The included soils make up about 40 percent of most areas.

Runoff is rapid, and erosion is a severe hazard. Both soils have a moderately low content of organic matter. The root zone is mainly moderately deep in the Shinrock soil and deep in the Martinsville soil. Permeability is moderately slow in the Shinrock soil and moderate in the Martinsville soil. The available water capacity is moderate in the Shinrock soil and high in the Martinsville soil. A water table is in the lower part of the subsoil of the Shinrock soil in winter and spring and during other extended wet periods. The subsoil of the Shinrock soil is strongly acid to slightly acid in the upper part and medium acid to mildly alkaline in the lower part. The subsoil of the Martinsville soil ranges from strongly acid to neutral.

These soils are used mainly for cultivated crops, although they have low potential for use as cropland. Corn, soybeans, wheat, and grass-legume hay are the main crops. Controlling erosion is a major management concern in farming. If not protected, the soils are subject to sheet, rill, and gully erosion. These soils respond to practices that reduce runoff, correct acidity, and add plant nutrients. They can be cropped successfully, but the cropping system should include small grains and hay or pasture. Tillage methods that only partly cover the crop residue and leave a rough or ridged surface help reduce erosion and control runoff. The soils are well suited to no-till planting. Winter cover crops and contour tillage reduce erosion and control runoff. Grassed waterways may be needed where runoff collects in concentrated flow.

In a few areas these soils are used as woodland, and some areas previously cropped are reverting to woodland. Species selected for planting on the Shinrock soil should be tolerant of the high content of clay in the subsoil. Plant competition can be reduced by spraying, mowing, disking, or girdling.

Because of the good natural drainage of the Martinsville soil, that soil is better suited as a site for buildings and septic tank absorption fields than the Shinrock soil. Buildings should be designed to conform to the natural slope of the land. Land shaping is needed in some areas. Fills should be well compacted to reduce settlement and cracking of foundations. Placing drains at the base of footings and coating the exterior basement walls help prevent wet basements in houses on the Shinrock soil. The distribution lines in septic tank absorption fields should be installed on the contour to reduce seepage of effluent to the surface. Ponds constructed on these soils are subject to seepage that may be difficult to seal.

The capability subclass is IIIe. The Shinrock soil is in woodland suitability subclass 2c and the Martinsville soil in 1o.

SfD2—Shinrock-Martinsville complex, 12 to 18 percent slopes, eroded. This complex consists of deep, moderately well drained Shinrock soil and well drained Martinsville soil on the margin of former glacial lake basins. These soils are moderately steep and are in dissected areas. The areas of the individual soils are so intricately mixed or so small that mapping them separately was not practical. The mapped areas of this complex consist of about 30 percent Shinrock silt loam, 30 percent Martinsville fine sandy loam, and 40 percent other soils. Most of the areas are 2 to 20 acres in size and are crescent shaped.

Typically, the surface layer of the Shinrock soil is dark brown, friable silt loam about 9 inches thick. The subsoil is multicolored, firm silty clay loam and friable silt loam about 28 inches thick. It is mottled in the middle and lower parts. The underlying material to a depth of about 60 inches is dark brown, friable silt loam and firm silty clay loam. In a few areas where the soil is severely eroded the surface layer is silty clay loam.

Typically, the surface layer of the Martinsville soil is dark brown, friable fine sandy loam about 8 inches thick. The subsoil is about 39 inches thick. The upper part is brown and yellowish brown, firm and friable sandy loam; and the lower part is dark brown, firm loam and very friable fine sandy loam. The underlying material to a depth of about 60 inches is yellowish brown, laminated, friable loam, sandy loam, and silt loam. In a few wooded areas the soil is slightly eroded, and in other areas it is severely eroded. In a few areas the underlying material has glacial till.

Included with these soils in mapping are small areas of Glenford, Oshtemo, Milford, Luray, Colwood, Del Rey, Fitchville, and Kibbie soils. Areas of the Glenford soils are intermingled with areas of the Shinrock and Martinsville soils. Oshtemo soils are on the upper part of some slopes. The very poorly drained Milford, Luray, and Colwood soils are in drainageways. The somewhat poorly drained Del Rey, Fitchville, and Kibbie soils are on the lower part of slopes. The included soils make up less than 40 percent of most areas.

Runoff is rapid. The content of organic matter is moderately low for both soils. The root zone is mainly moderately deep in the Shinrock soil and deep in the Martinsville soil. Permeability is moderately slow in the Shinrock soil and moderate in the Martinsville soil. The available water capacity is moderate in the Shinrock soil and high in the Martinsville soil. A seasonal high water table is in the lower part of the subsoil of the Shinrock soil in winter and spring and during other extended wet periods. The subsoil of the Shinrock soil is strongly acid to slightly acid in the upper part and medium acid to mildly alkaline in the lower part. The subsoil of the Martinsville soil is strongly acid to neutral.

These soils are used mainly for pasture and as woodland. In some areas they are occasionally used for crops. These soils have low potential for use as cropland. Controlling erosion, conserving moisture, and maintaining fertility are management concerns. Sheet, rill, and gully erosion occur in unprotected areas. The cropping system should include long-term hay or pasture. Using winter cover crops and minimum tillage reduces erosion and runoff. These soils are suited to no-till planting. Grassed waterways are used to reduce runoff and gully erosion where water collects in natural channels.

These soils are suited to trees and to use as habitat for openland and woodland wildlife. Most of the woodland is mixed stands of native hardwoods. Logging roads and skid trails should be protected against erosion by water bars or other practices. Plant competition can be reduced by spraying, mowing, disking, or girdling.

These soils are poorly suited to use as a site for buildings and septic tank absorption fields. Extensive land shaping is generally needed to prepare a site for buildings. Material used as fill should be well compacted to reduce settling and cracking of foundations. The Martinsville soil is better suited as a site for buildings and septic tank absorption fields than the Shinrock soil. On the Shinrock soil, placing drains at the base of the foundation and coating the exterior basement walls help prevent wet basements. The distribution lines in septic tank absorption fields should be installed on the contour to reduce seepage of effluent to the soil surface.

These soils are in capability subclass IVe. The Shinrock soil is in woodland suitability subclass 2c, and the Martinsville soil is in subclass 1r.

Sg—Shoals silt loam, rarely flooded. This is a deep, nearly level, somewhat poorly drained soil on low stream terraces along the major streams. It is a few feet higher than the flood plain and is flooded during periods of unusually high runoff. Slope is 0 to 2 percent. Most areas are 5 to 40 acres in size and are crescent or ribbon shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is grayish brown and dark yellowish brown, mottled, friable and firm silt loam about 30 inches thick. The underlying material to a depth of about 60 inches is grayish brown, firm stratified loam and silt loam. In a few areas the surface layer is darker. In some areas the soil is poorly drained and is in drainageways and slight depressions. In a few areas the subsoil has strongly acid layers. A few areas are occasionally flooded.

Included with this soil in mapping are small areas of Lindside, Medway, Bono, Chagrin, Belmore, and Haney soils. The moderately well drained Lindside soils are on flood plains. The moderately well drained Medway soils are on flats and very slight rises. The very poorly drained Bono soils are in old stream channels. The well drained Chagrin and Belmore soils and the moderately well drained Haney soils are on slight rises and low knolls. The included soils make up 10 to 30 percent of most areas.

A seasonal high water table is at a depth of 12 to 36 inches in winter and spring and during other extended wet periods. The surface layer is high in silt and moderate in organic matter. It crusts after hard rains. Crusting reduces infiltration and increases runoff. Permeability is moderate. The available water capacity is high. The root zone is deep and is slightly acid or neutral.

In most areas this soil is artificially drained and is used for crops. It has medium potential for use as cropland. Corn, soybeans, wheat, and hay are commonly grown. The seasonal high water table is the major management concern. Surface drains are effective in removing ponded floodwater from most areas. Subsurface drains are used to lower the seasonal high water table. Tillage that partially covers crop residue and leaves the surface rough or ridged reduces crusting and hastens soil drying. Planting deep-rooted crops, for example, alfalfa, increases the internal movement of water to drains. If adequately drained, this soil is suited to no-till planting.

In a few areas this soil is in native mixed hardwoods. It is well suited to trees and other vegetation grown as habitat for openland and woodland wildlife. Species that can tolerate some wetness should be selected for plantings. Plant competition can be reduced by spraying, mowing, or disking.

Because of the rare flooding and seasonal wetness, this soil is generally not suited as a site for buildings and is poorly suited to septic tank absorption fields. Structures such as roads, bridges, farm buildings, or recreation facilities need special design to prevent flood damage. Structures should be elevated above the known high-water level. Material used as fill should not block the flow of floodwaters. Levees are used to protect the soil in a few areas. However, these levees tend to increase the water level on unprotected soils nearby. In areas protected from flooding, septic tank absorption fields can be improved by installing perimeter drains.

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

Sh—Shoals silt loam, occasionally flooded. This is a deep, nearly level, somewhat poorly drained soil on flood plains. Along major streams it is in low areas near slope breaks to uplands or terraces. Along the smaller streams it is the dominant soil on the flood plains and is subject to flooding following intense local thunderstorms (fig. 5). Brief flooding usually occurs in fall, winter, and spring. Flooding occasionally occurs

Figure 5.—Narrow flood plain of Shoals silt loam, occasionally flooded, along a meandering stream. Shinrock-Martinsville complex, 6 to 12 percent slopes, eroded, is on the slope breaks to the uplands.

during the growing season. Slope is 0 to 2 percent. Most areas are 5 to 160 acres in size and long and narrow in shape.

Typically, the surface layer is dark grayish brown, friable silt loam about 11 inches thick. The substratum to a depth of about 60 inches is multicolored, friable silt loam and loam. In some small areas the surface layer is loam, sandy loam, or silty clay loam. In a few areas in depressions and along former stream channels the soil is poorly drained, and the subsoil has more clay. On many of the smaller flood plains, clay loam or silty clay loam till is at a depth of 40 to 60 inches. In a few areas the soil is rarely flooded.

Included with this soil in mapping are small areas of Genesee, Chagrin, Lindside, Medway, Pandora, and Pewamo soils. The well drained Genesee and Chagrin soils and the moderately well drained Lindside and Medway soils are near stream channels and on slightly elevated parts of flood plains. The poorly drained Pandora soils and the very poorly drained Pewamo soils are at the upstream end of small flood plains. The included soils make up 20 to 40 percent of most areas.

Runoff is slow. The content of organic matter is moderate. The root zone is deep and is slightly acid to mildly alkaline. A seasonal high water table is at a depth of 12 to 36 inches in winter and spring and during other extended wet periods. Permeability is moderate. The available water capacity is high.

The potential of this soil for various uses depends on the degree of protection from flooding and the extent to which adequate drainage is provided. In some areas in the wider valleys it is used as cropland. In most areas in the narrower valleys it is used for pasture or as woodland. This soil has medium potential for use as cropland. The hazard of flooding and wetness are limitations. They delay planting in most years and limit the choice of crops. This soil is suited to row crops that can be planted when flooding is not a major threat. Flooding has increased on this soil as more areas on the uplands are cultivated. The level of flooding can be reduced by keeping existing channels free of logs and debris. Surface and subsurface drains are effective in removing ponded water after flooding and in lowering the seasonal water table. However, in some areas on narrow flood plains this soil is difficult to drain. In some areas diversions are needed on the lower part of the slope breaks to uplands and terraces. Tillage that partially covers crop residue and leaves a rough or ridged surface reduces removal of crop residue by floodwaters, hastens drying, and increases infiltration. In adequately drained areas this soil is suited to no-till planting. Weed control is difficult on this soil because weed seeds are carried in by floodwaters.

This soil is suited to trees and other vegetation grown as habitat for openland and woodland wildlife. Species that are tolerant of some wetness and can withstand flooding should be selected for planting.

This soil is generally not suited to use as a site for buildings and septic tank absorption fields. It is suited to recreation uses, for example, hiking trails, during the drier part of the year.

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

So—Sloan silt loam, occasionally flooded. This is a deep, nearly level, very poorly drained soil in depressions on flood plains. Brief flooding usually occurs in winter and spring. Flooding occasionally occurs during the growing season. Slope is 0 to 2 percent. Most areas are 5 to 80 acres in size and long and narrow in shape.

Typically, the surface layer is very dark grayish brown, friable silt loam about 12 inches thick. The subsurface layer is very dark gray, mottled, friable silty clay loam about 8 inches thick. The subsoil is dark grayish brown and grayish brown, mottled, firm silt loam and silty clay loam about 25 inches thick. The underlying material to a depth of about 60 inches is gray, mottled, firm, stratified silt loam and loam. In some areas the surface layer is silty clay loam, and in a few areas it is mucky silt loam. In a few areas in old channels the subsoil has more clay. In some areas along drainage ditches the subsoil is strongly acid or medium acid.

Included with this soil in mapping are small areas of Colwood, Millgrove, Medway, and Olentangy soils. The Colwood, Medway, and Millgrove soils are in slightly higher positions than this Sloan soil and are rarely flooded. The Olentangy soils are in a few of the deeper depressions. The included soils make up 10 to 25 percent of most areas.

A seasonal high water table is near the surface in the dormant season and during prolonged rainy periods. Runoff is very slow. In some areas this soil is ponded. The content of organic matter is high. This soil has good tilth. Permeability is moderate or moderately slow. The available water capacity is high. The root zone is slightly acid to mildly alkaline.

In most areas this soil is used as cropland. In a few areas it is used for pasture. This soil has high potential for use as cropland. Flooding and wetness are management concerns. They delay planting and limit the choice of crops. In drained areas this soil is suited to row crops. Flooding often damages winter grain crops. Tillage should be done at the optimum moisture content because this soil becomes cloddy and compacted if worked when wet. If suitable outlets are available, surface and subsurface drains are effective in removing ponded water and lowering the seasonal high water table. Minimizing tillage, incorporating crop residue, and planting cover crops maintain tilth and protect the surface in areas that are subject to scouring by floodwaters. Spring tillage and planting should be delayed until flooding is no longer a major hazard.

This soil is well suited to native hardwoods and to habitat for wetland wildlife. Species that can tolerate wetness should be selected for planting. Plant competition can be reduced by spraying, mowing, or disking. Wetness limits the use of tree planting and logging equipment in winter and spring.

This soil is generally not suited to use as a site for buildings and septic tank absorption fields because of the flooding hazard and seasonal wetness. In some areas this soil is protected by flood control measures. Structures such as farm buildings and roads can be elevated above the flood level. However, the fill should not block the flow of water. Local roads can be improved by providing artificial drainage and a suitable base material.

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

TrA—Tiro silt loam, 0 to 2 percent slopes. This is a deep, nearly level, somewhat poorly drained soil on water-modified till plains. It is on low knolls near the margin of former glacial lake plains and receives very little runoff from the adjacent soils. Most areas are 5 to 80 acres in size and are convoluted in shape.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 24 inches thick. The upper and middle parts are dark brown and yellowish brown, mottled, firm silty clay loam; and the lower part is dark brown, mottled, firm loam. The underlying material to a depth of about 60 inches is dark grayish brown, firm and very firm silty clay loam glacial till. In some small areas the surface layer is fine sandy loam. In other areas the loamy layer above the glacial till is thicker. In a few areas the soil formed entirely in glacial till or silty lacustrine sediment. In some areas the subsoil is less acid.

Included with this soil in mapping are small areas of Pewamo, Pandora, Lykens, Cardington, Glynwood, and Tuscola soils. The very poorly drained Pewamo soils and the poorly drained Pandora soils are in depressions and along drainageways. The moderately well drained Lykens, Cardington, Glynwood, and Tuscola soils are on low knolls. The included soils make up less than 15 percent of most areas.

Runoff is slow. The content of organic matter is moderate. The surface layer crusts after heavy rains. Permeability is moderate in the subsoil and moderately slow or slow in the substratum. The root zone is moderately deep or deep to compact glacial till. A seasonal high water table is in the upper part of the subsoil in winter and spring and during other extended wet periods. The available water capacity is moderate. The subsoil is strongly acid to slightly acid in the upper and middle parts and slightly acid to mildly alkaline in the lower part.

This soil is used mainly as cropland. It has medium potential for use as cropland. Corn, soybeans, and wheat are commonly grown in rotation. In a few areas this soil is used for grass-legume hay. Wetness delays tillage, planting, and harvesting. Both surface and subsurface drains are used to remove excess surface water and lower the seasonal high water table. Tillage that leaves a rough or ridged surface and crop residue partially covered and the application of barnyard manure increase infiltration and reduce runoff and surface crusting. Fall tillage is less likely to cause compaction than spring tillage because the subsoil is usually drier in fall. However, in fall the soil is more susceptible to runoff and erosion. In drained areas this soil is suited to no-till planting. Deep-rooted crops, for example, alfalfa, leave pathways that facilitate the movement of water to subsurface drains.

This soil is suited to use as woodland, and in a few areas it is used as woodland. Species selected for planting should be tolerant of some wetness. Plant competition can be reduced by spraying, mowing, or disking.

This soil is moderately well suited to use as a site for buildings and poorly suited to use as septic tank absorption fields. It is better suited to houses without basements than to houses with basements. Perimeter drains, foundation drains, french drains, and surface grading are used to remove water from around buildings. Agricultural drains usually need to be deepened and enlarged to handle storm water in residential areas. Increasing the size of absorption fields and using perimeter drains increase the absorption of effluent in septic tank absorption fields. Using artificial drainage and suitable base material under local roads and streets reduces damage from frost action and increases soil strength.

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

TrB—Tiro silt loam, 2 to 6 percent slopes. This is a deep, gently sloping, somewhat poorly drained soil on water-modified till plains. It is on knolls along the margins of former glacial lakes. Most areas are 5 to 40 acres in size and convoluted or roughly circular in shape.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 24 inches thick. The upper and middle parts are dark brown and yellowish brown, mottled, firm silty clay loam; and the lower part is yellowish brown, mottled, firm loam. The underlying material to a depth of about 60 inches is dark grayish brown, very firm and firm silty clay loam glacial till. In some small areas the surface layer is sandy loam. In other areas the loamy layer above the glacial till is thicker. In a few areas the soil formed entirely in glacial till or silty lacustrine sediment. In some areas the subsoil is less acid.

Included with this soil in mapping are small areas of Pewano, Pandora, Lykens, Tuscola, Glynwood, and Cardington soils. The very poorly drained Pewamo soils and the poorly drained Pandora soils are in depressions and along minor drainageways. The moderately well drained Lykens and Tuscola soils and the eroded Glynwood and Cardington soils are on knolls and side slopes. The included soils make up less than 15 percent of most areas.

Runoff is medium. The content of organic matter is moderate. The surface layer crusts after heavy rains. Permeability is moderate in the subsoil and moderately slow or slow in the substratum. A seasonal high water table is in the upper part of the subsoil in winter and spring and during other extended wet periods. The available water capacity is moderate. The root zone is moderately deep or deep to compact glacial till. The subsoil is strongly acid to slightly acid in the upper and middle parts and slightly acid to mildly alkaline in the lower part.

This soil is used mainly as cropland. It has medium potential for use as cropland. Corn, soybeans, and wheat are commonly grown in rotation. In a few areas this soil is used as hay. This soil responds well to good management. Controlling erosion, lowering the seasonal high water table, increasing the infiltration rate, preventing soil compaction, and improving nutrient availability are management concerns. Subsurface drains are commonly used to remove excess water from the subsoil. Tillage that leaves crop residue partially covered, winter cover crops, close-growing crops used in the rotation, and contour tillage help reduce sheet erosion and crusting. Grassed waterways are used in some areas to control gully and rill erosion. Deep-rooted legumes and grasses in the rotation help maintain pathways for water to move to drains. In adequately drained areas this soil is suited to no-till planting.

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

This soil is moderately well suited to use as a site for buildings and poorly suited to use as septic tank absorption fields. Because of seasonal wetness, this soil is better suited to houses without basements than to houses with basements. Drains at the base of footings help prevent wet basements; also the exterior basement walls should be coated. Increasing the size of the absorption field and using perimeter drains increase the absorption of effluent in septic tank absorption fields.

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

TuB—Tuscola fine sandy loam, 2 to 6 percent slopes. This is a deep, moderately well drained, gently sloping soil on knolls and ridges on the margins of former glacial lakes. It is commonly in the highest positions on the local relief. Areas are 5 to 40 acres in size and are roughly crescent shaped.

Typically, the surface layer is dark grayish brown, friable fine sandy loam about 10 inches thick. The subsoil is about 48 inches thick. The upper part is yellowish brown and brown, mottled friable fine sandy loam; and the lower part is brown, mottled, friable sandy loam and sandy clay loam. The underlying material to a depth of about 60 inches is brown, laminated, firm silty clay loam. In a few areas this soil has less clay throughout, and in other areas the lower part of the subsoil has some gravel. In some areas the surface layer is loam or silt loam. In a few areas the soil is well drained.

Included with this soil in mapping are small areas of Colwood, Milford, Tiro, Del Rey, Kibbie, Fitchville, and Shinrock soils. The very poorly drained Colwood and Milford soils are in minor drainageways and depressions. The somewhat poorly drained Tiro, Del Rey, Kibbie, and Fitchville soils are on the lower part of some slopes. The Shinrock soils are on the upper part of slopes. The included soils make up about 15 percent of most areas.

Runoff is medium. The content of organic matter is moderately low. Permeability is moderate. The available water capacity is high. The root zone is deep. The subsoil is medium acid to neutral. A seasonal water table is often in the lower part of the subsoil during the dormant season and after prolonged rainy periods.

In most areas this soil is used as cropland. This soil has medium potential for crop production. Corn, soybeans, and wheat are commonly grown in rotation. Some fields are occasionally returned to hay. If this soil is irrigated, it is suited to a variety of special crops, for example, strawberries. Tillage that leaves crop residue partially covered, cover crops, small grains or forage used in the rotation, contour tillage, and grassed waterways reduce runoff and soil loss by erosion. This soil erodes easily. It is suited to no-till planting and to deep-rooted perennials, for example, alfalfa.

This soil is well suited to use as woodland and as habitat for openland and woodland wildlife. In a few areas it is used as woodland. Plant competition can be reduced by spraying, mowing, disking, or girdling.

This soil is suited to use as a site for buildings and moderately well suited to use as septic tank absorption fields. Because of the seasonal wetness and the apparent water table this soil is better suited to houses without basements than to houses with basements. Drains at the base of footings and a coating on exterior basement walls help prevent wet basements. Sloughing is a hazard in excavations. Material used as fill should be well compacted to reduce settlement and cracking of foundations. Using artificial drainage and suitable base material under local roads reduces damage from frost action. Perimeter drains around septic tank absorption fields help lower the seasonal high water table.

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

Ud—Udorthents, loamy. These are deep, gently sloping to steep soils on landfills and quarries and on manmade features such as ditches, earthfills, and spoil piles. In surface mining the areas, earthmoving and grading have obliterated or mixed the original surface layer, subsoil, and underlying material. Slope ranges from 2 to 25 percent. Most areas are 10 to 80 acres in size and are rectangular or polyhedral in shape.

Typically, the surface layer is dark gray, friable clay loam about 2 inches thick. The underlying material is dark gray, firm and very firm clay loam.

Included with these soils in mapping are small areas of shallow fill over undisturbed soils. Spoil piles of rock material such as lime dust and large stones are included near quarries. Also included are small areas of nonsoil material, for example, wood, metal, glass, rubber, and other organic debris. These inclusions make up about 20 percent of most areas.

Runoff is rapid. The content of organic matter is very low. Permeability varies; however, it is generally very slow. The available water capacity is very low. These soils are neutral to moderately alkaline throughout.

Many of the earth structures or spoil banks have been reseeded to fescue or trees. The soils have very low potential for use as cropland.

Controlling erosion, improving fertility and drainage, selecting adapted plant species, and controlling pollution are management concerns. The hazard of erosion is slight where slopes are gentle and short. However, where slopes are steep or long, runoff is very rapid, and sheet, rill, and gully erosion are active. Grading and reshaping are often necessary to control surface water. In some areas, outlet structures are needed to control the flow of water into streams. Sediment ponds may be needed to trap sediment. In some of the less sloping areas, surface and subsurface drains are needed. Reseeding helps control runoff. Native or adapted species that provide rapid ground cover and that tolerate the neutral to moderately alkaline soil and low fertility should be selected. Blanketing with topsoil assures more rapid establishment of plant cover. Mulching of seedlings helps retain moisture and increase growth. Seepage from included areas of buried waste needs to be contained to prevent stream pollution. Uneven settlement of compacted fill and seepage from included areas of toxic wastes are potential hazards. Some borrow areas do not have good drainage outlets.

The suitability of these soils as a site for buildings depends on the slope, compaction, and drainage. These soils are generally not suited to septic tank absorption fields. Onsite investigation is needed to determine suitability for a specific land use.

These soils are not assigned to a capability subclass or woodland suitability subclass.

Ur—Urban land-Udorthents complex. This complex consists of industrial and commercial sites, pavement and berm of highways, and deep, gently sloping to steep soils. Extensive excavations and fillings are included in these areas. Industrial and commercial sites are about 90 percent Urban land and 5 percent Udorthents. Highway areas are about 30 percent Urban land and 65 percent Udorthents. Slope ranges from 2 to 25 percent. Most of the mapped areas of this complex are 10 to 80 acres in size and are rectangular in shape.

Urban land is covered by streets, parking lots, buildings, and other structures that have so altered the soils that identification is not feasible.

Typically, the surface layer of Udorthents is dark gray, friable clay loam about 2 inches thick. The underlying material is dark gray, firm and very firm clay loam.

Included with this complex in mapping are areas of shallow fill over undisturbed soils. These inclusions make up about 5 percent of most areas.

Runoff is rapid. The content of organic matter, permeability, and available water capacity of Udorthents vary greatly. Generally, the content of organic matter is very low, permeability is very slow, and the available water capacity is very low. These soils are neutral to moderately alkaline.

In most areas of this complex, construction has taken place. Rill, sheet, and gully erosion are common in areas of Udorthents. Grasses, shrubs, and weeds grow slowly. In many areas these soils have been reseeded to fescue or trees. The suitability of this complex as a site for buildings and highways varies. Onsite investigation is needed to determine the potential or the limitations for any proposed use.

Vegetation should be maintained on Udorthents to reduce the risk of erosion. In some areas, drainage outlet structures are needed to control the flow of water into streams. Sediment ponds help trap sediment before it enters streams. Blanketing with topsoil increases the water-holding capacity and assures more rapid establishment of plant cover. Seedlings should be mulched to help retain moisture.

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

prime farmland

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

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

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

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

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

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

prime farmland in Wyandot County

About 228,500 acres, or nearly 88 percent of the county, is prime farmland. The western and central parts of the county are dominantly prime farmland. Many areas throughout the rest of the county are also prime farmland. The largest areas are in soil associations 1, 3, 6, 8, 10, and 11 on the general soil map. Many scattered areas of prime farmland are in the other associations.

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

An analysis of the long-term trends, based on yields from about 1940 to 1975, indicates that the prime farmland soils are responding to improved technology. For example, average yields of corn have increased from about 45 bushels per acre in 1940 to more than 100 bushels per acre in 1976. Similar increases have been recorded for soybeans and wheat.

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

BeA Belmore loam, 0 to 2 percent slopes
BeB Belmore loam, 2 to 6 percent slopes
BgA Bennington silt loam, 0 to 2 percent slopes (where drained)
BgB Bennington silt loam, 2 to 6 percent slopes (where drained)
BoA Blount silt loam, 0 to 2 percent slopes (where drained)
BoB Blount silt loam, 2 to 6 percent slopes (where drained)
Br Bono silty clay (where drained)
CdB2 Cardington silt loam, 2 to 6 percent slopes, eroded
Cm Chagrin silt loam, rarely flooded
Co Colwood silt loam (where drained)

DeA Del Rey silt loam, 0 to 2 percent slopes (where drained)
DeB Del Rey silt loam, 2 to 6 percent slopes (where drained)
DgA Digby loam, 0 to 3 percent slopes (where drained)
EtA Elliott silt loam, 0 to 3 percent slopes
FcA Fitchville silt loam, 0 to 2 percent slopes (where drained)
FcB Fitchville silt loam, 2 to 6 percent slopes (where drained)
FuA Fulton silty clay loam, 0 to 2 percent slopes (where drained)
Ge Genesee silt loam, occasionally flooded
GfB Glenford silt loam, 2 to 6 percent slopes
GwB Glynwood silt loam, 2 to 6 percent slopes
GwB2 Glynwood silt loam, 2 to 6 percent slopes, eroded
HaA Haney loam, 0 to 2 percent slopes
HaB Haney loam, 2 to 6 percent slopes
HkA Haskins loam, 0 to 2 percent slopes (where drained)
HkB Haskins loam, 2 to 6 percent slopes (where drained)
KbA Kibbie fine sandy loam, till substratum, 0 to 2 percent slopes
KbB Kibbie fine sandy loam, till substratum, 2 to 6 percent slopes
KcA Kibbie-Blount complex, 0 to 2 percent slopes (where drained)
KcB Kibbie-Blount complex, 2 to 6 percent slopes (where drained)
Lb Latty silty clay loam (where drained)
Lc Latty silty clay (where drained)
Lk Lindside silt loam, occasionally flooded
Lu Luray silty clay loam (where drained)
LyA Lykens silt loam, 0 to 2 percent slopes
LyB Lykens silt loam, 2 to 6 percent slopes
LzB Lykens-Milton silt loams, 2 to 6 percent slopes
MaB Martinsville fine sandy loam, 2 to 6 percent slopes
Md Medway silt loam, rarely flooded
Mf Mermill loam (where drained)
Mg Mermill silty clay loam (where drained)
Mh Milford silty clay loam (where drained)
Mk Millgrove silt loam (where drained)
Mm Millsdale silty clay loam (where drained)
MoA Milton silt loam, 0 to 2 percent slopes
MoB Milton silt loam, 2 to 6 percent slopes
NpB Nappanee silt loam, 2 to 6 percent slopes (where drained)
NtA Nappanee silty clay loam, 0 to 2 percent slopes (where drained)
NtB2 Nappanee silty clay loam, 2 to 6 percent slopes, eroded (where drained)
OsB Oshtemo fine sandy loam, 1 to 6 percent slopes
Pa Pandora silty clay loam (where drained)
Pm Pewamo silty clay loam (where drained)
RaA Randolph silt loam, 0 to 3 percent slopes (where drained)
SeB2 Shinrock silt loam, 2 to 6 percent slopes, eroded
Sg Shoals silt loam, rarely flooded (where drained)
Sh Shoals silt loam, occasionally flooded (where drained)
So Sloan silt loam, occasionally flooded (where drained)
TrA Tiro silt loam, 0 to 2 percent slopes (where drained)
TrB Tiro silt loam, 2 to 6 percent slopes (where drained)
TuB Tuscola fine sandy loam, 2 to 6 percent slopes

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

R.G. Courtright, county extension agent, Cooperative Extension Service, helped prepare this section.

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

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

Each map unit is rated according to its potential for the production of cultivated crops and hay. Soil potential ratings are classes that indicate the relative quality of a soil for a particular use compared with other soils in a given area. Crop yields, the relative cost of applying modern technology to minimize the effects of any soil limitations, and the adverse effects of continuing limitations, if any, are considered in developing the ratings. Corn, soybeans, wheat, and a grass-legume hay were the specific crops used in the Wyandot County study.

The soil potential classes used in this survey are high, medium, and low.

High potential—Production is at or above the level of local standards, the cost of measures to overcome soil limitations is judged locally to be favorable in relation to the expected yields, and the soil limitations that remain after corrective measures are installed do not detract appreciably from environmental quality or economic returns.

Medium potential—Production is somewhat below local standards, or the cost of measures to overcome soil limitations is judged to be high, or the soil limitations that remain after corrective measures are installed detract from environmental quality or economic returns.

Low potential—Production is significantly below local standards, or the cost of measures to overcome soil limitations is very high, or the soil limitations that remain after corrective measures are installed detract appreciably from environmental quality or economic returns.

The potential ratings were made with assistance from the Cooperative Extension Service, Ohio Agriculture Research and Development Center, and the Ohio Department of Natural Resources, Capability Analysis Program. The worksheets and a list of criteria used to develop the ratings are available in the local office of the Soil Conservation Service.

In 1974, less than 195,000 acres, or 75 percent of the county, was used for crops and pasture, according to the Census of Agriculture for that year. About 178,000 acres of this total was used as cropland that was harvested, 8,000 acres was used only for pasture, and 9,000 acres was used as all other cropland.

The potential for increased crop production in Wyandot County is good. Both the acreage farmed and the yields per acre can be increased. About 10,000 acres of potentially good cropland is currently being used as woodland (*10*). However, the cost of converting to cropland and the impact of the loss of the woodland need to be considered. Food production can also be increased by applying the latest crop production technology to the existing cropland in the county.

Very little of the cropland and pastureland in Wyandot County has been used for urban development. In 1967 an estimated 10,000 acres was used as urban land (*10*). Urban land has been increasing at a rate of about 50 acres per year.

Soil drainage is the major management concern in Wyandot County. On nearly 75 percent of the cropland and pasture, wetness is a hazard. Subsurface and surface drains are used to remove excess water to allow tilling and planting early in spring. Short season or early maturing crop varieties can be harvested earlier. Subsurface drains lower the seasonal water table and thus increase the depth to which plant roots can penetrate.

Some of the soils commonly have a seasonal high water table above or near the surface. Natural drainage outlets are not available because of the position of the soils on the landscape. If subsurface drainage is not provided, these soils are usually too wet to produce most of the crops commonly grown. The very poorly drained Bono, Colwood, Latty, Luray, Milford, Millgrove, Millsdale, Mermill, Paulding, Pewamo, and Sloan soils and the poorly drained Pandora soils have a seasonal high water table. These soils make up 78,174 acres, or 36 percent of Wyandot County.

The somewhat poorly drained soils have a water table in the upper part of the subsoil in winter and spring, Subsurface drainage is needed for most crops. Even if they are drained, these soils generally stay wet longer than the associated poorly drained and very poorly drained soils. Crop growth and yields are generally less if the soils are not drained. Planting and harvesting are usually delayed. The Bennington, Blount, Del Rey, Digby, Elliott, Fitchville, Fulton, Haskins, Kibbie, Nappanee, Randolph, Shoals, and Tiro soils are somewhat poorly drained. These soils make up 116,630 acres, or 45 percent of the county.

The Cardington, Glenford, Glynwood, Haney, Lykens, Shinrock, and Tuscola soils are moderately well drained. These soils commonly include areas of wetter soils in seeps and swales and along drainageways, especially where slopes are 2 to 6 percent. Surface and subsurface drains are effective in these wetter areas.

The design of both surface and subsurface drainage systems varies with the type of soil and the availability of adequate outlets. A combination of surface drainage and subsurface drainage is needed in most areas of the poorly drained, very poorly drained, and somewhat poorly drained soils that are intensively row cropped. Soils that have slow or very slow permeability require closer spacing of drains than soils that are more permeable. Subsurface drainage is very slow in Bono, Fulton, Latty, Nappanee, and Paulding soils. Open ditches that provide outlets for subsurface drainage systems are costly to build and maintain in areas of the poorly drained and very poorly drained soils.

Special drainage is needed to control the depth and the period of drainage in organic soils. Carlisle and Olentangy soils are organic soils. These soils oxidize and subside when the pore spaces are filled with air. Oxidation and subsidence are minimized by keeping the water at the level required by crops during the growing season and then raising it to the surface during the rest of the year. Information on drainage design for each soil in the survey area is available at the local office of the Wyandot Soil and Water Conservation District.

Maintaining a drainage system is more economical than replacing the system. Seeding ditchbanks and berms reduces streambank erosion and slumping of banks. Removing brush reduces the risk of floodwater rising above the level of outlets for subsurface drains. Animal guards prevent animals from damaging subsurface drains and blocking the flow of water. Replacing broken drains keeps silt from accumulating on the bottom of the drains and blocking drainage.

Soil erosion is a major management concern on about 31 percent of the land in Wyandot County. Erosion is a hazard where slopes are more than 2 percent. Where slopes are 2 to 6 percent, Bennington, Blount, Del Rey, Fitchville, Haskins, Kibbie, Nappanee, and Tiro soils are subject to erosion and to wetness.

Soil erosion is damaging for two reasons. Soil productivity is lost, and surface water in streams and lakes is polluted. Erosion of the surface layer is especially damaging on soils that have a clayey subsoil, for example, Cardington, Glynwood, Morley, Nappanee, and Shinrock soils. As the surface layer is removed, part of the subsoil is incorporated into the plow layer. The clay in the surface layer decreases soil tilth. The soils then require more energy to till and need more fertilizer to replace lost plant nutrients. Soil erosion is also damaging to soils that are shallow and moderately deep to bedrock, for example, Milton and Ritchey soils, because it reduces the already shallow to moderately deep root zone. Erosion reduces productivity on soils that tend to be droughty, for example, Belmore and Oshtemo soils. The surface layer stores the largest amount of water, and if it erodes the available water capacity of the soil is reduced.

Erosion degrades water quality by increasing the amount of sediment in streams. Sediment is the largest pollutant of streams in Wyandot County. Sediment indirectly degrades water quality because of the organic matter, plant nutrients, herbicides, and insecticides it carries from eroding fields. Control of erosion minimizes the pollution of streams by sediment and improves the water quality for municipal and recreation use and for fish and other wildlife.

Practices that control erosion provide a protective surface cover, reduce runoff, and increase the infiltration rate. A cropping system that keeps plant cover on the soil for extended periods reduces erosion. Legume and grass forage crops in the rotation reduce the risk of erosion, provide nitrogen, and improve tilth.

The gently sloping to moderately steep Cardington, Glynwood, Morley, Shinrock, and Nappanee soils have short, irregular slopes, and erosion is a severe hazard if these soils are farmed using conventional methods. Minimum tillage and no-till farming systems, which leave crop residue on the surface, increase the rate of water infiltration and reduce the hazard of runoff and erosion. Contour farming and terracing generally are not practical on these soils because of the short, irregular slopes.

Grassed waterways are natural or constructed outlets protected by grass cover. Natural drainageways are the best locations for waterways and often require a minimum of shaping to produce a good channel. Waterways should be wide and flat to facilitate the crossing of farm machinery.

Soil blowing is a hazard on soils that have a muck, mucky silt loam, or fine sandy loam surface layer, for example, Carlisle, Martinsville, Olentangy, Oshtemo, and Tuscola soils. These soils are subject to damage if winds are strong and the soils are dry and bare of vegetation or mulch. Maintaining a plant cover or mulch or keeping the surface rough through proper tillage reduces soil loss by wind. Field windbreaks of suitable shrubs or trees are effective in reducing the risk of soil blowing.

Information on the design of erosion control practices for each kind of soil is available at the local office of the Wyandot Soil and Water Conservation District.

Soil fertility is naturally low in many of the soils on uplands that have a light colored surface layer (*11*). These soils are naturally acid, and the content of organic matter is moderate, moderately low, or low. The acid subsoil limits the availability of plant nutrients. The soils on flood plains and low alluvial terraces, for example, Chagrin, Lindside, Medway, Shoals, and Sloan soils, are medium acid to mildly alkaline in the surface layer and are naturally higher in plant nutrients than most of the upland soils. The content of organic matter ranges from moderate to high. The surface layer of Bono, Colwood, Luray, Mermill, Milford, Millgrove, Millsdale, and Pewamo soils that are in depressions and drainageways is very dark and is medium acid to mildly alkaline. The content of organic matter is high. The surface layer of the clayey, nearly level and level Latty and Paulding soils is slightly acid or neutral. The content of organic matter is moderate. Except where lime has been added, the soils that have a very high content of organic matter, for example, Carlisle and Olentangy soils, are commonly naturally acid. Special fertilizer may be needed because of deficiencies of boron and other trace elements.

The usefulness of applying nitrogen in the fall to the very poorly drained, poorly drained, and somewhat poorly drained soils is reduced by leaching and denitrification. Incorporating fertilizer into the soil on the gently sloping and sloping soils reduces loss through erosion. Applications of lime are necessary to raise the reaction of the surface layer to a level where most plant nutrients are readily available. On all of the soils, a balanced fertility program that includes adding lime and fertilizer should be based on the results of soil tests. Soil limitations other than fertility should be considered. The Cooperative Extension Service and private soil labs can help in determining the kinds and amounts of fertilizer to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soils. Soils that have good tilth are friable and porous. They are worked easily, provide good seed contact, and allow for quick seedling emergence and strong root growth.

Many of the soils used as cropland have a silt loam surface layer that is moderate or moderately low in organic matter. The surface of these soils generally crusts when it dries after heavy rainfall. The crust is hard and is slow to absorb water. It reduces the infiltration rate, retards seedling emergence, and increases runoff. Regularly adding crop residue, manure, and other organic materials maintains or improves the soil structure and reduces crusting. Minimum or mulch tillage or incorporating crop residue into the surface layer also reduces crusting. Allowing part of the residue to be exposed above the surface provides pathways for the movement of air and water.

Fall moldboard plowing is generally not the best practice on soils that have a light colored silt loam surface layer because the surface crusts in winter and spring. Many of these soils are nearly as dense and hard after fall moldboard plowing as they were before plowing. Moreover, soils that have slopes of 2 percent or more are subject to erosion if they are moldboard plowed in the fall. A rough, irregular surface that leaves residue partially covered absorbs more water and dries faster than a smoothly tilled surface.

The Bono, Milford, Luray, Millsdale, and Pewamo soils have a dark surface layer and more clay than most of the soils that have a lighter colored surface layer. Poor tilth is a problem because these soils tend to stay wet until late in spring. If they are tilled when wet, the soils tend to be very cloddy when dry, and the preparation of a good seedbed is difficult. Fall tillage generally results in improved tilth in spring.

The Fulton, Latty, Pandora, and Paulding soils are subject to crusting, which affects tilth. Fall tillage reduces the clodding that occurs in spring if these soils are worked when wet. Fall plowing allows winter freezing and drying to break up clods. These soils can be tilled only within a narrow range of moisture content. Mulch tillage and returning crop residue help reduce crusting. These soils generally crack upon drying, increasing infiltration. However, the remaining crust hinders germination.

Soil compaction occurs if the soils are worked when wet or if they are subject to heavy traffic or heavy loads. Compaction can be prevented by tilling the soils at the proper time, using minimum tillage, and planting deep-rooted legumes and grasses. Also, flotation tires on the vehicles used to work the soils help reduce compaction. Soil compaction limits root growth, reduces water movement, and creates plow pans.

Field crops suited to the soils and climate of the survey area include many that are not now commonly grown. Corn and soybeans are the main row crops. Grain sorghum, sugar beets, sunflowers, navy beans, and similar crops can be grown. Economic conditions generally determine whether these crops are grown.

Wheat and oats are the most common close-growing crops. Alfalfa and grass-legume hay are also grown. The soils are suited to rye, barley, buckwheat, and flax and grass seed produced from bromegrass, fescue, timothy, and bluegrass.

Specialty crops grown commercially in the survey area are mainly apples, popcorn, potatoes, tomatoes, strawberries, and sweet corn. The acreage of such crops could be increased if economic conditions were favorable.

Belmore, Milton, Oshtemo, Ritchey, and Martinsville soils that have slopes of less than 6 percent and good natural drainage and warm early in spring are especially well suited to vegetables and fruits. These soils make up about 7,000 acres. Crops can generally be planted and harvested earlier on these soils than on the other soils in the county.

If they are adequately drained, the organic soils in the survey area, Carlisle and Olentangy soils, are well suited to a wide range of vegetable crops and to sod production. These soils make up about 1,200 acres. The latest information on growing specialty crops can be obtained from the Cooperative Extension Service.

Permanent pasture makes up about 3 percent of the acreage of the survey area. This low percentage is partly the result of a reduction in livestock and the use of more confined feeding. Some of the permanent pasture is in areas of eroded soils that were once cultivated and in narrow strips and irregularly shaped areas of frequently flooded soils. A few woodlots are also pastured. Woodlots, however, generally provide grazing of poor quality because forage plants are sparse. Permanent pasture near farmsteads is often used as feedlots or access lanes.

Most of the soils in the county are suited to the production of high-quality permanent pasture, although yields vary widely. Sloping to steep soils, for example, Cardington, Glynwood, Morley, Nappanee, and Shinrock soils, are commonly eroded, are low in fertility, and have less water available for plants because runoff is rapid. Forage production on these soils is low. Growth is good on the gently sloping Bennington, Blount, Cardington, Del Rey, Fitchville, Haskins, Glenford, Glynwood, Shinrock, and Tuscola soils. However, these soils are subject to erosion if the plant cover is damaged by overgrazing. Severe compaction occurs if grazing livestock are allowed to trample the soils during wet periods.

The Chagrin, Lindside, Medway, Shoals, and Sloan soils on flood plains and low terraces are potentially well suited to use as permanent pasture. Occasional flooding during the growing season on Lindside, Shoals, and Sloan soils is less damaging to pasture than to grain crops. These alluvial soils are fertile, the available water capacity is high, and potential pasture yields are high. Surface drains and subsurface drains are needed to remove excess water on the somewhat poorly drained, poorly drained, and very poorly drained soils, particularly if legumes are grown. Artificial drainage is generally not needed on the better drained Chagrin, Lindside, and Medway soils.

Permanent pasture has fertility requirements similar to those of cropland. Lime and fertilizer should be applied at rates indicated by soil tests. The control of weeds by periodic clipping and use of recommended herbicides encourages the growth of desirable pasture plants. Controlled grazing helps maintain pasture. The latest information on seeding mixtures, herbicide treatment, and other management for specific soils can be obtained from the local offices of the Cooperative Extension Service and the Soil Conservation Service.

Irrigation is not used to a great extent in Wyandot County. Generally, rainfall is ample for crop moisture requirements. However, rainfall is commonly not timely or well distributed. During dry periods, supplemental irrigation helps increase yields. Many of the soils in the county are suited to irrigation and can be irrigated if water is available.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors (*5*).

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The Wyandot Soil and Water Conservation District, the Soil Conservation Service, and the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey (*16*). These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of each map unit is given in the section "Detailed soil map units."

woodland management and productivity

T.E. Hennessy, service forester, Ohio Department of Natural Resources, Division of Forestry, helped prepare this section.

When the first settlers arrived, most of Wyandot County was mixed hardwood forest with some prairie openings. The climax forest communities were oak-hickory, beech-maple, and elm-ash swamp forest (*8*). In 1974 woodland made up about 16,000 acres or 6 percent of the county, according to the Census of Agriculture for that year. Small scattered woodlots are on slopes along stream valleys, on flood plains, and in undrained areas on uplands. Many of these woodlots have been grazed, cut over, and left unmanaged.

Potential for increased production of timber is high. If managed well, woodlots are capable of producing high-quality, fast-growing native hardwoods.

Woodlots need protection from grazing and fire. Grazing damages roots on existing trees and increases the mortality rate of seedlings. Timber stand improvement practices of culling diseased and less desirable trees and cutting or spraying vines increases the growth rate of favored species. Harvesting methods that benefit the desirable tree species should be used. Selective harvesting benefits shade-tolerant trees, whereas small clear-cut openings benefit shade-intolerant species. Species selected for plantings should be adapted to the soil.

The return from the sale of wood products is smaller than from other farm products on individual farms, although some good quality saw and veneer logs of red oak, white oak, and black walnut are harvested. Woodlots also provide firewood, lumber, edible nuts, wildlife habitat, aesthetic value, and protection from strong winds.

Information on forest management is available from the Ohio Department of Natural Resources, Division of Forestry, the Cooperative Extension Service, Agricultural Stabilization and Conservation Service, and the Soil Conservation Service.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *w* indicates excessive water in or on the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: w, d, c, and r.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that few trees may be blown down by strong winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

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

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

windbreaks and environmental plantings

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

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

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

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

recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

wildlife habitat

R.E. Sturgeon, wildlife area supervisor, Killdeer Plains Wildlife Area, Ohio Department of Natural Resources, Division of Wildlife, helped prepare this section.

Wildlife is an important natural resource in Wyandot County. The state wildlife area near Carey and the Killdeer Plains Wildlife Area are owned and operated by the Ohio Department of Natural Resources, Division of Wildlife. These areas are available for public hunting and fishing.

Cottontail rabbit, bobwhite quail, and ring-necked pheasant were once the most abundant openland game species in the county. However, populations of these species have decreased greatly as their habitat and supply of winter food have been reduced because of the removal of fence rows and fall plowing. The population of white-tailed deer is moderately high and is increasing. Habitat for this species has increased because of the availability of pastures and woodlots that are no longer being grazed by cattle and sheep. Furbearers, particularly fox, raccoon, and muskrat, are plentiful, as are fox squirrel and woodchuck. Many different species of nesting and migrant birds can also be found in the county. Ducks and geese are numerous in the wildlife areas and on scattered ponds and wetlands.

Under proper management all the soils in Wyandot County can be used to provide wildlife food and shelter. Openland, wetland, and woodland wildlife habitat can sometimes be incorporated into a single area to attract the widest variety of wildlife species.

Habitat for wetland wildlife can be developed in undrained upland depressions and in old stream meanders on flood plains. Ponds can also be used as habitat for wetland wildlife. Special plantings help attract waterfowl.

Eroded soils can be developed into habitat for openland wildlife by planting meadow mixtures and shrubs that provide food and shelter. Plant cover also helps control erosion.

Woodlots and windbreaks around farm buildings can provide food and shelter for wildlife if they are composed of suitable species. Creating a special habitat through the use of birdhouses, bird feeders, seed crops, and flowers helps attract specific songbirds.

For additional information on the development of wildlife habitat contact the game protector and the local office of the Cooperative Extension Service or the Soil Conservation Service.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor (*1*). A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are foxtail, goldenrod, smartweed, ragweed, and fescue.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, beech, maple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are shrub honeysuckle, autumn-olive, and crabapple.

Coniferous plants furnish browse, 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 and spruce.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are duckweed, wild millet, willow, reed canarygrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and shallow ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, muskrat, mink, and beaver.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 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 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

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

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 18.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil 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. The AASHTO classification for soils tested is given in table 18.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

physical and chemical properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

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

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

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

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

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

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

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

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

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

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

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

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

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

In table 16, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

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

The four hydrologic soil groups are:

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

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

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

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

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

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

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

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

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

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

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

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as hard, if applicable. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

physical and chemical analyses of selected soils

Many of the soils in Wyandot County were sampled and laboratory data 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 these soils and in evaluating their behavior under various land uses. Among these data, 5 of the profiles were selected as representative for the respective series and are described in this survey. These series and their laboratory identification numbers are: Del Rey (WY 22), Oshtemo (WY 26), Paulding (WY 11), Shinrock (WY 21), and Shoals (WY 25).

In addition to the Wyandot County data, laboratory data are also available from nearby counties in north-central Ohio with many of the same soils. These data and the Wyandot 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 through special studies of soils in nearby counties (*14, 20*).

engineering index test data

Table 18 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil series and their morphology." The soil samples were tested by the Ohio Department of Transportation, Division of Highways, Bureau of Testing, Soils and Foundation Section.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*17*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 19, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol.* An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aqualf (*Aqu*, meaning water, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Ochraqualfs (*Ochr*, meaning light colored surface layer, plus *aqualf*, the suborder of the Alfisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Aeric* identifies the subgroup that is drier than the typical great group. An example is Aeric Ochraqualfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-illitic, mesic Aeric Ochraqualfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*15*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*17*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Belmore series

The Belmore series consists of deep, well drained, moderately rapidly permeable soils that formed in loamy, water-sorted material on outwash terraces, stream terraces, deltas, and beach ridges of former glacial lakes. Slope ranges from 0 to 6 percent.

Belmore soils are similar to Haney, Oshtemo, and Martinsville soils and are commonly adjacent to Digby and Millgrove soils. Unlike Belmore soils, Haney soils are moderately well drained and have gray mottles in the lower part of the subsoil. Oshtemo soils have less clay and gravel in the subsoil than Belmore soils. Martinsville soils have less gravel in the subsoil and the underlying material. Digby soils are somewhat poorly drained, and Millgrove soils are very poorly drained. Digby and Millgrove soils are mottled throughout the subsoil.

Typical pedon of Belmore loam, 0 to 2 percent slopes, about 1 mile southeast of McCutchenville, in Tymochtee Township, about 2,000 feet north and 1,000 feet east of the southwest corner of sec. 3, T. 1 S., R. 14 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine roots; 10 percent gravel; neutral; abrupt smooth boundary.

B1—8 to 15 inches; dark brown (10YR 4/3) loam; moderate medium subangular blocky structure; friable; common fine roots; 10 percent gravel; neutral; clear wavy boundary.

B21t—15 to 32 inches; dark yellowish brown (10YR 4/4) gravelly clay loam; moderate medium subangular blocky structure; firm; common fine roots; medium patchy clay films on faces of peds; clay bridges between sand grains; 15 percent gravel; medium acid; clear wavy boundary.

B22t—32 to 45 inches; dark brown (7.5YR 4/4) gravelly clay loam; moderate medium subangular blocky structure; firm; few fine roots; medium continuous clay films on gravel; 25 percent gravel (mainly crystalline rock fragments and shale); neutral; abrupt smooth boundary.

IIC—45 to 60 inches; stratified dark brown (10YR 4/3) gravelly sandy loam and dark grayish brown (10YR 4/2) loamy sand; single grained; loose; 15 to 30 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 35 to 55 inches. The gravel content is 2 to 20 percent, by volume, in the upper part of the B horizon and 10 to 40 percent in the lower part.

The Ap horizon has chroma of 2 or 3. The A horizon is dominantly loam; however, it is fine sandy loam or silt loam in some pedons. It is slightly acid or neutral. The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is loam, clay loam, or gravelly clay loam. Reaction ranges from medium acid to mildly alkaline. The C horizon has value of 4 or 5 and chroma of 2 to 5. It is stratified sand, loamy sand, gravelly clay loam, and gravelly sandy loam.

Bennington series

The Bennington series consists of deep, somewhat poorly drained, slowly permeable soils on ground moraines and end moraines. These soils form in calcareous glacial till. Slope ranges from 0 to 6 percent.

Bennington soils are similar to Blount, Pandora, and Tiro soils and are commonly adjacent to Cardington and Pewamo soils. Blount soils have a thinner solum, a less acid subsoil, and a lower content of shale. Blount soils also have more clay in the subsoil. Cardington soils are moderately well drained and do not have gray mottles directly below the plow layer. Pewamo and Pandora soils are wetter and are dominantly gray in the upper part of the subsoil. Tiro soils have less clay in the subsoil.

Typical pedon of Bennington silt loam, 2 to 6 percent slopes, about 2 miles east-southeast of Sycamore, in Sycamore Township, about 270 feet north and 680 feet east of the southwest corner of sec. 22, T. 1 S., R. 15 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine roots; few pebbles; neutral; abrupt smooth boundary.

B1—8 to 12 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct grayish brown (10YR 5/2) mottles; moderate fine subangular blocky structure; firm; common fine roots; brown (10YR 5/3) silt coatings on faces of peds; few pebbles; very strongly acid; clear smooth boundary.

B21t—12 to 18 inches; yellowish brown (10YR 5/6) silty clay loam; many medium distinct gray (10YR 5/1) mottles; moderate medium subangular blocky structure; firm; common fine roots; dark grayish brown (10YR 4/2) coatings on faces of peds; medium continuous clay films on faces of peds; few pebbles; very strongly acid; clear wavy boundary.

B22t—18 to 32 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct gray (10YR 5/1) mottles; moderate medium subangular blocky structure; firm; few fine roots; dark grayish brown (10YR 4/2) coatings on faces of peds; medium patchy clay films on faces of peds; 5 percent gravel; slightly acid; gradual wavy boundary.

B3t—32 to 40 inches; dark brown (10YR 4/3) clay loam; common medium distinct gray (10YR 5/1 and N 5/0) mottles; weak coarse prismatic structure; firm; few fine roots; medium patchy dark grayish brown (10YR 4/2) clay films on vertical faces of peds; 5 percent gravel; mildly alkaline; abrupt wavy boundary.

C1—40 to 50 inches; dark brown (10YR 4/3) clay loam; common medium distinct gray (10YR 5/1) mottles; massive; firm; common black shale fragments; 5 percent gravel; slight effervescence; moderately alkaline; gradual wavy boundary.

C2—50 to 60 inches; dark brown (10YR 4/3) clay loam; common medium distinct gray (10YR 5/1) mottles; massive; very firm; common streaks of white (10YR 8/2) secondary lime coatings; 5 percent gravel; common black shale fragments; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 28 to 50 inches. The gravel content ranges from 1 to 5 percent by volume in the upper 20 inches and from 2 to 10 percent below a depth of 20 inches.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is dominantly silt loam. In some places it is loam. Reaction is strongly acid to neutral. The B2t horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is silty clay loam or clay loam and has individual subhorizons of clay in some pedons. The Bt horizon ranges from 35 to 40 percent clay and has individual subhorizons that are 30 to 44 percent clay. The Bt horizon is very strongly acid to slightly 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, value of 4 or 5, and chroma of 1 to 4. It is clay loam, loam, or silty clay loam.

Blount series

The Blount series consists of deep, somewhat poorly drained, slowly or moderately slowly permeable soils on till plains. These soils formed in calcareous glacial till. Slope ranges from 0 to 6 percent.

Blount soils are similar to Bennington, Del Rey, Fulton, Nappanee, and Pandora soils. Bennington soils have a subsoil that is thicker and more acid and a noncalcareous B3 horizon. Fulton and Del Rey soils formed in lacustrine sediment. Fulton soils have more clay in the subsoil than Blount soils. Nappanee soils have more clay in the C horizon. Pandora soils are wetter and are dominantly gray in the upper part of the subsoil.

Typical pedon of Blount silt loam, 0 to 2 percent slopes, about 4 miles northwest of Upper Sandusky, in Salem Township, about 1,400 feet north and 1,200 feet east of the southwest corner of sec. 12, T. 2 S., R. 13 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; common medium faint dark brown (10YR 4/3) and grayish brown (10YR 5/2) mottles and common medium distinct yellowish brown (10YR 5/4) mottles; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B21t—9 to 14 inches; dark brown (10YR 4/3) silty clay loam; few fine distinct yellowish brown (10YR 5/4) and few fine distinct gray (10YR 5/1) mottles; moderate fine prismatic structure parting to moderate medium subangular blocky; firm; common fine roots; medium continuous dark grayish brown (10YR 4/2) clay films on vertical and horizontal faces of peds; strongly acid; clear wavy boundary.

B22t—14 to 21 inches; yellowish brown (10YR 5/4) silty clay; common medium distinct dark brown (10YR 4/3) and few fine distinct grayish brown (10YR 5/2) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; medium continuous dark gray (10YR 4/1) clay films on vertical and horizontal faces of peds; 3 percent gravel; medium acid; gradual wavy boundary.

B23tg—21 to 28 inches; grayish brown (10YR 5/2) silty clay; common medium distinct yellowish brown (10YR 5/4) and few fine distinct dark gray (10YR 4/1) mottles; moderate medium prismatic structure parting to weak coarse subangular blocky; firm; few fine roots; medium patchy gray (10YR 5/1) clay films on vertical faces of peds; 2 or 3 percent gravel; neutral; clear wavy boundary.

B3g—28 to 34 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine distinct yellowish brown (10YR 5/4) and few medium distinct gray (10YR 5/1) mottles; moderate coarse prismatic structure; firm; medium patchy gray (10YR 5/1) clay films on vertical faces of peds; 2 or 3 percent gravel; slight effervescence; mildly alkaline; clear wavy boundary.

C1g—34 to 50 inches; dark grayish brown (10YR 4/2) silty clay loam; common medium distinct yellowish brown (10YR 5/4) and gray (10YR 5/1) mottles; massive; very firm; common medium very pale brown (10YR 7/3) secondary lime blotches; 2 to 5 percent gravel; strong effervescence; moderately alkaline; gradual wavy boundary.

C2g—50 to 60 inches; dark grayish brown (10YR 4/2) silty clay loam; massive; very firm; 2 to 5 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum and depth to free carbonates range from 20 to 40 inches. The gravel content ranges from 0 to 10 percent by volume throughout the soil.

The Ap horizon has chroma of 1 or 2. It is dominantly silt loam. In some places it is loam. Some pedons have an A1 horizon. Reaction is slightly acid or neutral, although in uncultivated areas it is medium acid in places. The B2t horizon has value of 4 or 5 and chroma of 2 to 4. It is silty clay loam, silty clay, clay, or clay loam. Individual subhorizons range from 30 to 50 percent clay. Reaction is medium acid to very strongly acid in the upper part and slightly acid to mildly alkaline in the lower part. The C horizon is silty clay loam or clay loam.

Bono series

The Bono series consists of deep, very poorly drained, slowly or very slowly permeable soils that formed in lacustrine sediment in depressions and flat basins. Slope is 0 to 2 percent.

Bono soils are similar to Luray and Milford soils and are commonly adjacent to Pewamo and Sloan soils. Luray, Milford, and Pewamo soils have less clay in the surface layer and subsoil. Pewamo soils formed in glacial till. Sloan soils are on flood plains and have less clay in the subsoil.

Typical pedon of Bono silty clay, about 1 mile east of Little Sandusky, in Pitt Township, about 690 feet west and 1,900 feet north of the southeast corner of sec. 36, T. 3 S., R. 14 E.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay, gray (10YR 5/1) dry; moderate coarse granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A12—8 to 12 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; few medium distinct dark grayish brown (2.5Y 4/2) mottles; moderate fine angular blocky structure; firm; many fine roots; very dark gray (10YR 3/1) coatings on faces of peds; neutral; abrupt irregular boundary.

B21g—12 to 24 inches; dark gray (10YR 4/1) silty clay; common fine distinct dark grayish brown (2.5Y 4/2) and yellowish brown (10YR 5/4) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; firm; common fine roots; gray (5Y 5/1) coatings on faces of peds; many medium very dark gray (10YR 3/1) krotovinas; mildly alkaline; clear wavy boundary.

B22g—24 to 36 inches; olive gray (5Y 5/2) silty clay; many medium distinct yellowish brown (10YR 5/4) and gray (10YR 5/1) mottles; moderate medium prismatic structure; firm; common fine roots; gray (5Y 5/1) coatings on faces of peds; mildly alkaline; gradual wavy boundary.

B23g—36 to 47 inches; dark grayish brown (10YR 4/2) silty clay loam; many fine distinct dark yellowish brown (10YR 4/4) and gray (10YR 5/1) mottles; moderate coarse prismatic structure; firm; few fine roots; gray (5Y 5/1) coatings on faces of peds; mildly alkaline; clear wavy boundary.

B3g—47 to 60 inches; dark grayish brown (10YR 4/2) silty clay loam; common medium distinct dark yellowish brown (10YR 4/4) and many fine distinct gray (10YR 5/1) mottles; weak coarse prismatic structure; very firm; gray (5Y 5/1) coatings on faces of peds; mildly alkaline; abrupt wavy boundary.

C—60 to 70 inches; dark brown (10YR 4/3) laminated silt loam and silty clay loam; few coarse distinct gray (10YR 5/1) and common medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 50 to 60 inches. The mollic epipedon ranges from 10 to 22 inches thick.

The Ap horizon has hue of 10YR to 5Y or N, value of 2 or 3, and chroma of 0 to 2. It is dominantly silty clay. In some places it is silty clay loam. The B2 horizon has hue of 10YR to 5Y or hue is neutral; this horizon has value of 4 or 5 and chroma of 0 to 2. It is silty clay loam, silty clay, or clay. The textural control section averages 40 to 50 percent clay, although the clay content is variable. Reaction is slightly acid to mildly alkaline in the upper part and neutral to moderately alkaline in the lower part. The C horizon has hue of 10YR to 5Y, value of 3 to 6, and chroma of 1 to 3. It is silt loam, silty clay loam, or silty clay. Reaction is mildly alkaline or moderately alkaline. Free carbonates are not present in the upper part of the C horizon in some pedons.

Cardington series

The Cardington series consists of deep, moderately well drained, moderately slowly permeable soils on end moraines and in the dissected areas of ground moraines. These soils formed in calcareous glacial till. Slope ranges from 2 to 18 percent.

Cardington soils are similar to Glynwood, Lykens, and Shinrock soils and are commonly adjacent to Bennington and Tiro soils. Bennington and Tiro soils have gray mottles directly below the surface layer. The Glynwood soils have more clay in the subsoil, a thinner subsoil, and fewer shale fragments in the glacial till. Lykens soils have more silt and less clay in the upper part of the soil. Shinrock soils formed in lacustrine sediment.

Typical pedon of Cardington silt loam, 6 to 12 percent slopes, eroded, about 2.3 miles south-southeast of Sycamore, Ohio, in Sycamore Township, about 300 feet south and 1,900 feet west of the northwest corner of sec. 32, T. 1 S., R. 15 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; few coarse distinct yellowish brown (10YR 5/4) mottles; moderate medium granular structure; friable; many fine roots; few pebbles; neutral; abrupt smooth boundary.

B21t—8 to 16 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; medium continuous dark brown (10YR 4/3) clay films on faces of peds; few pebbles; medium acid; clear wavy boundary.

B22t—16 to 22 inches; yellowish brown (10YR 5/4) clay loam; common fine distinct gray (10YR 5/1) and common fine faint yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure; firm; few fine roots; medium continuous grayish brown (10YR 5/2) clay films on faces of peds; few pebbles; strongly acid; gradual wavy boundary.

B23t—22 to 28 inches; yellowish brown (10YR 5/4) clay loam; many fine distinct gray (10YR 5/1) and many fine faint yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to moderate coarse subangular blocky; firm; very dark brown (7.5YR 2/2) stains (iron and manganese oxides); medium patchy gray (10YR 5/1) clay films on faces of peds; few pebbles; medium acid; clear wavy boundary.

B31—28 to 31 inches; dark brown (10YR 4/3) loam; few fine distinct yellowish brown (10YR 5/4) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm; few pebbles; neutral; clear wavy boundary.

B32—31 to 40 inches; yellowish brown (10YR 5/4) clay loam; moderate coarse prismatic structure; firm; medium continuous grayish brown (10YR 5/2) clay films on vertical faces of peds; few pebbles; mildly alkaline; clear wavy boundary.

C—40 to 60 inches; dark grayish brown (10YR 4/2) clay loam; few medium distinct yellowish brown (10YR 5/4) mottles; massive; very firm; many medium pale brown (10YR 6/3) secondary lime streaks; 10 percent gravel; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 30 to 50 inches. Coarse fragments, dominantly shale and igneous pebbles, range from 2 to 10 percent throughout the soil.

The Ap horizon has chroma of 2 or 3. It is dominantly silt loam. In places it is loam or silty clay loam. The reaction is slightly acid or neutral, where lime has been added. A1 and A2 horizons are present in some pedons. The B2 horizon has value of 4 or 5 and chroma of 3 to 6. It is silty clay loam or clay loam. The reaction of the B horizon 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 value of 4 or 5 and chroma of 2 to 4. It is silty clay loam, clay loam, or loam.

Carlisle series

The Carlisle series consists of deep, very poorly drained, moderately rapidly to moderately slowly permeable soils that formed in organic material from grasses, sedges, reeds, and woody material in bogs on till plains and lake plains. Slope is 0 to 2 percent.

Carlisle soils are commonly adjacent to Olentangy soils. Olentangy soils formed in coprogenous earth 24 to 50 inches thick and are underlain by lacustrine material or glacial till.

Typical pedon of Carlisle muck, about 2 miles north of Carey, in Crawford Township, about 400 feet north and 1,600 feet east of the southwest corner of sec. 5, T. 1 S., R. 13 E.

Oap—0 to 10 inches; black (10YR 2/1) broken face and rubbed sapric material, black (10YR 2/1) dry; moderate fine granular structure; very friable; many fine roots; neutral; abrupt smooth boundary.

Oa2—10 to 28 inches; very dark brown (10YR 2/2) broken face and rubbed sapric material; about 30 percent fiber, 5 percent rubbed; weak coarse subangular blocky structure; friable; many fine roots; neutral; clear smooth boundary.

Oa3—28 to 60 inches; dark reddish brown (5YR 3/2) broken face and rubbed sapric material; about 30 percent fiber, 10 percent rubbed; massive; friable; few fine roots; brownish yellow (10YR 6/8) fibers; mildly alkaline.

The thickness of the organic material is commonly more than 60 inches. Reaction ranges from strongly acid to mildly alkaline throughout the soil.

The surface tier has hue of 10YR or N, value of 2, and chroma of 0 to 2. The subsurface tier has hue of 5YR to 10YR, value of 2 or 3, and chroma of 0 to 3. Content of fibers is 0 to 15 percent rubbed. The bottom tier has colors similar to the subsurface tier. It is dominantly sapric material. However, some pedons have thin layers of hemic material. Woody fragments are common in some pedons.

Chagrin series

The Chagrin series consists of deep, well drained, moderately permeable soils that formed in alluvium on low stream terraces in the major stream valleys. Slope is 0 to 2 percent.

Chagrin soils are similar to Belmore, Genesee, and Lindside soils and are commonly adjacent to Medway and Shoals soils. Belmore soils are on outwash terraces, stream terraces, deltas, and beach ridges. They have more gravel throughout the soil and a regular decrease in organic matter with depth. Genesee soils are well drained and are on flood plains. They have a higher content of lime below a depth of about 40 inches. Lindside and Medway soils are moderately well drained, and Shoals soils are somewhat poorly drained. These soils have more gray mottles in the 30-inch zone directly below the surface layer. Medway soils have a mollic epipedon.

Typical pedon of Chagrin silt loam, rarely flooded, about 3 miles southwest of Belle Vernon in Tymochtee Township, about 600 feet west and 780 feet north of the southeast corner of sec. 33, T. 1 S., R. 14 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B21—10 to 20 inches; dark brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure; firm; common medium roots; medium continuous dark yellowish brown (10YR 3/4) silt coatings on faces of peds; thin very patchy clay films in pores; slightly acid; gradual smooth boundary.

B22—20 to 30 inches; dark brown (7.5YR 4/4) silt loam; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common medium roots; medium continuous dark yellowish brown (10YR 3/4) silt coatings on faces of peds; medium acid; clear smooth boundary.

B23—30 to 48 inches; dark brown (7.5YR 4/4) loam; few medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) mottles; moderate medium prismatic structure; friable; medium acid; abrupt wavy boundary.

C—48 to 60 inches; stratified dark brown (7.5YR 4/4) fine sand and grayish brown (10YR 5/2) silt loam; many medium faint reddish brown (5YR 4/4) mottles; massive; friable; medium acid.

The thickness of the solum ranges from 40 to 48 inches, and the depth to carbonates is more than 60 inches. The lower part of the solum is 0 to 15 percent gravel by volume. The soil is medium acid to neutral throughout.

The Ap horizon has chroma of 2 to 4. It is dominantly silt loam. In some pedons it is loam or fine sandy loam. The B2 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is loam, silt loam, sandy loam, or fine sandy loam. The C horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 6. It is stratified loam, silt loam, sandy loam, fine sand, or loamy fine sand.

Colwood series

The Colwood series consists of deep, very poorly drained, moderately permeable soils that formed in water-deposited material in depressions on outwash plains and margins of glacial lake plains. Slope is 0 to 2 percent.

Colwood soils are similar to Luray, Mermill, Millgrove, and Sloan soils and are commonly adjacent to Kibbie and Tuscola soils. Kibbie soils are somewhat poorly drained, and Tuscola soils are moderately well drained. These soils have less gray in the subsoil. Luray soils have more silt and less sand in the subsoil. Mermill soils have more clay in the underlying material. Millgrove soils have more gravel in the subsoil and underlying material. Sloan soils are on flood plains and are occasionally flooded.

Typical pedon of Colwood silt loam, about 1 mile west of Carey, in Crawford Township, about 520 feet north and 1,200 feet west of the southeast corner of sec. 18, T. 1 S., R. 13 E.

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B21g—11 to 17 inches; dark grayish brown (10YR 4/2) silt loam; few medium prominent yellowish brown (10YR 5/6) and common fine faint dark gray (10YR 4/1) mottles; moderate medium subangular blocky structure; friable; many fine roots; very dark grayish brown (10YR 3/2) organic coatings on faces of peds; neutral; clear wavy boundary.

B22g—17 to 22 inches; dark grayish brown (10YR 4/2) silty clay loam; common medium prominent yellowish brown (10YR 5/6) and common fine distinct gray (10YR 5/1) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common fine roots; very dark gray (10YR 3/1) organic coatings on faces of peds; neutral; clear wavy boundary.

B23g—22 to 29 inches; grayish brown (10YR 5/2) loam; few fine faint gray (10YR 5/1), common fine prominent yellowish brown (10YR 5/8), and few fine prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; neutral; clear wavy boundary.

B24g—29 to 36 inches; grayish brown (10YR 5/2) loam; few fine faint gray (10YR 5/1) and common medium distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; few fine roots; neutral; clear wavy boundary.

B3g—36 to 46 inches; grayish brown (10YR 5/2) clay loam; common fine distinct yellowish brown (10YR 5/4) and few fine prominent yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; dark gray (10YR 4/1) coatings on faces of peds; neutral; clear wavy boundary.

C1g—46 to 54 inches; grayish brown (10YR 5/2) fine sandy loam; massive; friable; slight effervescence; mildly alkaline; clear wavy boundary.

C2g—54 to 60 inches; laminated gray (10YR 5/1) fine sandy loam and silt loam; firm; many fine prominent very dark brown (7.5YR 2/2) stains (iron and manganese oxides); strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 30 to 50 inches. Reaction ranges from slightly acid to mildly alkaline throughout the solum. The mollic epipedon ranges from 10 to 13 inches in thickness. Some pedons have gravel in the C horizon.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly silt loam. In places it is loam or fine sandy loam. The B horizon has hue of 7.5YR to 5Y, value of 4 to 6, and chroma of 1 or 2. Some pedons have subhorizons in the lower part that have chroma of 4 to 6. The B horizon is loam, silt loam, silty clay loam, clay loam, or fine sandy loam and has thin strata of fine sand or silty clay. The C horizon has hue of 10YR to 5YR, value of 4 to 6, and chroma of 1 or 2. In some pedons strata that have color of higher chroma are present. The C horizon is silt loam, loamy sand, loam, or very fine to coarse sandy loam.

Del Rey series

The Del Rey series consists of deep, somewhat poorly drained, slowly permeable soils that formed in calcareous, lacustrine sediment in basins of former glacial lakes. Slope ranges from 0 to 6 percent.

Del Rey soils are similar to Blount, Fulton, and Fitchville soils and are commonly adjacent to Milford and Shinrock soils. Blount soils formed in glacial till and have more sand and gravel throughout the soil. Fulton soils have more clay and Fitchville soils have less clay in the subsoil and substratum. Milford soils are very poorly drained and have a mollic epidedon. Shinrock soils do not have gray mottles below the surface layer.

Typical pedon of Del Rey silt loam, 0 to 2 percent slopes, about 3.5 miles north of Upper Sandusky, in Crane Township, about 440 feet north and 1,100 feet east of the southwest corner of sec. 9, T. 2 S., R. 14 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many medium roots; neutral; abrupt smooth boundary.

B1—10 to 14 inches; brown (10YR 5/3) silty clay loam; common medium faint yellowish brown (10YR 5/4) and many medium distinct light brownish gray (2.5Y 6/2) mottles; moderate medium platy structure parting to weak medium subangular blocky; firm; common fine roots; continuous silt coatings on faces of peds; strongly acid; clear wavy boundary.

B21t—14 to 24 inches; yellowish brown (10YR 5/4) silty clay loam; many fine distinct gray (10YR 5/1) and common fine faint yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; medium continuous dark gray (10YR 4/1) clay films on faces of peds; strongly acid; gradual wavy boundary.

B22t—24 to 37 inches; olive brown (2.5Y 4/4) silty clay loam; common medium faint yellowish brown (10YR 5/4) mottles; moderate medium prismatic structure; firm; few fine roots; few fine very dark brown (7.5YR 2/2) stains; gray (10YR 5/1) coatings on faces of peds; thick continuous dark gray (10YR 4/1) clay films on faces of peds; medium acid; gradual wavy boundary.

B3t—37 to 45 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct gray (10YR 5/1) and common medium distinct dark grayish brown (10YR 4/2) mottles; moderate coarse prismatic structure; firm; gray (5Y 5/1) coatings on faces of peds; thick patchy dark gray (10YR 4/1) clay films on faces of peds; neutral; abrupt wavy boundary.

C—45 to 60 inches; dark grayish brown (10YR 4/2) silty clay loam; common medium distinct yellowish brown (10YR 5/4) and gray (N 6/0) mottles; weak very coarse prismatic structure; firm; light gray (10YR 7/1) secondary lime deposits; laminated; strong effervescence; moderately alkaline.

The thickness of the solum and depth to free carbonates range from 24 to 48 inches.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is dominantly silt loam. In places it is silty clay loam. The B2 horizon has hue of 10YR to 5Y and value and chroma of 4 to 6. It is silty clay loam or silty clay. Thin lenses of silt loam are in some pedons. The upper 20 inches of the argillic horizon is 35 to 42 percent clay; however, individual subhorizons are as much as 45 percent clay. The reaction of the B horizon ranges from strongly acid to slightly acid in the upper part and medium acid to moderately alkaline in the lower part. In places, the C horizon is laminated with layers of silt loam, silty clay loam, or silty clay and thin lenses of loam or sandy loam.

Digby series

The Digby series consists of deep, somewhat poorly drained soils that formed in glacial outwash on outwash plains and on terraces along small valleys. Slope ranges from 0 to 3 percent. Permeability is moderate in the subsoil and rapid in the underlying material.

Digby soils are similar to Kibbie soils and are commonly adjacent to Haney, Haskins, Millgrove, and Shoals soils. Haney soils are moderately well drained and have less gray in the subsoil. Haskins soils have glacial till or lacustrine sediment in the underlying material. Millgrove soils have a mollic epipedon and a dominantly gray subsoil. Shoals soils are on flood plains and are subject to flooding. Kibbie soils have a darker colored surface layer and less gravel throughout the soil.

Typical pedon of Digby loam, 0 to 3 percent slopes, about 3 miles southeast of Sycamore, in Sycamore Township, about 450 feet north and 230 feet west of the center of sec. 27, T. 1 S., R. 15 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many medium roots; 3 to 5 percent gravel; neutral; abrupt smooth boundary.

B1g—10 to 16 inches; grayish brown (10YR 5/2) loam; common fine distinct dark yellowish brown (10YR 4/4) mottles; weak thick platy structure parting to moderate medium subangular blocky; friable; common fine roots; dark gray (10YR 4/1) coatings on faces of peds; 3 to 5 percent gravel; neutral; clear wavy boundary.

B21tg—16 to 21 inches; grayish brown (10YR 5/2) clay loam; common fine distinct yellowish brown (10YR 5/4) and common fine prominent strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; friable; common fine roots; thin patchy gray (10YR 5/1) clay films on faces of peds; clay bridging between sand grains; 2 to 5 percent gravel; slightly acid; clear wavy boundary.

B22t—21 to 25 inches; yellowish brown (10YR 5/4) clay loam; common medium faint yellowish brown (10YR 5/6) and common fine distinct gray (10YR 5/1) mottles; moderate medium subangular blocky structure; friable; few fine roots; medium continuous gray (10YR 5/1) clay films on vertical faces of peds; 2 to 5 percent gravel; neutral; gradual wavy boundary.

B23t—25 to 32 inches; yellowish brown (10YR 5/4) loam; common fine distinct yellowish brown (10YR 5/8) and common medium distinct gray (10YR 5/1) mottles; weak medium subangular blocky structure;

friable; few fine roots; medium continuous gray (10YR 5/1) clay films on vertical faces of peds; 2 to 5 percent gravel; neutral; clear wavy boundary.

IIB24—32 to 40 inches; yellowish brown (10YR 5/4) gravelly clay loam; common fine distinct dark gray (10YR 4/1) and yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; firm; few fine roots; dark gray (10YR 4/1) clay bridging between sand grains; 20 percent gravel; neutral; clear wavy boundary.

IIB3—40 to 48 inches; yellowish brown (10YR 5/4) gravelly clay loam; common medium distinct yellowish brown (10YR 5/8) and common fine distinct grayish brown (10YR 5/2) mottles; weak very coarse subangular blocky structure; firm; gray (10YR 5/1) clay bridging between sand grains; 15 percent gravel; mildly alkaline; gradual wavy boundary.

IIC—48 to 60 inches; gray (10YR 5/1) gravelly loamy sand; single grained; loose; many black shale fragments; 20 percent gravel; slight effervescence; mildly alkaline.

The thickness of the solum and depth to free carbonates range from 35 to 48 inches. Fine and medium gravel range from 0 to 15 percent by volume in the A horizon, 2 to 15 percent in the B horizon, and 15 to 40 percent in the IIB and IIC horizons.

The Ap horizon has value of 4 or 5 and chroma of 1 to 3. It is dominantly loam. In places it is silt loam or sandy loam. Reaction ranges from neutral to medium acid. The B horizon has value of 4 or 5 and chroma of 2 to 4. It is loam, clay loam, or sandy clay loam. Reaction ranges from strongly acid to neutral. The IIB horizon has chroma of 2 to 6. It is gravelly clay loam or gravelly loam. Reaction ranges from slightly acid to mildly alkaline. The IIC horizon has value of 5 or 6 and chroma of 1 to 4. It is gravelly sandy loam to gravelly sand. Reaction is mildly alkaline or moderately alkaline.

Elliott series

The Elliott series consists of deep, somewhat poorly drained, slowly permeable soils that formed in calcareous glacial till on till plains. Slope is 0 to 3 percent.

Elliott soils are similar to Blount, Del Rey, and Pewamo soils, and are commonly adjacent to the Milford soils. The Blount and Del Rey soils are somewhat poorly drained soils on similar landscapes. They do not have a mollic epipedon. Milford and Pewamo soils are very poorly drained and are dominantly gray in the upper and middle parts of the subsoil. Milford soils formed in lacustrine sediment.

Typical pedon of Elliott silt loam, 0 to 3 percent slopes, about 2.5 miles northwest of Upper Sandusky, in Salem Township, about 1,400 feet west and 900 feet south of the northeast corner of sec. 24, T. 2 S., R. 13 E.

Ap—0 to 11 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate fine granular structure; very friable; many fine roots; neutral; abrupt smooth boundary.

B1—11 to 17 inches; yellowish brown (10YR 5/4) silty clay loam; many fine faint yellowish brown (10YR 5/6) and few fine distinct light brownish gray (10YR 6/2) mottles; moderate fine subangular blocky structure; firm; common fine roots; very dark gray (10YR 3/1) organic coatings on faces of peds; slightly acid; clear smooth boundary.

B21t—17 to 24 inches; yellowish brown (10YR 5/4) silty clay loam; many medium faint yellowish brown (10YR 5/6) and few fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; medium continuous dark grayish brown (10YR 4/2) clay films on faces of peds; slightly acid; clear wavy boundary.

B22t—24 to 30 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct grayish brown (10YR 5/2) mottles; moderate medium prismatic structure; very firm; few fine roots; dark grayish brown (10YR 4/2) thin continuous clay films on faces of peds; neutral; clear wavy boundary.

B3—30 to 35 inches; yellowish brown (10YR 5/4) silty clay loam; few fine faint yellowish brown (10YR 5/6) and common medium distinct grayish brown (10YR 5/2) mottles; weak coarse prismatic structure; very firm; dark grayish brown (10YR 4/2) clay films in old root channels; 5 percent gravel; mildly alkaline; clear wavy boundary.

C—35 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; few medium faint yellowish brown (10YR 5/6) and many medium distinct gray (10YR 5/1) mottles; massive; very firm; light gray (10YR 7/1) secondary lime coatings; 5 to 10 percent gravel; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 45 inches. Reaction is slightly acid to neutral in the upper part of the solum and neutral to mildly alkaline in the lower part. The gravel content ranges from 0 to 10 percent by volume throughout the solum.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly silt loam. In some pedons it is silty clay loam. The A horizon ranges from 10 to 16 inches in thickness. The B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 or 4. It is typically silty clay loam or silty clay. The C horizon is silt loam, silty clay loam, or clay loam.

Fitchville series

The Fitchville series consists of deep, somewhat poorly drained, moderately slowly permeable soils on glacial lake plains. These soils formed in silty laminated lacustrine sediment. Slope ranges from 0 to 6 percent.

Fitchville soils are similar to Del Rey, Kibbie, and Tiro soils and are commonly adjacent to Glenford and Luray soils. Del Rey soils have more clay in the subsoil. Kibbie soils have more sand and less silt in the subsoil. Tiro soils have glacial till in the lower part of the subsoil and in the underlying material. Glenford soils are moderately well drained and are less gray in the subsoil. Luray soils are very poorly drained and are dominantly gray in the upper part of the subsoil.

Typical pedon of Fitchville silt loam, 0 to 2 percent slopes, about 1 mile northwest of Upper Sandusky, in Crane Township, about 1,300 feet east and 400 feet south of the northwest corner of sec. 30, T. 2 S., R. 14 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; few medium distinct yellowish brown (10YR 5/4) mottles; moderate fine granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

B1—8 to 12 inches; yellowish brown (10YR 5/4) silt loam; few fine faint yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; common fine roots; grayish brown (10YR 5/2) silt coatings on faces of peds; medium acid; clear smooth boundary.

B21t—12 to 21 inches; yellowish brown (10YR 5/4) silt loam; few medium faint yellowish brown (10YR 5/6) and few fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; medium continuous gray (10YR 5/1) clay films on faces of peds; strongly acid; clear wavy boundary.

B22t—21 to 32 inches; yellowish brown (10YR 5/4) silty clay loam; many medium faint yellowish brown (10YR 5/6) and few fine distinct yellowish brown (10YR 5/8) and gray (10YR 5/1) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; medium continuous grayish brown (10YR 5/2) clay films on faces of peds; very strongly acid; clear wavy boundary.

B3t—32 to 44 inches; dark brown (7.5YR 4/4) silty clay loam; common fine distinct yellowish brown (10YR 5/4) mottles; weak very coarse prismatic structure parting to moderate medium subangular blocky; firm; medium patchy dark brown (7.5YR 4/2) clay films on faces of peds; very dark brown (10YR 2/2) stains; neutral; gradual wavy boundary.

C1—44 to 55 inches; yellowish brown (10YR 5/4) silty clay loam; few fine distinct yellowish brown (10YR 5/8) and common medium distinct grayish brown (10YR 5/2) and gray (10YR 5/1) mottles; weak coarse subangular blocky structure; firm; laminated; mildly alkaline; gradual wavy boundary.

C2—55 to 60 inches; brown (10YR 5/3) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; very firm; laminated; light gray (10YR 7/2) secondary lime deposits; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 40 to 70 inches. Reaction ranges from very strongly acid to medium acid in the upper part of the B horizon and from medium acid to neutral in the lower part. The C horizon is slightly acid to mildly alkaline.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2. The Bt horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 1 to 6. It is dominantly silt loam or silty clay loam, but in some places it has thin strata of loam or clay loam. The C horizon is dominantly laminated silt loam or silty clay loam. In some places it has thin strata of loam, fine sandy loam, or loamy fine sand.

Fulton series

The Fulton series consists of deep, somewhat poorly drained, slowly or very slowly permeable soils that formed in lacustrine sediment on glacial lake plains. Slope is 0 to 2 percent.

Fulton soils are similar to Blount, Nappanee, and Del Rey soils and are commonly adjacent to Latty soils. Blount and Nappanee soils formed in glacial till and have a few coarse fragments and more sand in the subsoil. Del Rey soils have less clay in the subsoil and underlying material. Latty soils are very poorly drained and have a dominantly gray subsoil.

Typical pedon of Fulton silty clay loam, 0 to 2 percent slopes, about 5 miles south-southeast of Forest, in Jackson Township, about 1,200 feet south and 1,850 feet west of the northeast corner of sec. 33, T. 3 S., R. 12 E.

Ap—0 to 8 inches; grayish brown (2.5Y 5/2) silty clay loam, light gray (2.5Y 7/2) dry; moderate medium granular structure; friable; common fine roots; neutral; abrupt smooth boundary.

B21t—8 to 14 inches; yellowish brown (10YR 5/4) silty clay; many medium distinct grayish brown (10YR 5/2) and common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium angular blocky structure; firm; few fine roots; medium patchy gray (10YR 5/1) clay films on faces of peds; strongly acid; clear wavy boundary.

B22t—14 to 24 inches; yellowish brown (10YR 5/4) silty clay; common fine faint yellowish brown (10YR 5/6) and common fine distinct gray (N 5/0) mottles; moderate coarse angular blocky structure; firm; few fine roots; medium continuous gray (10YR 5/1) clay films on faces of peds; strongly acid; gradual wavy boundary.

B23t—24 to 37 inches; dark brown (10YR 4/3) silty clay; common fine distinct gray (10YR 5/1) and yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure; firm; pressure faces and some slickensides; thick continuous grayish brown (10YR 5/2) clay films on vertical faces of some peds; mildly alkaline; clear wavy boundary.
Cg—37 to 60 inches; dark grayish brown (10YR 4/2) silty clay; few fine distinct yellowish brown (10YR 5/4) mottles; massive; very firm; gray (5Y 5/1) clay films on vertical faces of peds; few fine prominent light gray (10YR 7/2) secondary lime streaks; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 40 inches. Reaction ranges from strongly acid to neutral in the A horizon and upper part of the B horizon and from slightly acid to mildly alkaline in the lower part of the B horizon.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is dominantly silty clay loam. In some pedons it is silt loam or silty clay. The B horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 to 4. It is dominantly silty clay or clay and has individual subhorizons that are 40 to 60 percent clay. In some places it has thin strata of silt loam or silty clay loam. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. It is silty clay loam, silty clay, or clay.

Genesee series

The Genesee series consists of deep, well drained, moderately permeable soils that formed in alluvium on flood plains. Slope is 0 to 2 percent.

Genesee soils in Wyandot County have less sand and a little less clay than is defined as the range for the Genesee series. This difference, however, does not affect the use or management of the soils.

Genesee soils are similar to Chagrin, Lindside, and Medway soils and are commonly adjacent to Belmore and Shoals soils. Chagrin soils are lower in lime in the C horizon and are rarely flooded. Belmore soils are on outwash terraces, stream terraces, deltas, and beach ridges. They have more gravel in the subsoil and underlying material. Lindside and Medway soils are moderately well drained and have gray mottles below a depth of about 16 inches. Medway soils have a mollic epipedon. Shoals soils are somewhat poorly drained and have gray mottles below the surface layer.

Typical pedon of Genesee silt loam, occasionally flooded, about 5 miles northeast of Upper Sandusky, in Crane Township, about 1,040 feet west and 1,175 feet south of the northeast corner of sec. 10, T. 2 S., R. 14 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; many medium roots; neutral; abrupt smooth boundary.
A12—10 to 13 inches; dark brown (10YR 4/3) silt loam; weak medium angular blocky structure; firm; common fine roots; dark grayish brown (10YR 4/2) common krotovinas and many coatings on faces of peds; neutral; abrupt smooth boundary.
C1—13 to 23 inches; dark brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable; common fine roots; many dark grayish brown (10YR 4/2) coatings on faces of peds and worm casts; neutral; abrupt wavy boundary.
C2—23 to 43 inches; dark brown (10YR 4/3) loam; moderate medium prismatic structure; friable; few fine roots; common dark grayish brown (10YR 4/2) krotovinas; mildly alkaline; gradual wavy boundary.
C3—43 to 60 inches; dark brown (10YR 4/3) loam; weak coarse prismatic structure; friable; few dark grayish brown (10YR 4/2) krotovinas; mildly alkaline.

Reaction is neutral or mildly alkaline and gravel content is 0 to 10 percent by volume throughout the soil.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is dominantly silt loam. In places it is loam or sandy loam. The C horizon to a depth of about 40 inches has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or loam (high in very fine sand), but in some pedons it has thin subhorizons of very fine sandy loam, fine sandy loam, clay loam, or silty clay loam. In some pedons the C horizon below a depth of 40 inches is stratified with loam, silt loam, sandy loam, or fine sand.

Glenford series

The Glenford series consists of deep, moderately well drained, moderately slowly permeable soils that formed in calcareous lacustrine sediment on the margin of former glacial lakes. Slope ranges from 2 to 6 percent.

Glenford soils are similar to Lykens, Martinsville, and Tuscola soils and are commonly adjacent to Fitchville and Luray soils. Fitchville soils are somewhat poorly drained, and Luray soils are very poorly drained. These soils have a subsoil that is more gray than that of the Glenford soils. Lykens soils are moderately well drained and have glacial till in the lower part of the subsoil and in the underlying material. Martinsville soils are well drained and do not have mottles of low chroma in the subsoil. Tuscola soils have more sand and less silt in the subsoil.

Typical pedon of Glenford silt loam, 2 to 6 percent slopes, about 2.5 miles southeast of Upper Sandusky, in Crane Township, about 700 feet west and 100 feet north of the center of sec. 3, T. 3 S., R. 14 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many medium and fine roots; neutral; abrupt smooth boundary.

B21t—9 to 16 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; common fine roots; thin very patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

B22t—16 to 24 inches; yellowish brown (10YR 5/4) silty clay loam; few fine faint grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

B23t—24 to 32 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine distinct grayish brown (10YR 5/2) and few fine faint yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; thin patchy dark brown (10YR 4/3) clay films on faces of peds; very dark brown (7.5YR 2/2) stains (iron and manganese oxides); neutral; clear wavy boundary.

B3—32 to 40 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure parting to weak thin platy; firm; neutral; clear wavy boundary.

C—40 to 60 inches; stratified yellowish brown (10YR 5/4) silt loam and fine sandy loam; common fine distinct light brownish gray (2.5Y 6/2) and brownish yellow (10YR 6/6) mottles; massive; firm; slight effervescence; mildly alkaline.

The thickness of the solum and depth to carbonates range from 30 to 60 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. 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. Reaction ranges from very strongly acid to medium acid in the upper part and medium acid to neutral in the lower part. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. It is medium acid to mildly alkaline.

Glynwood series

The Glynwood series consists of deep, moderately well drained, slowly permeable soils on end moraines and ground moraines (fig. 6). These soils formed in calcareous glacial till. Slope ranges from 2 to 12 percent.

Glynwood soils are similar to Cardington, Morley, and Shinrock soils and are commonly adjacent to Blount and Pewamo soils. Blount and Pewamo soils are wetter than Glynwood soils and have colors of low chroma directly below the surface layer. Cardington soils have a thicker subsoil and more shale fragments in the glacial till. The Morley soils are well drained and do not have mottles of low chroma in the upper part of the B horizon. Shinrock soils formed in lacustrine sediment.

Typical pedon of Glynwood silt loam, 6 to 12 percent slopes, eroded, about 3 miles west-northwest of Nevada, Ohio, in Eden Township, about 2,000 feet east and 1,500 feet south of the northwest corner of sec. 31, T. 2 S., R. 15 E.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular

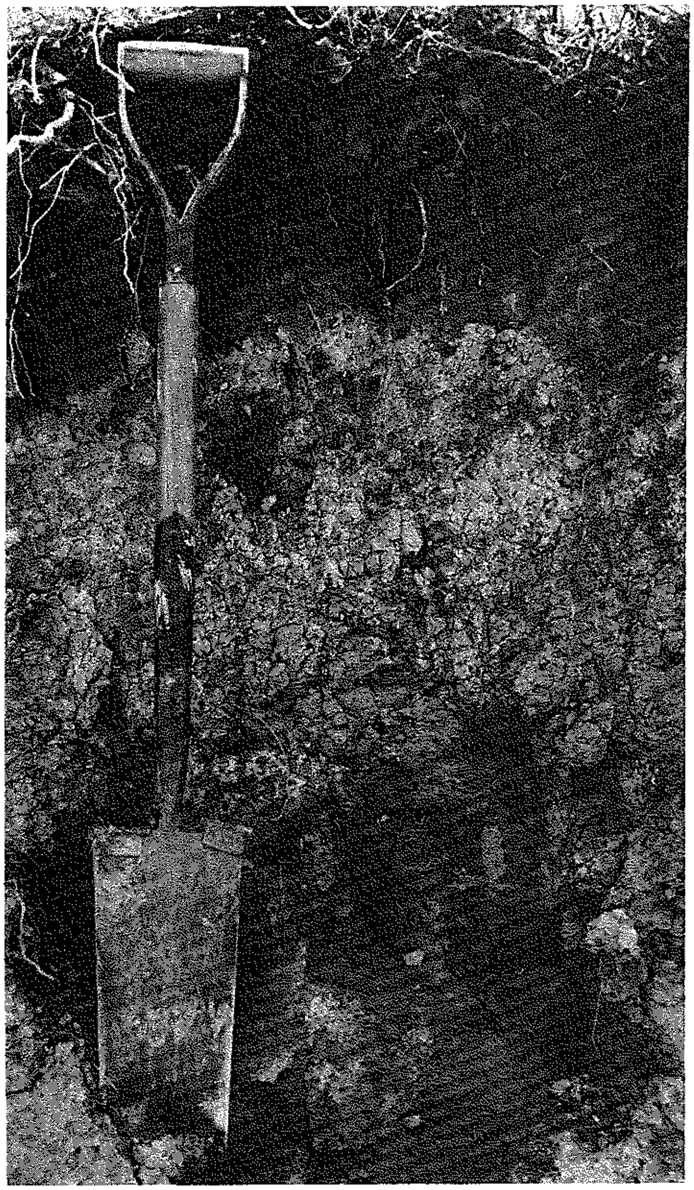

Figure 6.—Profile of Glynwood soils in an uncultivated area. The bleached zone below the surface layer is an A2 horizon (subsurface layer). This zone has been mixed with the surface layer in most cultivated areas of this soil.

structure; friable; many fine roots; 5 percent gravel; slightly acid; abrupt smooth boundary.

B21t—8 to 16 inches; dark brown (10YR 4/3) clay; common medium distinct yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; firm; common fine roots; medium continuous dark brown (10YR 3/3) clay films on vertical and horizontal faces of peds; common fine very dark brown (7.5YR 2/2) stains (iron and manganese oxides); 3 percent gravel; medium acid; clear wavy boundary.

B22t—16 to 22 inches; yellowish brown (10YR 5/4) silty clay; few fine faint yellowish brown (10YR 5/6) and few fine distinct gray (10YR 5/1) mottles; moderate medium subangular blocky structure; firm; few fine roots; thick continuous dark grayish brown (10YR 4/2) clay films on faces of peds; 3 percent gravel; strongly acid; clear wavy boundary.

B23t—22 to 30 inches; yellowish brown (10YR 5/4) silty clay loam; few fine faint yellowish brown (10YR 5/6) and few fine distinct gray (10YR 5/1) mottles; weak medium subangular blocky structure; firm; thin continuous dark brown (10YR 4/3) clay films on faces of peds; 3 percent gravel; neutral; gradual wavy boundary.

B3—30 to 35 inches; yellowish brown (10YR 5/4) silty clay loam; few medium faint yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; thin patchy dark brown (10YR 4/3) clay films on vertical faces of peds; 5 percent gravel; mildly alkaline; gradual wavy boundary.

C—35 to 60 inches; brown (10YR 5/3) clay loam; massive; very firm; 10 percent gravel; slight effervescence; moderately alkaline.

The thickness of the solum and depth to carbonates range from 24 to 40 inches. The gravel content ranges from 0 to 5 percent, by volume, in the A horizon and from 1 to 10 percent in the B and C horizons.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. It is dominantly silt loam. In some eroded areas it is silty clay loam or clay loam. Uncultivated areas have A1 and A2 horizons. The reaction of the A horizon ranges from medium acid to neutral. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 6. It is dominantly silty clay loam or silty clay. In places it is clay or clay loam. The reaction ranges from very strongly acid to medium 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, value of 4 or 5, and chroma of 2 to 4. It is dominantly silty clay loam or clay loam glacial till. It is mildly alkaline or moderately alkaline.

Haney series

The Haney series consists of deep, moderately well drained soils that formed in calcareous glacial outwash on shorelines of former glacial lakes, terraces, and outwash plains. Permeability is moderate in the subsoil and rapid in the underlying material. Slope ranges from 0 to 6 percent.

Haney soils are similar to Belmore and Tuscola soils and are commonly adjacent to Digby and Millgrove soils. Belmore soils are well drained and do not have mottles of low chroma in the subsoil. Digby soils are somewhat poorly drained, and Millgrove soils are very poorly drained. These soils have more gray in the subsoil. Tuscola soils formed in glacial lake shoreline deposits that had very little or no gravel.

Typical pedon of Haney loam, 0 to 2 percent slopes, about 2.75 miles northeast of Sycamore, in Sycamore Township, about 600 feet west and 2,100 feet south of the northeast corner of sec. 5, T. 1 S., R. 15 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine roots; 2 percent gravel; neutral; abrupt smooth boundary.

B1—8 to 16 inches; dark brown (10YR 4/3) loam; few fine distinct yellowish brown (10YR 5/4) mottles; moderate fine subangular blocky structure; firm; common fine roots; 5 percent gravel; strongly acid; clear smooth boundary.

B21t—16 to 24 inches; dark brown (7.5YR 4/4) clay loam; few fine distinct yellowish brown (10YR 5/4) and grayish brown (10YR 5/2) mottles; moderate fine subangular blocky structure; firm; few fine roots; medium continuous dark brown (10YR 4/3) clay films on faces of peds; 10 percent gravel; medium acid; clear wavy boundary.

IIB22t—24 to 30 inches; yellowish brown (10YR 5/4) gravelly clay loam; common coarse distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; medium patchy dark grayish brown (10YR 4/2) clay films on faces of peds; 15 percent gravel; neutral; gradual wavy boundary.

IIB23t—30 to 34 inches; dark brown (7.5YR 3/2) gravelly clay loam; common fine distinct yellowish brown (10YR 5/4) and few medium distinct light brownish gray (10YR 6/2) mottles; moderate coarse subangular blocky structure; firm; clay bridging between sand grains; 25 percent gravel; neutral; abrupt wavy boundary.

IIC1—34 to 40 inches; dark grayish brown (10YR 4/2) gravelly sandy loam; single grained; loose; 20 percent gravel; mildly alkaline; clear wavy boundary.

IIC2—40 to 60 inches; dark grayish brown (10YR 4/2) gravelly sandy loam; massive; single grained; loose; 30 percent gravel; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 34 to 40 inches. The gravel content ranges from 2 to 15 percent, by volume, in the upper part of the solum and from 10 to 40 percent in the lower part.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. It is dominantly loam. In places it is silt loam, sandy loam, or fine sandy loam. Reaction ranges from medium acid to neutral. The B and IIB horizons have hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. They are clay loam, sandy clay loam, loam, or a gravelly analog of these textures. Thin subhorizons of sandy loam and gravelly sandy loam are in some pedons. The reaction ranges from strongly acid to slightly acid in the upper part and slightly acid to mildly alkaline in the lower part. The C horizon has hue of 10YR or 7.5YR, value of 4 to 7, and chroma of 1 to 8. The C horizon is stratified sandy loam, sand, loamy sand, or a gravelly analog.

Haskins series

The Haskins series consists of deep, somewhat poorly drained soils that formed in glacial outwash and in the underlying glacial till or lacustrine sediment on beach ridges, terraces, and outwash plains. Permeability is moderate in the outwash and slow in the underlying material. Slope ranges from 0 to 6 percent.

Haskins soils are similar to Kibbie and Tiro soils and are commonly adjacent to Blount, Del Rey, Digby, and Mermill soils. Blount soils formed in glacial till, and Del Rey soils formed in lacustrine sediment. Both soils have more clay in the subsoil. Digby soils formed in glacial outwash. Kibbie soils have a darker colored surface layer and do not have glacial till in the lower part of the subsoil. Tiro soils have less sand and gravel in the upper part of the solum. Mermill soils are very poorly drained and have a dominantly gray subsoil.

Typical pedon of Haskins loam, 0 to 2 percent slopes, about 4.5 miles west-northwest of Upper Sandusky, in Salem Township, about 1,420 feet west and 830 feet north of the southeast corner of sec. 21., T. 2 S., R. 13 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine roots; 5 percent gravel; neutral; abrupt smooth boundary.

B21t—8 to 16 inches; grayish brown (10YR 5/2) loam; few medium distinct yellowish brown (10YR 5/4 and 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; medium continuous grayish brown (10YR 5/2) clay films on faces of peds; 8 percent gravel; strongly acid; clear wavy boundary.

B22t—16 to 24 inches; dark brown (10YR 4/3) gravelly clay loam; few medium distinct yellowish brown (10YR 5/6) and common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; medium continuous grayish brown (10YR 5/2) clay films on faces of peds; 15 percent gravel; neutral; abrupt wavy boundary.

IIB3—24 to 30 inches; yellowish brown (10YR 5/4) clay loam; few medium faint yellowish brown (10YR 5/6) and few medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; few fine roots; dark brown (7.5YR 3/2) stains; 5 percent gravel; mildly alkaline; abrupt wavy boundary.

IIC—30 to 60 inches; yellowish brown (10YR 5/4) clay loam; few medium faint yellowish brown (10YR 5/6) mottles; massive; very firm; 3 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum and depth to carbonates range from 25 to 50 inches. Fine textured or moderately fine textured material is commonly within that depth. Depth to the IIB horizon ranges from 20 to 40 inches. The gravel content ranges from 2 to 20 percent by volume in the B horizon and 0 to 10 percent in the IIB and IIC horizons.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is dominantly loam. In some places it is silt loam, sandy loam, or fine sandy loam. Reaction is neutral to strongly acid. The B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is clay loam, sandy clay loam, loam, sandy loam, or a gravelly analog. Reaction ranges from strongly acid to neutral. The IIB horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 4. It is clay loam, silty clay loam, silty clay, or clay. Reaction ranges from slightly acid to mildly alkaline. The IIC horizon is dominantly calcareous silty clay loam, clay loam, or silty clay glacial till or lacustrine sediment.

Kibbie series

The Kibbie series consists of deep, somewhat poorly drained soils that formed in stratified loamy and silty sediment on till plains, lake plains, outwash plains, and deltas. Permeability is moderate in the subsoil and slow or moderately slow in the underlying material. Slope ranges from 0 to 6 percent.

Kibbie soils are similar to Digby and Haskins soils and are commonly adjacent to Bennington, Blount, Colwood, Del Rey, and Tuscola soils. All of these soils except the Colwood soils have a lighter colored surface layer. Bennington, Blount, and Del Rey soils have more clay in the subsoil. Colwood soils are very poorly drained and have a dominantly gray subsoil. Digby soils have more gravel throughout the soil. Haskins soils have finer textured material in the lower part of the subsoil. Tuscola soils are moderately well drained and have less gray in the subsoil.

Typical pedon of Kibbie fine sandy loam, till substratum, 0 to 2 percent slopes, about 0.5 mile east of Carey, in Crawford Township, about 660 feet west and 2,250 feet north of the southeast corner of sec. 16, T. 1 S., R. 13 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; strong fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B21t—9 to 19 inches; yellowish brown (10YR 5/4) sandy clay loam; common fine distinct strong brown (7.5YR 5/8) and few fine distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; common fine roots; thin patchy clay films on faces of peds; neutral; clear wavy boundary.

B22t—19 to 27 inches; yellowish brown (10YR 5/6) loam; few fine distinct gray (10YR 5/1), strong brown (7.5YR 5/6), and brown (7.5YR 4/4) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; friable; common fine roots; medium continuous grayish brown (10YR 5/2) clay films on faces of peds; common fine prominent very dark brown (7.5YR 2/2) stains; neutral; clear wavy boundary.

B3t—27 to 33 inches; yellowish brown (10YR 5/4) silty clay loam; few fine faint yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; firm; few fine roots; thick continuous grayish brown (10YR 5/2) clay films on faces of peds; mildly alkaline; clear wavy boundary.

C1—33 to 52 inches; yellowish brown (10YR 5/4) stratified silty clay loam and sandy loam; few medium faint yellowish brown (10YR 5/6) mottles; massive; firm; many medium light brownish gray (10YR 6/2) secondary lime deposits; strong effervescence; moderately alkaline; clear wavy boundary.

IIC2—52 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; few fine faint yellowish brown (10YR 5/6) mottles; massive; very firm; many medium grayish brown (10YR 5/2), gray (10YR 5/1), and light brownish gray (10YR 6/2) secondary lime deposits; 5 percent pebbles; strong effervescence; moderately alkaline.

The thickness of the solum and depth to free carbonates range from 28 to 42 inches. Depth to the IIC horizon ranges from 40 to 60 inches.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly fine sandy loam. In places it is silt loam, loam, or sandy loam. Reaction ranges from medium acid to neutral. In some pedons where lime has been added it is mildly alkaline. The B2 horizon has value of 4 or 5 and chroma of 3 to 6. It is sandy clay loam, clay loam, loam, or silty clay loam and has thin strata of silt loam, fine sandy loam, fine sand, or loamy fine sand. The texture varies from place to place within a short distance. The B2 horizon ranges from medium acid to neutral. The C horizon is stratified sediment that varies within a short distance from silty clay loam to loamy sand. The IIC horizon is silty clay loam or clay loam. The C horizon is mildly alkaline or moderately alkaline.

Latty series

The Latty series consists of deep, very poorly drained, very slowly permeable soils that formed in clayey lacustrine sediment on lake plains. Slope is 0 to 2 percent.

Latty soils are similar to Pandora and Paulding soils and are commonly adjacent to Bono, Fulton, and Nappanee soils. Bono soils have a mollic epipedon and are less acid in the subsoil. Fulton and Nappanee soils are somewhat poorly drained and do not have a dominantly gray subsoil. Nappanee and Pandora soils formed in glacial till. Pandora soils have less clay in the subsoil and underlying material, and Paulding soils have more clay.

Typical pedon of Latty silty clay, about 3 miles southeast of Forest, in Jackson Township, about 1,000 feet north and 65 feet east of the corner of sec. 21, T. 3 S., R. 12 E.

Ap—0 to 8 inches; dark grayish brown (2.5Y 4/2) silty clay, gray (10YR 6/1) dry; weak medium granular structure; firm; many fine roots; medium acid; abrupt smooth boundary.

B21g—8 to 17 inches; dark gray (10YR 4/1) clay; common medium distinct strong brown (7.5YR 5/6) and few medium faint grayish brown (2.5Y 5/2) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; firm; common fine roots; medium acid; clear wavy boundary.

B22g—17 to 33 inches; grayish brown (10YR 5/2) clay; common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; firm; common fine roots; few fine faint gray (10YR 5/1) coatings on faces of peds; medium acid; gradual wavy boundary.

B23g—33 to 45 inches; grayish brown (10YR 5/2) clay; common medium distinct yellowish brown (10YR 5/4) mottles; moderate coarse prismatic structure; firm; common fine roots; few fine faint gray (5Y 5/1) coatings on faces of peds; slightly acid; gradual wavy boundary.

B3g—45 to 58 inches; grayish brown (10YR 5/2) clay; common medium distinct yellowish brown (10YR 5/4) mottles; weak very coarse prismatic structure; firm; few fine roots; many fine faint gray (10YR 5/1) coatings on faces of peds; slight effervescence; mildly alkaline; gradual wavy boundary.

Cg—58 to 60 inches; gray (10YR 5/1) clay; common medium distinct yellowish brown (10YR 5/4) mottles; firm; massive; laminated; gray (5Y 5/1) coatings on faces of peds; slight effervescence; moderately alkaline.

The thickness of the solum and depth to carbonates range from 45 to 60 inches.

The Ap horizon has hue of 10YR or 2.5Y, value of 4, and chroma of 1 or 2. It is dominantly silty clay or silty clay loam. In places it is clay. Reaction ranges from medium acid to neutral. The Bg horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. It is clay or silty clay that is 45 to 60 percent clay. The B horizon is medium acid to mildly alkaline. The C horizon is lacustrine sediment that is 45 to 60 percent clay or glacial till that is 35 to 45 percent clay.

Lindside series

The Lindside series consists of deep, moderately well drained soils that formed in alluvium on flood plains. Permeability is moderate or moderately slow. Slope is 0 to 2 percent.

Lindside soils are similar to Chagrin, Genesee, and Medway soils and are commonly adjacent to Shoals soils. Chagrin and Genesee soils are well drained and do not have gray mottles within a depth of 24 inches. Medway soils are on low stream terraces and have a mollic epipedon. They are rarely flooded. Shoals soils are somewhat poorly drained and have mottles of low chroma below the surface layer.

Typical pedon of Lindside silt loam, occasionally flooded, about 1 mile southwest of Crawford, in Crawford Township, about 500 feet north and 200 feet east of the southwest corner of sec. 34, T. 1 S., R. 13 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; very friable; many fine roots; slightly acid; abrupt smooth boundary.

B21—8 to 19 inches; dark brown (10YR 4/3) silt loam; moderate medium subangular blocky structure; friable; common fine roots; neutral; clear wavy boundary.

B22—19 to 33 inches; dark brown (10YR 4/3) silty clay loam; common fine faint yellowish brown (10YR 5/4) and dark grayish brown (10YR 4/2) mottles; weak coarse subangular blocky structure; firm; common fine roots; neutral; gradual wavy boundary.

C1—33 to 43 inches; yellowish brown (10YR 5/4) silt loam; common fine faint grayish brown (10YR 5/2) and few fine distinct dark grayish brown (10YR 4/2) mottles; massive; friable; few fine roots; light gray (10YR 7/2) krotovinas; mildly alkaline; gradual wavy boundary.

C2—43 to 48 inches; yellowish brown (10YR 5/4) loam; common fine faint yellowish brown (10YR 5/6) and common fine distinct dark gray (10YR 4/1) mottles; massive; friable; mildly alkaline; gradual wavy boundary.

C3—48 to 60 inches; yellowish brown (10YR 5/4) stratified sandy loam and fine sandy loam; common fine faint yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) mottles; massive; very friable; mildly alkaline.

The thickness of the solum ranges from 30 to 50 inches. The solum is medium acid to mildly alkaline throughout. Coarse fragments range from 0 to 5 percent in the upper 40 inches.

The Ap horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 or 3. It is dominantly silt loam. In some places it is silty clay loam or loam. The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6 above a depth of 20 inches and chroma of 1 to 4 below a depth of 20 inches. It is silt loam or silty clay loam that has thin layers of loam in some pedons. The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 to 4. It is stratified loam, sandy loam, fine sandy loam, silt loam, or silty clay loam.

Luray series

The Luray series consists of deep, very poorly drained, moderately slowly permeable soils that formed in lacustrine sediment. These soils are on broad flats in slightly depressional areas in basins of glacial lakes. Slope is 0 to 2 percent.

Luray soils are similar to Colwood and Milford soils and are commonly adjacent to Fitchville, Tiro, and Tuscola soils. Milford soils have more clay in the subsoil. Colwood and Tuscola soils have more sand in the subsoil. Fitchville and Tiro soils are somewhat poorly drained. Tuscola soils are moderately well drained and have less gray in the subsoil.

Typical pedon of Luray silty clay loam, about 0.5 mile west of Sycamore, Ohio, in Sycamore Township, about 2,200 feet east and 600 feet south of the northwest corner of sec. 19, T. 1 S., R. 15 E.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

B1g—8 to 11 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate medium angular blocky structure; firm; many fine roots; very dark gray (10YR 3/1) coatings on faces of peds; neutral; clear wavy boundary.

B21g—11 to 20 inches; dark gray (10YR 4/1) silty clay loam; few medium prominent yellowish brown (10YR 5/6) mottles; moderate fine prismatic structure; firm; common fine roots; thin very patchy clay films on vertical and horizontal faces of peds; neutral; gradual wavy boundary.

B22tg—20 to 30 inches; dark gray (10YR 4/1) silty clay loam; common medium prominent yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to weak medium subangular blocky; firm; few fine roots; dark gray (N 4/0) coatings on faces of peds; thin very patchy clay films on horizontal surfaces and medium continuous films on vertical surfaces of peds; neutral; clear wavy boundary.

B23tg—30 to 40 inches; dark brown (10YR 4/3) silty clay loam; many fine prominent gray (10YR 5/1) and many medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure; firm; dark gray (10YR 4/1) coatings on faces of peds; thick continuous clay films on vertical faces of peds; neutral; gradual wavy boundary.

B3—40 to 50 inches; yellowish brown (10YR 5/6) silt loam; common medium prominent gray (10YR 5/1) mottles; weak very coarse prismatic structure; firm; laminated; neutral; clear smooth boundary.

Cg—50 to 60 inches; stratified grayish brown (10YR 5/2) fine sandy loam and sandy loam; few fine distinct yellowish brown (10YR 5/4) and few fine distinct dark gray (10YR 4/1) mottles; massive; friable; mildly alkaline.

The thickness of the solum ranges from 40 to 60 inches. Reaction ranges from slightly acid to neutral in the solum. Thickness of the mollic epipedon ranges from 10 to 13 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is silty clay loam. In some places it is silt loam. The B2t horizon has hue of 10YR to 5Y or N, value of 3 to 6, and chroma of 1 or 2 in the upper part and 1 to 3 in the lower part. The weighted average clay content is 25 to 35 percent. The C horizon is commonly stratified fine sandy loam, sandy loam, silt loam, or loam. It ranges from slightly acid to moderately alkaline.

Lykens series

The Lykens series consists of deep, moderately well drained, moderately slow or slowly permeable soils that formed in water-deposited material and the underlying glacial till on water-modified till plains. Slope ranges from 0 to 6 percent.

Lykens soils are similar to Cardington and Tuscola soils and are commonly adjacent to Bennington, Milton, and Tiro soils. Bennington and Cardington soils formed in glacial till on till plains and have more clay in the subsoil. Bennington and Tiro soils are somewhat poorly drained and have mottles of low chroma below the surface layer. Milton soils are well drained and have bedrock between depths of 20 and 40 inches. Tuscola soils formed in glacial lake shoreline deposits. They have more sand in the subsoil, and the underlying layers are laminated.

Typical pedon of Lykens silt loam, 2 to 6 percent slopes, about 2 miles east-northeast of Sycamore, in Sycamore Township, 1,100 feet south and 260 feet west of the northeast corner of sec. 16, T. 1 S., R. 15 E.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; many medium roots; neutral; abrupt smooth boundary.

A2—9 to 12 inches; brown (10YR 5/3) silt loam; moderate medium platy structure; friable; many fine roots; neutral; clear smooth boundary.

B21t—12 to 18 inches; yellowish brown (10YR 5/4) silt loam; few fine faint brown (10YR 5/3) mottles; moderate medium subangular blocky structure; firm; common fine roots; pale brown (10YR 6/3) silt coatings on faces of peds; thin very patchy clay films on faces of peds; medium acid; clear wavy boundary.

B22t—18 to 24 inches; yellowish brown (10YR 5/4) silt loam; common medium faint yellowish brown (10YR 5/6) and common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; medium patchy gray (10YR 5/1) clay films on faces of peds; medium acid; clear wavy boundary.

IIB23t—24 to 27 inches; dark brown (10YR 4/3) loam; common medium faint yellowish brown (10YR 5/6) and common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; medium patchy gray (10YR 5/1) clay films on faces of peds; slightly acid; clear wavy boundary.

IIIB3—27 to 42 inches; dark yellowish brown (10YR 4/4) clay loam; few fine faint yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; firm; gray (10YR 5/1) coatings on faces of peds; 5 percent gravel; medium acid; clear wavy boundary.

IIIC—42 to 60 inches; yellowish brown (10YR 5/4) clay loam; common medium faint yellowish brown (10YR 5/6) and common medium distinct gray (10YR 5/1) mottles; massive; very firm; 5 percent gravel; slight effervescence; mildly alkaline.

The thickness of the solum and depth to carbonates range from 24 to 50 inches. The overlying silt mantle is 20 to 36 inches thick. Below this mantle is weakly stratified loamy material 2 to 15 inches thick over glacial till. The gravel content is less than 2 percent by volume in the upper silty material, 0 to 25 percent in the IIB horizon, and 3 to 10 percent in the IIIB and IIIC horizons.

The Ap horizon has chroma of 2 or 3. Some pedons have A1 and A2 horizons. The A horizon is dominantly silt loam. In places it is loam or very fine sandy loam. It is neutral to strongly acid. The B2 and IIB2 horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The B2 horizon is silt loam or silty clay loam. The IIB horizon is clay loam, loam, sandy loam, or a gravelly analog of these textures. The IIIB3 horizon is clay loam, silty clay loam, or loam. The B horizon ranges from very strongly acid to medium acid in the upper part and strongly acid to mildly alkaline in the lower part. The C horizon has value of 4 or 5 and chroma of 2 to 4. It is silty clay loam, loam, silt loam, or clay loam.

Martinsville series

The Martinsville series consists of deep, well drained, moderately permeable soils that formed in stratified loamy and sandy sediment on glacial lake shoreline beaches, bars, and dunes. Slope ranges from 2 to 18 percent.

Martinsville soils are similar to Belmore, Oshtemo, and Tuscola soils and are commonly adjacent to Fitchville and Luray soils. Belmore and Oshtemo soils have less silt and more gravel than the Martinsville soils. Fitchville soils are somewhat poorly drained, Luray soils are very poorly drained, and Tuscola soils are moderately well drained. Luray soils have color of low chroma in the subsoil.

Typical pedon of Martinsville fine sandy loam, 2 to 6 percent slopes, about 4 miles southeast of Sycamore, in Tymochtee Township, about 585 feet east and 780 feet north of the southwest corner of sec. 35, T. 1 S., R. 14 E.

Ap—0 to 8 inches; dark brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B1—8 to 14 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium platy structure; friable; common fine roots; few small strong brown (7.5YR 5/6) blotches; neutral; clear wavy boundary.

B21t—14 to 20 inches; brown (7.5YR 5/4) loam; moderate coarse subangular blocky structure; firm; few fine roots; few medium brown (10YR 5/3) blotches; slightly acid; clear wavy boundary.

B22t—20 to 31 inches; dark brown (7.5YR 4/4) loam; weak coarse subangular blocky structure; firm; few fine roots; clay bridging between sand grains; few medium yellowish brown (10YR 5/6) and brown (10YR 5/3) blotches; medium acid; clear wavy boundary.

B3—31 to 47 inches; yellowish brown (10YR 5/4) and brown (10YR 5/3) fine sandy loam; weak very coarse subangular blocky structure; very friable; few fine very dark brown (7.5YR 2/2) stains; medium acid; gradual wavy boundary.

C—47 to 60 inches; yellowish brown (10YR 5/4 and 10YR 5/6) loamy fine sand; single grained; loose; slightly acid.

The thickness of the solum ranges from 40 to 60 inches. Reaction is strongly acid to neutral.

The Ap horizon has chroma of 2 or 3. It is dominantly fine sandy loam. In places it is silt loam or loam. The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. The B horizon is fine sandy loam, sandy loam, loam, or sandy clay loam. The C horizon is loamy fine sand, sandy loam, loam, or silt loam. It ranges from slightly acid to mildly alkaline.

Medway series

The Medway series consists of deep, moderately well drained, moderately permeable soils that formed in alluvium on low stream terraces along major streams. Slope is 0 to 2 percent.

Medway soils are similar to Chagrin, Genesee, and Lindside soils and are commonly adjacent to Shoals and Sloan soils. Chagrin, Genesee, Lindside, and Shoals soils do not have a mollic epipedon. Chagrin and Genesee soils are well drained and do not have gray mottles within a depth of 24 inches. Shoals soils are somewhat poorly drained, and Sloan soils are very poorly drained. Shoals and Sloan soils have more gray in the 30-inch zone directly below the surface layer.

Typical pedon of Medway silt loam, rarely flooded, about 3 miles southeast of Carey, in Crawford Township, about 100 feet east and 100 feet north of the center of sec. 26, T. 1 S., R. 13 E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; strong fine granular structure; friable; many fine roots; neutral; clear smooth boundary.

A12—10 to 16 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; strong fine subangular blocky structure; friable; many fine roots; very dark gray (10YR 3/1) coatings on faces of peds; neutral; clear wavy boundary.

B21—16 to 26 inches; brown (10YR 4/3) silt loam; few fine faint yellowish brown (10YR 5/4) and few fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; common fine roots; dark gray (10YR 4/1) coatings on faces of peds; mildly alkaline; clear wavy boundary.

B22—26 to 40 inches; yellowish brown (10YR 5/4) silt loam; few fine faint yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to weak coarse subangular blocky; friable; common fine roots; common medium prominent dark gray (10YR 4/1) krotovinas; dark grayish brown (10YR 4/2) coatings on faces of peds; mildly alkaline; clear wavy boundary.

B3—40 to 50 inches; yellowish brown (10YR 5/4) silt loam; few fine faint yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; friable; few fine roots; dark gray (10YR 4/1) krotovinas; dark grayish brown (10YR 4/2) coatings on faces of peds; mildly alkaline; clear wavy boundary.

C—50 to 60 inches; yellowish brown (10YR 5/4) stratified loam, sandy loam, and silt loam; few fine distinct gray (10YR 5/1) and few medium faint yellowish brown (10YR 5/6) mottles; single grained and massive; loose and very friable; few fine roots; few medium prominent dark grayish brown (10YR 4/2) krotovinas; few medium light gray (10YR 7/2) soft pieces of weathered dolomite; mildly alkaline.

Thickness of the solum commonly ranges from 30 to 50 inches. Thickness of the mollic epipedon ranges from 10 to 24 inches. The solum is slightly acid to mildly alkaline. It is 0 to 5 percent gravel.

The Ap horizon has value of 2 or 3 and chroma of 1 to 3. It is dominantly silt loam. In places it is loam. The B horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is dominantly silt loam or loam. In some places it has thin strata of clay loam, silty clay loam, sandy loam, fine sandy loam, or sandy clay loam. The C horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 1 to 6. It is stratified loam, silt loam, sandy loam, silty clay loam, or clay loam. In some pedons loamy sand, sand, and gravel are below a depth of 40 inches.

Mermill series

The Mermill series consists of deep, very poorly drained soils that formed in glacial outwash and the underlying glacial till or lacustrine material on glacial lake deltas, on outwash terraces, and between dolomite ridges on uplands. Permeability is moderate in the subsoil and slow in the underlying material. Slope is 0 to 2 percent.

Mermill soils are similar to Colwood and Millgrove soils and are commonly adjacent to Haskins, Millsdale, and Pewamo soils. Colwood and Millgrove soils have a thicker dark colored surface layer and have less clay in the lower part of the B horizon and in the C horizon. Haskins soils are somewhat poorly drained and are less gray in the subsoil. Millsdale soils have dolomitic limestone bedrock at a depth of 20 to 40 inches. Pewamo soils formed in glacial till and have more clay in the subsoil.

Typical pedon of Mermill loam, about 5 miles northeast of Upper Sandusky, in Crane Township, about 3,000 feet north and 1,600 feet west of the southeast corner of sec. 4, T. 2 S., R. 14 E.

Ap—0 to 9 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; many fine roots; 5 percent gravel; neutral; abrupt smooth boundary.

B1g—9 to 14 inches; dark gray (10YR 4/1) clay loam; few fine distinct light olive brown (2.5Y 5/4) mottles; moderate fine subangular blocky structure; friable; many fine roots; very dark grayish brown (10YR 3/2) coatings on faces of peds; 5 percent gravel; neutral; clear wavy boundary.

B21tg—14 to 20 inches; dark grayish brown (2.5Y 4/2) clay loam; common medium distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; common fine roots; dark gray (10YR 4/1) coatings on faces of peds; thin patchy clay films on faces of peds and bridging sand grains; 5 percent gravel; neutral; clear wavy boundary.

B22tg—20 to 25 inches; dark grayish brown (10YR 4/2) clay loam; many medium distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; firm; few fine roots; dark gray (10YR 4/1) coatings on faces of peds; medium patchy clay films on faces of peds and bridging sand grains; 10 percent gravel; neutral; gradual wavy boundary.

B23tg—25 to 30 inches; grayish brown (10YR 5/2) gravelly sandy clay loam; many fine distinct yellowish brown (10YR 5/4) and many fine distinct dark gray (10YR 4/1) mottles; weak coarse subangular blocky structure; firm; few fine roots; dark gray (10YR 4/1) coatings on faces of peds; thin patchy clay films on faces of peds and bridging sand grains; 20 percent gravel; neutral; abrupt smooth boundary.

IIB3g—30 to 42 inches; grayish brown (10YR 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/4) and common medium faint gray (10YR 5/1) mottles; moderate coarse prismatic structure; very firm; gray (10YR 5/1) coatings on faces of peds; medium continuous clay films on vertical faces of peds; neutral; gradual wavy boundary.

IICg—42 to 60 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct yellowish brown (10YR 5/4) and few medium faint gray (10YR 5/1) mottles; moderate very coarse prismatic structure; firm; neutral.

Thickness of the solum ranges from 24 to 48 inches. Depth to glacial till or lacustrine material ranges from 25 to 40 inches. Coarse fragments in the A and B horizons typically range from 0 to 10 percent, by volume, but the range can be up to 20 percent in an individual subhorizon in the lower part of the B horizon. The A and B horizons are medium acid to neutral. The IIB and IIC horizons are neutral to moderately alkaline.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly loam or silty clay loam. In some places it is clay loam or silt loam. The B2t horizon has hue of 10YR to 5Y or N, value of 4 to 6, and chroma of 0 to 2. It is loam, clay loam, or sandy clay and has thin subhorizons of a gravelly analog. The IIB horizon has hue of 10YR to 5Y or N, value of 4 to 6, and chroma of 0 to 2. It is silty clay, clay loam, or silty clay loam. Clay content ranges from 35 to 60 percent. The IIC horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 3. Its texture is similar to that of the IIB horizon.

Milford series

The Milford series consists of deep, very poorly drained, moderately slowly permeable soils that formed in calcareous lacustrine sediment in flat or depressional areas on lake plains. Slope is 0 to 2 percent.

Milford soils are similar to Bono, Colwood, Luray, and Pewamo soils and are commonly adjacent to Del Rey soils. Bono soils have more clay, and Colwood and Luray soils have less clay in the subsoil. Pewamo soils have a few pebbles throughout the soil and formed in glacial till. Del Rey soils are somewhat poorly drained and do not have a dominantly gray subsoil.

Typical pedon of Milford silty clay loam, about 2 miles east of Little Sandusky, in Antrim Township, about 2,450 feet north and 1,900 feet west of the southeast corner of sec. 31, T. 3 S., R. 15 E.

Ap—0 to 10 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; many medium roots; neutral; clear smooth boundary.

A12—10 to 14 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; strong medium granular structure; friable; many medium roots; neutral; clear smooth boundary.

B21g—14 to 24 inches; dark gray (10YR 4/1) silty clay loam; many fine distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; common fine roots; very dark grayish brown (10YR 3/2) coatings on faces of peds; neutral; gradual wavy boundary.

B22g—24 to 40 inches; dark gray (10YR 4/1) silty clay loam; many fine faint gray (10YR 5/1) and many fine distinct yellowish brown (10YR 5/4) mottles; moderate medium prismatic structure; firm; common fine roots; grayish brown (2.5Y 5/2) coatings on faces of peds; neutral; diffuse wavy boundary.

B23g—40 to 54 inches; dark grayish brown (10YR 4/2) silty clay loam; many fine distinct yellowish brown (10YR 5/4) and gray (10YR 5/1) mottles; moderate coarse prismatic structure; firm; mildly alkaline; gradual wavy boundary.

Cg—54 to 60 inches; dark grayish brown (10YR 4/2) laminated silty clay loam and silt loam; common medium distinct yellowish brown (10YR 5/4) and gray (10YR 5/1) mottles; weak coarse prismatic structure; firm; slight effervescence below a depth of 64 inches; mildly alkaline.

Thickness of the solum ranges from 40 to 60 inches. Depth to free carbonates ranges from 50 to 70 inches. Thickness of the mollic epipedon ranges from 10 to 16 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly silty clay loam. In some pedons it is silt loam. Reaction is slightly acid or neutral. The B2 horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. It is dominantly silty clay loam. In places it is silty clay. The control section has a weighted average clay content of 35 to 40 percent. Thin strata of a sandier texture are in the lower part of the B horizon in some pedons. Reaction is slightly acid or neutral in the upper part of the B horizon and neutral or mildly alkaline in the lower part. The C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 6. It is silt loam, silty clay loam, or clay loam and has thin strata of a finer or coarser texture in some pedons. It is mildly alkaline or moderately alkaline.

Millgrove series

The Millgrove series consists of deep, very poorly drained, moderately permeable soils on beach ridges, terraces, and outwash plains. These soils formed in loamy water-laid sediment over calcareous sandy outwash that contains gravel. Slope is 0 to 2 percent.

Millgrove soils are similar to Colwood and Mermill soils and are commonly adjacent to Digby and Haney soils. Colwood soils do not have as much gravel as the Millgrove soils. Digby soils are somewhat poorly drained, and Haney soils are moderately well drained. Digby and Haney soils have less gray in the subsoil. Mermill soils have glacial till or lacustrine sediment in the underlying material.

Typical pedon of Millgrove silt loam, about 5.5 miles northeast of Upper Sandusky, in Crane Township, about 1,200 feet west and 1,930 feet south of the northeast corner of sec. 3, T. 2 S., R. 14 E.

Ap—0 to 11 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; many fine roots; 5 percent gravel; neutral; abrupt smooth boundary.

B1g—11 to 20 inches; gray (5Y 5/1) loam; many medium distinct yellowish brown (10YR 5/4) mottles; moderate fine prismatic structure; firm; common fine roots; dark gray (10YR 4/1) coatings on faces of peds; 5 percent gravel; neutral; clear wavy boundary.

B21tg—20 to 30 inches; gray (5Y 5/1) clay loam; many medium distinct yellowish brown (10YR 5/4) mottles; moderate medium prismatic structure; firm; common fine roots; thin continuous gray (10YR 5/1) clay films on faces of peds; clay bridgings between sand grains; 5 percent gravel; neutral; clear wavy boundary.

B22tg—30 to 36 inches; gray (5Y 5/1) clay loam; common fine distinct yellowish brown (10YR 5/4) mottles; moderate medium prismatic structure; firm; few fine roots; clay bridging between sand grains; 5 percent gravel; neutral; clear wavy boundary.

B23tg—36 to 44 inches; gray (5Y 5/1) clay loam; many medium faint dark gray (5Y 4/1) and olive gray (5Y 5/2) mottles; weak coarse prismatic structure; firm; few fine roots; clay bridging between sand grains; 10 percent gravel; neutral; abrupt wavy boundary.

IIC—44 to 60 inches; dark gray (10YR 4/1) loamy coarse sand; single grained; loose; 10 percent gravel; slight effervescence; mildly alkaline.

Thickness of the solum ranges from 35 to 55 inches. Depth to free carbonates is generally greater than the thickness of the solum. The gravel content ranges from

2 to 51 percent by volume to a depth of 15 to 36 inches and 10 to 30 percent in the lower part of the solum and in the C horizon. Thickness of the mollic epipedon ranges from 10 to 14 inches.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly silt loam. In places it is loam, silty clay loam, or fine sandy loam. Reaction is neutral or slightly acid. The Btg horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 or 2. It is loam, clay loam, sandy clay loam, or a gravelly analog. Reaction is slightly acid to mildly alkaline. The IIC horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is stratified sand or loamy sand and a gravelly analog and has subhorizons of loam, silt loam, or sandy loam in many pedons. It is mildly alkaline or moderately alkaline.

Millsdale series

The Millsdale series consists of moderately deep, very poorly drained, moderately slowly permeable soils on till plains. These soils formed in glacial till over dolomitic limestone. In some areas the lower part of the solum formed in residuum of dolomitic limestone. Slope is 0 to 2 percent.

The Millsdale soils are commonly adjacent to Mermill, Milton, Randolph, and Tiro soils. Mermill and Tiro soils are deep to bedrock. Milton soils are well drained, and Randolph and Tiro soils are somewhat poorly drained. Milton, Randolph, and Tiro soils have a light colored surface layer and do not have a dominantly gray subsoil.

Typical pedon of Millsdale silty clay loam about 3 miles northwest of Carey, in Crawford Township, about 1,400 feet north and 300 feet east of the southwest corner of sec. 6, T. 1 S., R. 13 E.

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; many fine roots; 3 percent gravel; slightly acid; abrupt smooth boundary.

B21g—11 to 15 inches; dark grayish brown (10YR 4/2) silty clay loam; many medium distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; common fine roots; brown (10YR 4/3) krotovinas; dark grayish brown (10YR 4/2) coatings on faces of peds; 5 percent gravel; neutral; clear wavy boundary.

B22tg—15 to 25 inches; grayish brown (10YR 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; common fine roots; brown (10YR 4/3) krotovinas; light brownish gray (2.5Y 6/2) coatings on faces of peds; medium patchy clay films on faces of peds; 5 percent gravel; mildly alkaline; clear wavy boundary.

B23tg—25 to 36 inches; grayish brown (10YR 5/2) clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure; firm; common fine roots; dark grayish brown (10YR 4/2) krotovinas; gray (5Y 5/1) coatings on faces of peds; medium patchy clay films on faces of peds; channery loamy sand in the lower part; slight effervescence in the lower part; mildly alkaline; abrupt smooth boundary.

IIR—36 inches; light gray (5Y 7/2) and pale yellow (5Y 7/3) coarse grained dolomitic limestone; massive; dense; slight effervescence; moderately alkaline.

Depth to bedrock and thickness of the solum range from 20 to 40 inches. Thickness of the mollic horizon ranges from 10 to 15 inches. Gravel of mixed igneous rock and dolomite, by volume, ranges from 2 to 10 percent, throughout the soil, except for a thin layer immediately above the bedrock that ranges from 10 to 40 percent flat dolomitic limestone fragments.

The Ap horizon has value of 2 or 3 and chroma of 0 to 2. It is silty clay loam. In some pedons it is silt loam or loam. Reaction is slightly acid or neutral. The B2 horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 to 4. It is silty clay loam or clay loam. Reaction ranges from slightly acid to mildly alkaline.

Milton series

The Milton series consists of moderately deep, well drained, moderately or moderately slowly permeable soils that formed in glacial till and residuum of dolomitic limestone on till plains. A few areas are on lake plains. Slope ranges from 0 to 6 percent.

Milton soils are similar to Ritchey soils and are commonly adjacent to Lykens, Millsdale, and Randolph soils. Lykens soils are moderately well drained and are deeper to bedrock. Ritchey soils have dolomitic limestone bedrock at a depth of 10 to 20 inches. Randolph soils are somewhat poorly drained, and Millsdale soils are very poorly drained. Randolph and Millsdale soils have a mottled subsoil.

Typical pedon of Milton silt loam, 2 to 6 percent slopes, about 2.8 miles northwest of Carey, in Crawford Township, about 260 feet east and 550 feet south of the northwest corner of sec. 7, T. 1 S., R. 13 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; strong fine granular structure; friable; many fine roots; 2 percent coarse fragments; neutral; abrupt smooth boundary.

B1—10 to 15 inches; brown (7.5YR 5/4) silty clay loam; strong medium subangular blocky structure; friable; common fine roots; many fine pores; 30 percent dark grayish brown (10YR 4/2) krotovinas; 2 percent coarse fragments, mainly igneous and shale; neutral; clear wavy boundary.

B21t—15 to 23 inches; brown (7.5YR 5/4) silty clay; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; brown (7.5YR 5/4) coatings on faces of peds; medium continuous brown (7.5YR 5/4) clay films on faces of peds; 3 percent coarse fragments, mainly igneous and shale; neutral; abrupt wavy boundary.

B22t—23 to 32 inches; dark brown (7.5YR 4/4) clay; strong fine angular blocky structure; firm; few fine roots; thick continuous dark brown (7.5YR 3/2) clay films on faces of peds; 5 percent coarse fragments, mainly igneous and shale; mildly alkaline; abrupt irregular boundary.

IIB3t—32 to 35 inches; yellowish brown (10YR 5/4) loam; weak medium subangular blocky structure; friable; few fine roots; dark brown (7.5YR 3/2) coatings on faces of peds; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; 5 percent coarse fragments, mainly dolomitic limestone; mildly alkaline; abrupt irregular boundary.

IIC—35 to 38 inches; light gray (10YR 7/1) sandy loam; few common distinct light brownish gray (10YR 6/2) mottles; single grained; loose; 12 percent coarse fragments, mainly dolomitic limestone; strong effervescence; moderately alkaline; abrupt irregular boundary.

IIR—38 inches; light brownish gray (10YR 6/2) and light gray (10YR 7/1) dolomitic limestone; massive; dense; strong effervescence; moderately alkaline.

Thickness of the solum and depth to bedrock range from 20 to 40 inches. Coarse fragments range from 2 to 10 percent by volume in the solum.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 or 3. It is dominantly silt loam. In some pedons it is loam. Reaction ranges from medium acid to neutral. The B horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 3 to 6. The B2t horizon is clay, silty clay, clay loam, or silty clay loam. The B3 horizon is loam or clay loam. Reaction ranges from very strongly acid to neutral in the upper part of the B horizon and slightly acid to mildly alkaline in the lower part. The C horizon, where present, is loam or sandy loam that derived from dolomitic limestone or clay loam that derived from till. It is mildly alkaline or moderately alkaline.

Morley series

The Morley series consists of deep, well drained, moderately slowly or slowly permeable soils on hillsides along streams and on end moraines. These soils formed in calcareous glacial till. Slope ranges from 6 to 50 percent.

Morley soils are similar to Cardington, Glynwood, and Shinrock soils and are commonly adjacent to Blount and Pewamo soils. Blount and Pewamo soils are wetter and have gray in the subsoil. Cardington, Glynwood, and Shinrock soils are moderately well drained and have mottles of low chroma in the upper part of the subsoil. Cardington and Glynwood soils are mainly in the less sloping areas. Shinrock soils formed in lacustrine sediment and are laminated in the C horizon.

Typical pedon of Morley silt loam, 12 to 18 percent slopes, eroded, about 3 miles east of Carey, in Crawford Township, about 1,000 feet east and 150 feet south of the northwest corner of sec. 24, T. 1 S., R. 13 E.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, gray (10YR 6/1) dry; strong fine granular structure; very friable; many fine roots; flecks of brown (10YR 4/3); 2 percent gravel; neutral; abrupt smooth boundary.

B1—5 to 13 inches; brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; firm; common medium roots; pale brown (10YR 6/3) and dark grayish brown (10YR 4/2) coatings on faces of peds; 2 percent gravel; medium acid; clear wavy boundary.

B21t—13 to 22 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium prismatic structure parting to moderate fine subangular blocky; firm; few fine roots; brown (10YR 4/3) coatings on faces of peds; medium continuous clay films on faces of peds; 3 percent gravel; strongly acid; clear wavy boundary.

B22t—22 to 32 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium prismatic structure; very firm; brown (10YR 4/3) coatings on faces of peds; thick continuous clay films on faces of peds; 3 percent gravel; medium acid; clear wavy boundary.

B3t—32 to 35 inches; yellowish brown (10YR 5/4) silty clay loam; few fine faint yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; very firm; brown (10YR 4/3) coatings on faces of peds; medium continuous clay films on faces of peds; 3 percent gravel; mildly alkaline; clear wavy boundary.

C—35 to 60 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; massive; very firm; many medium prominent light gray (10YR 7/1) secondary lime streaks; 5 percent gravel; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 20 to 48 inches. The depth to carbonates is slightly less than the thickness of the solum in some pedons. The gravel content is 2 to 10 percent, by volume, throughout the soil.

The Ap or A1 horizon has value of 2 to 4 and chroma of 1 to 3. The surface is dominantly silt loam. In some severely eroded areas it is silty clay loam. Reaction ranges from medium acid to neutral. The B horizon has value of 4 or 5 and chroma of 3 or 4. It is clay loam, silty clay loam, silty clay, or clay. The upper part is strongly acid or medium acid, and the lower part is slightly acid to mildly alkaline. The C horizon is silty clay loam or clay loam.

Nappanee series

The Nappanee series consists of deep, somewhat poorly drained, very slowly permeable soils on end moraines and ground moraines bordering lake plains. These soils formed in clayey calcareous glacial till. Slope ranges from 0 to 12 percent.

Nappanee soils are similar to Blount, Fulton, and Del Rey soils and are commonly adjacent to Latty and Pandora soils. Blount soils have less clay in the B and C horizons. Fulton, Del Rey, and Latty soils formed in lacustrine sediment. Latty and Pandora soils are wetter and are dominantly grayish in the upper part of the subsoil.

Typical pedon of Nappanee silt loam, 2 to 6 percent slopes, about 3 miles northwest of Marseilles, in Jackson Township, about 1,800 feet north and 2,100 feet west of the southeast corner of sec. 36, T. 3 S., R. 12 E.

Ap—0 to 6 inches; dark brown (10YR 4/3) silt loam, light gray (10YR 7/2) dry; moderate medium granular structure; friable; many fine roots; medium acid; few pebbles; abrupt smooth boundary.

A2—6 to 10 inches; pale brown (10YR 6/3) silty clay loam; few medium distinct gray (10YR 6/1) and yellowish brown (10YR 5/4) mottles; moderate medium platy structure; firm; few fine roots; few pebbles; strongly acid; clear smooth boundary.

B21t—10 to 13 inches; dark brown (10YR 4/3) silty clay; common medium distinct gray (10YR 5/1) and yellowish brown (10YR 5/6) mottles; moderate fine angular blocky structure; firm; few fine roots; thin patchy grayish brown (10YR 5/2) clay films on faces of peds; few pebbles; strongly acid; clear smooth boundary.

B22t—13 to 20 inches; dark brown (10YR 4/3) clay; common medium distinct gray (10YR 5/1) and yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; very firm; few fine roots; medium continuous dark grayish brown (10YR 4/2) clay films on faces of peds; few pebbles; strongly acid; clear wavy boundary.

B23t—20 to 28 inches; dark brown (10YR 4/3) clay; common medium distinct light gray (10YR 6/1) and yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure; very firm; medium continuous dark grayish brown (10YR 4/2) clay films on faces of peds; few pebbles; mildly alkaline; abrupt wavy boundary.

C—28 to 60 inches; dark brown (10YR 4/3) silty clay; many medium distinct gray (5Y 6/1) and yellowish brown (10YR 5/4) mottles; massive; very firm; common black shale fragments; white (10YR 8/2) secondary lime deposits; few pebbles; slight effervescence; moderately alkaline.

Thickness of the solum ranges from 20 to 36 inches. The gravel content is 0 to 3 percent, by volume, in the A and B horizons and 3 to 5 percent in the C horizon.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. It is dominantly silt loam or silty clay loam and is strongly acid to neutral. The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 3. It is dominantly silty clay or clay and is 45 to 55 percent clay in the texture control section. In some places it has thin subhorizons of silty clay loam. The B horizon is strongly acid to mildly alkaline. The C horizon is silty clay or clay and is 40 to 50 percent clay.

Olentangy series

The Olentangy series consists of deep, very poorly drained soils in deep depressions, in basins of former glacial lakes, and on till plains and outwash plains. These soils formed in coprogenous earth 24 to 50 inches thick and are underlain by lacustrine sediment or glacial till. Permeability is moderate in the solum and slow in the underlying material. Slope is 0 to 2 percent.

Olentangy soils are commonly adjacent to the very poorly drained Bono, Carlisle, Milford, and Sloan soils. Carlisle soils formed in organic material more than 51 inches thick. Bono, Milford, and Sloan soils formed in mineral material. Sloan soils are on flood plains and are occasionally flooded.

Typical pedon of Olentangy mucky silt loam, about 1.5 miles north of Upper Sandusky, in Crane Township, about 900 feet west and 2,600 feet north of the southeast corner of sec. 19, T. 2 S., R. 14 E.

Lcop—0 to 14 inches; black (10YR 2/1) mucky silt loam, very dark gray (10YR 3/1) dry; strong medium granular structure; very friable; many fine roots; neutral; abrupt smooth boundary.

Lco2—14 to 20 inches; dark grayish brown (10YR 4/2) mucky silt loam; weak medium prismatic structure; firm; many fine roots; many fine faint dark brown (10YR 4/3) and dark yellowish brown (10YR 4/4) streaks; yellowish brown (10YR 5/6) coatings on faces of peds in the upper part; many fine very dark brown (10YR 2/2) plant remains; very strongly acid; gradual wavy boundary.

Lco3—20 to 28 inches; dark grayish brown (10YR 4/2) silt loam; common medium distinct gray (5Y 5/1) mottles; weak thick platy structure; firm; common fine roots; many fine faint dark brown (10YR 4/3) and dark yellowish brown (10YR 4/4) streaks; many fine very dark brown (10YR 2/2) plant remains; medium acid; gradual wavy boundary.

Lco4—28 to 40 inches; dark gray (10YR 4/1) silt loam; massive; friable; olive (5Y 5/6) plant leaf impressions; few coarse distinct dark grayish brown (10YR 4/2) streaks; mildly alkaline; gradual wavy boundary.

IICg—40 to 60 inches; dark gray (5Y 4/1) silt loam; 10 percent fibers, 3 percent rubbed; massive; friable; few medium gray (5Y 5/1) secondary lime deposits; olive (5Y 5/6) plant leaf impressions; slight effervescence; mildly alkaline.

The thickness of the coprogenous earth and the depth to lacustrine sediment or glacial till range from 24 to 50 inches. The Lco horizon, which is coprogenous earth, ranges from extremely acid to mildly alkaline. The C horizon is mildly alkaline or moderately alkaline.

The Lcop horizon has hue of 10YR or 7.5YR or is neutral; it has value of 2 or 3 and chroma of 1 or 2. It is dominantly mucky silt loam; however, the range includes mucky silty clay loam and sapric or hemic organic material as much as 16 inches thick. The Lco horizon, which is coprogenous earth, below a depth of 14 inches has hue of 10YR to 5YR, value of 3 to 5, and chroma of 1 to 4. It is dominantly mineral material and is commonly mucky silt loam, silt loam, or silty clay loam. Leaf imprints and other plant remnants are evident in some pedons. Gypsum crystals along root channels and partings are evident in some pedons, and shell fragments are common in some pedons. The C horizon has hue of 10YR to 5G or is neutral; it has value of 4 to 6 and chroma of 1 or 2. It is silt loam, silty clay loam, or loam.

Oshtemo series

The Oshtemo series consists of deep, well drained soils that formed in stratified, calcareous, glacial fluvial deposits on outwash terraces and end moraines. Permeability is moderately rapid in the solum and very rapid in the underlying material. Slope ranges from 1 to 35 percent.

The Oshtemo soils are similar to Belmore and Martinsville soils and are commonly adjacent to Digby, Millgrove, and Tuscola soils. Belmore soils have more clay and gravel and less sand in the subsoil than the Oshtemo soils. Martinsville and Tuscola have less gravel and more silt throughout. Digby soils are somewhat poorly drained, and Millgrove soils are very poorly drained. Digby and Millgrove soils are mottled in the subsoil.

Typical pedon of Oshtemo fine sandy loam, 1 to 6 percent slopes, about 2.5 miles west-northwest of Sycamore, in Tymochtee Township, about 1,600 feet west and 2,100 feet south of the northeast corner of sec. 15, T. 1 S., R. 14 E.

Ap—0 to 9 inches; dark brown (10YR 4/3) fine sandy loam, light brownish gray (10YR 6/2) dry; weak medium granular structure; friable; many medium roots; 5 percent gravel; neutral; abrupt smooth boundary.

A2—9 to 16 inches; dark brown (10YR 4/3) fine sandy loam; weak thick platy structure parting to weak medium subangular blocky; friable; common fine roots; 5 percent gravel; slightly acid; clear smooth boundary.

B21t—16 to 24 inches; dark brown (10YR 4/3) sandy loam; moderate medium subangular blocky structure; friable; common fine roots; thin continuous silt coatings on faces of peds; 10 percent gravel; medium acid; clear wavy boundary.

B22t—24 to 32 inches; dark brown (10YR 4/3) fine sandy loam; weak coarse subangular blocky structure; friable; common fine roots; thin continuous silt coatings on faces of peds and some clay bridging; 10 percent gravel; medium acid; diffuse wavy boundary.

B31t—32 to 40 inches; dark yellowish brown (10YR 3/4) coarse sandy loam; weak coarse subangular blocky structure; friable; few fine roots; 10 percent gravel; slightly acid; gradual wavy boundary.

B32t—40 to 50 inches; dark yellowish brown (10YR 4/4) coarse sandy loam; weak coarse subangular blocky structure; friable; few fine roots; thin bands of sandy clay loam and loamy sand; clay bridging in sandy clay loam bands; 10 percent gravel; neutral; gradual wavy boundary.

B33t—50 to 66 inches; dark yellowish brown (10YR 3/4) coarse sandy loam; weak coarse subangular blocky structure; friable; dark yellowish brown (10YR 4/4) blotches; bridging between sand grains; 10 percent gravel; neutral; abrupt irregular boundary.

C—66 to 70 inches; light yellowish brown (10YR 6/4) gravelly loamy coarse sand; single grained; loose; 25 percent gravel and many very dark gray (N 3/0) shale fragments; strong effervescence; mildly alkaline.

Thickness of the solum ranges from 40 to 66 inches. The depth to free carbonates is more than the thickness of the solum in some pedons. The content of coarse fragments is 1 to 10 percent by volume in the upper part of the solum and 5 to 20 percent in the lower part. The C horizon is 10 to 30 percent coarse fragments. The solum is dominantly strongly acid to slightly acid. It ranges to neutral in the Ap horizon where lime has been added and in the B3 horizon where banded.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is commonly fine sandy loam. In some pedons it is sandy loam or loamy sand. The B2 horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 3 or 4. The Bt horizon is sandy loam, fine sandy loam, or sandy clay loam. The C horizon has value of 5 or 6 and chroma of 2 to 4. It is sand, loamy coarse sand, loamy sand, or a gravelly analog. Its reaction is mildly alkaline or moderately alkaline.

Pandora series

The Pandora series consists of deep, poorly drained, slowly permeable soils in slight depressions on till plains.

These soils formed in calcareous glacial till. Slope is 0 to 2 percent.

Pandora soils are similar to Latty soils and are commonly adjacent to Bennington, Blount, and Pewamo soils. Bennington and Blount soils are not dominantly grayish in the subsoil above a depth of 30 inches. Pewamo soils have a mollic epipedon. Latty soils have more clay in the subsoil and underlying material.

Typical pedon of Pandora silty clay loam, about 1.25 miles southwest of Kirby, in Jackson Township, about 725 feet west and 300 feet south of the northeast corner of sec. 11, T. 3 S., R. 12 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silty clay loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

B21tg—8 to 17 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine distinct yellowish brown (10YR 5/4) and few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common fine roots; medium continuous dark gray (10YR 4/1) clay films on vertical faces of peds; few pebbles; neutral; clear wavy boundary.

B22tg—17 to 26 inches; dark grayish brown (2.5Y 4/2) silty clay; common medium distinct yellowish brown (10YR 5/4) and few fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; medium continuous dark gray (10YR 4/1) clay films on vertical and horizontal faces of peds; few pebbles; neutral; clear wavy boundary.

B23tg—26 to 39 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine distinct olive brown (2.5Y 4/4) and yellowish brown (10YR 5/4) and few fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm; medium patchy gray (10YR 5/1) clay films on vertical and horizontal faces of peds; few pebbles; mildly alkaline; gradual wavy boundary.

B24t—39 to 46 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct grayish brown (10YR 5/2) and common fine faint yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; very firm; medium very patchy gray (10YR 5/1) clay films on vertical faces of peds; 5 percent gravel; mildly alkaline; gradual wavy boundary.

B3t—46 to 63 inches; yellowish brown (10YR 5/4) clay loam; few fine distinct grayish brown (10YR 5/2) and few fine faint yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; very firm; medium patchy gray (10YR 5/1) clay films on vertical and horizontal faces of peds; very dark brown (7.5YR 2/2) stains (iron and manganese oxides); 5 percent gravel; mildly alkaline; clear wavy boundary.

C—63 to 70 inches; dark yellowish brown (10YR 4/4) silty clay loam; massive; very firm; very pale brown (10YR 7/3) secondary lime stains; 5 percent gravel; strong effervescence; moderately alkaline.

Thickness of the solum and depth to free carbonates range from 40 to 70 inches. The content of gravel is 0 to 5 percent, by volume, throughout the soil.

The Ap horizon has value of 3 or 4 and chroma of 1 or 2. Some pedons have a thin A1 horizon. The A horizon is dominantly silty clay loam. In some places it is silt loam. It is slightly acid or neutral. The B horizon has hue of 5Y to 10YR, value of 4 to 6, and chroma of 0 to 2 above a depth of 30 inches and 0 to 4 below. The weighted average clay content ranges from 35 to 40 percent. The B horizon is slightly acid to mildly alkaline. The C horizon has value of 4 or 5 and chroma of 3 or 4. It is silty clay loam or clay loam.

Paulding series

The Paulding series consists of deep, very poorly drained, very slowly permeable soils that formed in calcareous clayey lacustrine sediment on lake plains. Slope is 0 to 2 percent.

The Paulding soils are similar to Latty soils and are commonly adjacent to Bono and Fulton soils. Bono soils have a mollic epipedon. Bono and Latty soils have less clay throughout the soil. Fulton soils are somewhat poorly drained and are less gray in the subsoil.

Typical pedon of Paulding clay, about 3.5 miles east of Marseilles, in Marseilles Township, about 450 feet west and 2,500 feet north of the southeast corner of sec. 14, T. 4 S., R. 13 E.

Ap—0 to 7 inches; dark gray (10YR 4/1) clay, gray (10YR 6/1) dry; moderate fine subangular blocky structure; firm; many fine roots; neutral; abrupt smooth boundary.

B1g—7 to 12 inches; dark gray (10YR 4/1) clay; common fine distinct yellowish brown (10YR 5/4) mottles; moderate medium angular blocky structure; very firm; common fine roots; common slickensides at 45 degree angle; neutral; clear smooth boundary.

B21g—12 to 22 inches; gray (10YR 5/1) clay; many fine distinct yellowish brown (10YR 5/4) mottles; moderate coarse angular blocky structure; very firm; few fine roots; continuous dark gray (10YR 4/1) coatings on faces of peds; common slickensides at 45 degree angle; neutral; gradual wavy boundary.

B22g—22 to 41 inches; grayish brown (10YR 5/2) clay; many fine distinct yellowish brown (10YR 5/4) mottles; weak medium prismatic structure; very firm; continuous gray (10YR 5/1) and patchy dark gray (10YR 4/1) coatings on vertical faces of peds;

common slickensides at 45 degree angle; mildly alkaline; gradual wavy boundary.

B3g—41 to 55 inches; grayish brown (10YR 5/2) clay; many medium distinct yellowish brown (10YR 5/4) mottles; weak coarse prismatic structure; very firm; continuous gray (10YR 5/1) coatings on faces of peds; few slickensides at 45 degree angle; mildly alkaline; clear wavy boundary.

Cg—55 to 60 inches; grayish brown (10YR 5/2) clay; common medium distinct light olive brown (2.5Y 5/4) mottles; weak very coarse prismatic structure; very firm; weakly laminated; slight effervescence; moderately alkaline.

Thickness of the solum ranges from 50 to 55 inches. Depth to carbonates in most places is slightly less than the thickness of the solum. The upper part of the solum is slightly acid or neutral, and the lower part is neutral or mildly alkaline.

The Ap horizon has hue of 10YR or 2.5Y and chroma of 1 or 2. Some pedons have an A1 horizon as much as 5 inches thick. The A horizon is dominantly clay. In some pedons it is silty clay. The Bg horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. The clay content ranges from 60 to 70 percent. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is clay or silty clay.

Pewamo series

The Pewamo series consists of deep, very poorly drained, moderately slowly permeable soils on broad flats and low lying or depressional areas of till plains. These soils formed in calcareous glacial till. Slope is 0 to 2 percent.

The Pewamo soils are similar to Bono, Elliott, Pandora, and Milford soils and are commonly adjacent to Bennington and Blount soils. Bennington, Blount, and Elliott soils are somewhat poorly drained and do not have a dominantly gray subsoil. Blount and Bennington soils have a lighter colored surface layer. Bono and Milford soils formed in lacustrine sediment. Pandora soils do not have a mollic epipedon.

Typical pedon of Pewamo silty clay loam, about 2 miles west of Wharton, in Richland Township, about 200 feet east and 300 feet north of the center of sec. 20, T. 2 S., R. 12 E.

Ap—0 to 11 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; strong fine granular structure; friable; many fine roots; few pebbles; neutral; clear smooth boundary.

B21tg—11 to 17 inches; dark gray (10YR 4/1) silty clay; common medium faint grayish brown (10YR 5/2) and few fine distinct yellowish brown (10YR 5/4) mottles; moderate medium prismatic structure; firm; common fine roots; very dark grayish brown (10YR 3/2) clay coatings on faces of peds; few pebbles; neutral; gradual wavy boundary.

B22tg—17 to 27 inches; gray (10YR 5/1) silty clay; many medium distinct grayish brown (2.5Y 5/2) and common medium prominent yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure; firm; few fine roots; gray (N 5/0) clay coatings on faces of peds; few pebbles; neutral; gradual wavy boundary.

B23tg—27 to 42 inches; olive gray (5Y 5/2) silty clay loam; common medium distinct light olive brown (2.5Y 5/4) mottles; moderate medium prismatic structure; firm; gray (N 5/0) clay coatings on faces of peds; few pebbles; neutral; gradual wavy boundary.

B3—42 to 65 inches; brown (10YR 5/3) clay loam; many medium distinct gray (10YR 5/1) mottles; moderate coarse prismatic structure; firm; yellowish brown (10YR 5/4) and gray (N 5/0) clay coatings on faces of peds; 5 percent gravel; mildly alkaline; abrupt wavy boundary.

Cg—65 to 70 inches; dark grayish brown (10YR 4/2) clay loam; few fine distinct gray (10YR 5/1) and yellowish brown (10YR 5/4) mottles; weak thick platy structure; very firm; 5 percent gravel, mainly fragments of black shale and crystalline pebbles; strong effervescence; moderately alkaline.

The thickness of the solum and depth to carbonates range from 40 to 70 inches. Content of gravel is 2 to 10 percent, by volume, throughout the soil. The thickness of the mollic epipedon ranges from 10 to 16 inches.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly silty clay loam. In some pedons it is silty clay or silt loam. It is slightly acid or neutral. The B horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 to 4. The weighted average clay content of the B2 horizon ranges from 35 to 45 percent. It is silty clay loam, silty clay, clay, or clay loam. Reaction is slightly acid to mildly alkaline, becoming more alkaline with depth. The C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. It is clay loam or silty clay loam glacial till.

Randolph series

The Randolph series consists of moderately deep, somewhat poorly drained, moderately slowly permeable soils on till plains. These soils formed in glacial till and in residuum of dolomitic limestone. Slope ranges from 0 to 3 percent.

Randolph soils are commonly adjacent to Mermill, Millsdale, Milton, Ritchey, and Tiro soils. Mermill and Millsdale soils are very poorly drained and have a dominantly gray subsoil. Milton and Ritchey soils are well drained and do not have mottles in the subsoil. Ritchey soils are shallow to bedrock, and Tiro soils are deep to bedrock.

Typical pedon of Randolph silt loam, 0 to 3 percent slopes, about 3 miles northwest of Carey, in Ridge Township, about 500 feet west and 200 feet north of the southeast corner of sec. 1, T. 1 S., R. 12 E.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, light gray (10YR 7/2) dry; moderate medium granular structure; friable; many fine roots; 2 percent gravel; slightly acid; abrupt smooth boundary.
B1—8 to 15 inches; dark brown (10YR 4/3) silt loam; few fine faint yellowish brown (10YR 5/6) and few fine distinct grayish brown (10YR 5/2) mottles; moderate fine subangular blocky structure; firm; common fine roots; thin very patchy grayish brown (10YR 5/2) clay films on faces of peds; 2 percent gravel; medium acid; clear smooth boundary.
B21t—15 to 25 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine faint yellowish brown (10YR 5/6) and few fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; common fine roots; medium patchy grayish brown (10YR 5/2) clay films on faces of peds; 2 percent gravel; slightly acid; gradual smooth boundary.
B22t—25 to 34 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine roots; medium continuous grayish brown (10YR 5/2) clay films on faces of peds; 5 percent gravel; neutral; abrupt smooth boundary.
IIC—34 to 36 inches; light gray (10YR 7/2) channery sandy loam; few fine distinct yellowish brown (10YR 5/6) mottles; single grained; loose; 35 percent coarse dolomitic limestone fragments; slight effervescence; mildly alkaline; abrupt smooth boundary.
IIR—36 inches; light gray (10YR 7/2) hard dolomitic limestone bedrock; massive; slight effervescence.

Thickness of the solum and depth to lithic contact range from 20 to 40 inches. However, the depth to dolomitic limestone bedrock is variable within short distances. Content of gravel ranges from 2 to 10 percent, by volume, in the solum. Dolomitic limestone fragments in the C horizon range from 10 to 60 percent.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 3. In some places there is an A1 horizon that is dominantly silt loam. In other places it is loam. Reaction is neutral to strongly acid. The B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4; some subhorizons have chroma of 1 or 2. The B2 horizon is silty clay loam, clay loam, or silty clay. Reaction ranges from slightly acid to strongly alkaline in the upper part of the B horizon and slightly acid to mildly alkaline in the lower part. The C horizon is loam, sandy loam, clay loam, or a channery analog. It is mildly alkaline or moderately alkaline.

Ritchey series

The Ritchey series consists of shallow, well drained, moderately permeable soils that formed in glacial till and in residuum of dolomitic limestone on the crest of glaciated bedrock-controlled ridges. Slope ranges from 1 to 12 percent.

The Ritchey soils in Wyandot County have more clay in the upper part of the subsoil than is defined as the range for the Ritchey series. This difference, however, does not affect the use and management of the soils.

The Ritchey soils are similar to Milton soils and are commonly adjacent to Lykens, Randolph, and Tiro soils. Milton soils are moderately deep to bedrock. Lykens soils are moderately well drained. Randolph and Tiro soils are somewhat poorly drained. These soils are deeper to bedrock and have mottles in the lower part of the subsoil.

Typical pedon of Ritchey silt loam, 1 to 6 percent slopes, about 3.5 miles northwest of Carey, in Ridge Township, about 460 feet west and 600 feet south of the center of sec. 2, T. 1 S., R. 12 E.

Ap—0 to 5 inches; brown (10YR 4/3) silt loam, brown (7.5YR 5/4) dry; strong fine granular structure; friable; many medium roots; 10 percent coarse fragments; neutral; clear smooth boundary.
B21t—5 to 10 inches; brown (7.5YR 4/4) clay; strong fine angular blocky structure; firm; common fine roots; thick continuous reddish brown (5YR 4/3) clay films on faces of peds; 5 percent coarse fragments; mildly alkaline; abrupt wavy boundary.
B22t—10 to 15 inches; brown (7.5YR 5/4) channery clay loam; weak medium subangular blocky structure; friable; few fine roots; medium patchy brown (7.5YR 4/4) clay films on faces of peds; 15 percent light yellowish brown (10YR 6/4) unweathered dolomitic limestone fragments; mildly alkaline; clear wavy boundary.
IIB3t—15 to 19 inches; brown (7.5YR 5/4) channery sandy clay loam; single grained; loose; 35 percent light yellowish brown (10YR 6/4) unweathered dolomite fragments; brown (7.5YR 4/4) medium patchy clay films on coarse fragments; mildly alkaline; abrupt wavy boundary.
IIR—19 inches; light gray (10YR 6/1) dolomitic limestone; porous; dense; massive.

Thickness of the solum and depth to bedrock range from 10 to 20 inches. The dolomitic limestone fragments range from 0 to 35 percent by volume in the horizon directly above the bedrock. The upper part of the solum is slightly acid to mildly alkaline, and the lower part is neutral to moderately alkaline.

The Ap horizon has chroma of 2 or 3. It is dominantly silt loam. In some pedons it is loam. The B2t horizon has hue of 10YR to 5YR, value of 4 to 6, and chroma of 3 to 5. The clay content averages 27 to 35 percent, although individual subhorizons may be as much as 55 percent clay. The sand content averages 15 to 50 percent. The B3 horizon is sandy clay loam, sandy loam, loam, or a channery analog. Some areas have tonguing of soil material into fractures in the bedrock.

Shinrock series

The Shinrock series consists of deep, moderately well drained, moderately slowly permeable soils that formed in calcareous lacustrine sediment on hillsides along stream valleys of dissected lake plains. Slope ranges from 2 to 18 percent.

Shinrock soils are similar to Cardington, Glynwood, and Lykens soils and are commonly adjacent to Del Rey, Martinsville, and Tuscola soils. Cardington and Glynwood soils formed in glacial till. Lykens soils formed in water-deposited material over glacial till. The soil derived from glacial till contains till pebbles. Del Rey and Milford soils are wetter and are mottled below the surface layer. Martinsville and Tuscola soils have less clay in the subsoil.

Typical pedon of Shinrock silt loam, 6 to 12 percent slopes, eroded, about 2 miles south of McCutchenville, in Tymochtee Township, 2,530 feet east and 325 feet south of the northwest corner of sec. 17, T. 1 S., R. 14 E.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam, light gray (10YR 7/2) dry; moderate coarse granular structure; friable; many medium roots; slightly acid; abrupt wavy boundary.

B21t—9 to 14 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine angular blocky structure; firm; many fine roots; thin continuous dark brown (10YR 4/3) clay films on vertical and horizontal faces of peds; medium acid; clear wavy boundary.

B22t—14 to 21 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct grayish brown (10YR 5/2) mottles; moderate medium angular blocky structure; firm; common fine roots; thin continuous dark brown (10YR 4/3) clay films on vertical and horizontal faces of peds; strongly acid; clear wavy boundary.

B23t—21 to 29 inches; dark brown (10YR 4/3) silty clay; few medium distinct gray (10YR 5/1) mottles; moderate medium prismatic structure parting to moderate coarse angular blocky; firm; few fine and medium roots; medium continuous dark grayish brown (10YR 4/2) clay films on vertical and horizontal faces of peds; few gray (5Y 5/1) krotovinas 2 to 3 inches in diameter that have brown (7.5YR 5/4) margins; strongly acid; abrupt wavy boundary.

B3t—29 to 37 inches; dark brown (10YR 4/3) silt loam; common fine distinct yellowish brown (10YR 5/6) and few fine distinct grayish brown (10YR 5/2) mottles; weak coarse prismatic structure with weak lamination; friable; many fine prominent very dark brown (7.5YR 2/2) stains (iron and manganese oxides); thick patchy dark grayish brown (10YR 4/2) clay films on vertical faces of peds; few gray (5Y 5/1) krotovinas 2 to 3 inches in diameter that have brown (7.5YR 5/4) margins; medium acid; abrupt wavy boundary.

C1—37 to 45 inches; dark brown (10YR 4/3) silt loam; massive with weak lamination; friable; few medium light gray (10YR 7/2) secondary lime deposits; slight effervescence; mildly alkaline; clear wavy boundary.

C2—45 to 60 inches; dark brown (10YR 4/3) silty clay loam; massive; very firm; few medium light gray (10YR 7/2) secondary lime nodules and few black shale fragments; slight effervescence; mildly alkaline.

The thickness of the solum and depth to free carbonates range from 30 to 40 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. It is dominantly silt loam. In some pedons it is loam, fine sandy loam, or silty clay loam. Reaction is medium acid to neutral. The B2 horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is silty clay loam, silty clay, or clay loam. Reaction is strongly acid to slightly acid in the upper part and medium acid to mildly alkaline in the lower part. The C horizon has hue of 7.5YR to 2.5Y, value or 4 or 5, and chroma of 2 to 4. It is dominantly silt loam or silty clay loam. In places it has strata of silty clay, loam, fine sandy loam, or very fine sandy loam. Reaction is neutral to moderately alkaline.

Shoals series

The Shoals series consists of deep, somewhat poorly drained, moderately permeable soils that formed in recent alluvium on flood plains and low stream terraces. Slope is 0 to 2 percent.

Shoals soils are similar to Sloan soils and are commonly adjacent to Chagrin, Genesee, Lindside, and Medway soils. Chagrin and Genesee soils are well drained, and Lindside and Medway soils are moderately well drained. Chagrin, Genesee, Lindside, and Medway soils do not have gray mottles directly below the plow layer. Medway and Sloan soils have a mollic epipedon. Sloan soils are very poorly drained and have a dominantly gray subsoil.

Typical pedon of Shoals silt loam, occasionally flooded, about 5 miles west of Upper Sandusky, in Salem Township, 400 feet north and 600 feet east of the southwest corner of sec. 33, T. 2 S., R. 13 E.

Ap—0 to 11 inches; dark grayish brown (10YR 4/2) silt loam, light gray (2.5Y 7/2) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

C1—11 to 23 inches; dark grayish brown (2.5Y 4/2) silt loam; many medium distinct gray (10YR 5/1), few fine distinct yellowish brown (10YR 5/4), and few medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; common fine roots; dark gray (10YR 4/1) coatings on faces of peds; neutral; gradual wavy boundary.

C2—23 to 37 inches; yellowish brown (10YR 5/4) silt loam; common medium faint grayish brown (10YR 5/2) and few medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; gray (10YR 5/1) coatings on faces of peds; very dark brown (7.5YR 2/2) stains (iron and manganese oxides) on faces of peds; neutral; gradual wavy boundary.

C3—37 to 50 inches; light olive brown (2.5Y 5/4) loam; few fine faint yellowish brown (10YR 5/6) and many fine distinct gray (10YR 5/1) mottles; weak coarse subangular blocky structure; friable; very dark brown (7.5YR 2/2) stains (iron and manganese oxides) on faces of peds; neutral; gradual wavy boundary.

C4—50 to 60 inches; yellowish brown (10YR 5/4) loam; common fine distinct grayish brown (10YR 5/2) and common medium distinct strong brown (7.5YR 5/6) mottles; massive; friable; 5 to 10 percent gravel; neutral.

Reaction is slightly acid to mildly alkaline in the upper 40 inches and slightly acid to moderately alkaline below a depth of 40 inches.

The Ap horizon has value of 4 or 5. It is silt loam. In some places it is loam or silty clay loam. The upper part of the C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. It is silt loam, loam, or silty clay loam. The lower part of the C horizon is loam, silt loam, sandy loam, or a gravelly analog.

Shoals silt loam, rarely flooded, has more development in the B horizon than is defined as the range for the series. This difference, however, does not affect the use and management of the soil.

Sloan series

The Sloan series consists of deep, very poorly drained, moderately or moderately slowly permeable soils that formed in alluvium on flood plains. Slope is 0 to 2 percent.

Sloan soils are similar to Shoals soils and are commonly adjacent to Chagrin, Genesee, Medway, and Olentangy soils. Chagrin and Genesee soils are well drained, Medway soils are moderately well drained, and Shoals soils are somewhat poorly drained. Chagrin, Genesee, Medway, and Shoals soils are not dominantly gray in the 30-inch zone directly below the surface layer. Chagrin, Genesee, and Shoals soils have an ochric epipedon. Olentangy soils formed in coprogenous earth on till plains and outwash plains and in basins of former glacial lakes.

Typical pedon of Sloan silt loam, occasionally flooded, about 1.25 miles east of Crawford, in Crawford Township, about 500 feet east and 400 feet south of the northwest corner of sec. 36, T. 1 S., R. 13 E.

Ap—0 to 12 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure parting to strong medium granular; friable; many fine roots; neutral; clear smooth boundary.

A12—12 to 20 inches; very dark gray (10YR 3/1) silty clay loam, grayish brown (10YR 5/2) dry; few fine distinct dark brown (10YR 4/3) mottles; moderate medium subangular blocky structure; friable; common fine roots; neutral; clear wavy boundary.

B21g—20 to 30 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine faint dark brown (10YR 4/3) and few fine distinct yellowish brown (10YR 5/4) mottles; moderate coarse subangular blocky structure; firm; few fine roots; dark gray (10YR 4/1) coatings on faces of peds; neutral; gradual wavy boundary.

B22g—30 to 45 inches; grayish brown (10YR 5/2) silt loam; common fine distinct yellowish brown (10YR 5/4) and few fine distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; few fine roots; dark gray (10YR 4/1) coatings on faces of peds; neutral; gradual wavy boundary.

Cg—45 to 60 inches; gray (N 5/0) stratified silt loam and loam; common medium prominent yellowish brown (10YR 5/4) and few medium prominent yellowish brown (10YR 5/6) mottles; massive; firm; few fine roots; neutral.

The solum ranges from 30 to 50 inches in thickness. Reaction is slightly acid to mildly alkaline throughout the solum.

The A horizon has value of 2 or 3 and chroma of 0 to 2. It ranges from 10 to 22 inches in thickness and is dominantly silt loam. In places it is silty clay loam. The B and C horizons have hue of 10YR to 5Y or N, value of 4 or 5, and chroma of 0 to 2. The B and C horizons are stratified in some pedons. They are dominantly silt loam or silty clay loam, but the range includes loam and clay loam. The gravelly analogs of these textures and sandy loam are below a depth of 40 inches in some pedons. The clay between depths of 10 and 40 inches makes up 22 to 33 percent of the volume, but the clay content in individual strata is outside this range.

Tiro series

The Tiro series consists of deep, somewhat poorly drained soils that formed in silty and loamy water-deposited sediment and in the underlying glacial till on water-modified till plains. Permeability is moderate in the upper part and moderately slow or slow in the lower part. Slope ranges from 0 to 6 percent.

Tiro soils are similar to Bennington, Blount, and Fitchville soils and are commonly adjacent to Lykens and Pandora soils. Bennington and Blount soils formed in glacial till and have more clay in the subsoil. Fitchville soils formed in deeper lacustrine deposits. Lykens soils formed in similar materials and do not have gray mottles directly below the A horizon. Pandora soils are dominantly grayish in the upper part of the subsoil.

Typical pedon of Tiro silt loam, 2 to 6 percent slopes, about 4 miles east-northeast of Upper Sandusky, in Crane Township, about 400 feet west and 200 feet south of the northeast corner of sec. 26, T. 2 S., R. 14 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B1—10 to 14 inches; yellowish brown (10YR 5/4) silty clay loam; few fine distinct grayish brown (10YR 5/2) and few fine faint yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; common fine roots; dark grayish brown (10YR 4/2) coatings on faces of peds; medium acid; clear wavy boundary.

B21t—14 to 21 inches; yellowish brown (10YR 5/4) silty clay loam; few fine faint yellowish brown (10YR 5/6) and few fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; medium continuous grayish brown (10YR 5/2) clay films on vertical and horizontal faces of peds; slightly acid; gradual wavy boundary.

B22t—21 to 27 inches; dark brown (10YR 4/3) silty clay loam; few medium distinct yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on vertical and horizontal faces of peds; slightly acid; clear wavy boundary.

IIB3—27 to 34 inches; yellowish brown (10YR 5/4) loam; few fine distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; mildly alkaline; clear wavy boundary.

IIIC1g—34 to 39 inches; dark grayish brown (10YR 4/2) silty clay loam; few medium distinct yellowish brown (10YR 5/4) and few medium faint grayish brown (10YR 5/2) mottles; massive; firm; 2 to 5 percent gravel; strong effervescence; mildly alkaline; gradual wavy boundary.

IIIC2g—39 to 60 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine faint grayish brown (10YR 5/2) and few fine distinct gray (10YR 5/1) mottles; massive; very firm; pale brown (10YR 6/3) secondary lime streaks; 5 to 10 percent gravel; slight effervescence; moderately alkaline.

Thickness of the solum and depth to carbonates range from 30 to 55 inches. Depth to the IIB horizon ranges from 22 to 36 inches, and depth to the IIIB or IIIC horizon ranges from 30 to 40 inches. The gravel content is less than 2 percent by volume in the silty mantle, 0 to 20 percent in the IIB horizon, and 3 to 10 percent in the IIIB and IIIC horizons.

The Ap horizon has value of 4 or 5. It is medium acid to neutral. The B and IIB horizons have hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 3 to 6. The B horizon is silt loam or silty clay loam. It is strongly acid to slightly acid. The IIB horizon is loam, sandy loam, clay loam, or a gravelly analog. It is slightly acid to mildly alkaline. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is clay loam or silty clay loam.

Tuscola series

The Tuscola series consists of deep, moderately well drained, moderately permeable soils that formed in glacial lake shoreline deposits on the margins of former glacial lakes. Slope ranges from 2 to 6 percent.

Tuscola soils are similar to Glenford, Haney, Lykens, and Martinsville soils and are commonly adjacent to Fitchville and Kibbie soils. Kibbie and Fitchville soils have colors of low chroma, are somewhat poorly drained, and have more gray in the subsoil. Glenford soils have more silt and less sand in the subsoil. Haney soils have more gravel throughout the soil. The lower part of the subsoil of the Lykens soils formed in glacial till. Martinsville soils are well drained and do not have mottles of low chroma in the subsoil.

Typical pedon of Tuscola fine sandy loam, 2 to 6 percent slopes, about 3 miles west-northwest of Sycamore, in Tymochtee Township, about 1,500 feet south of the northwest corner of sec. 14, T. 1 S., R. 14 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) fine sandy loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B1—10 to 20 inches; yellowish brown (10YR 5/4) fine sandy loam; few fine faint brown (10YR 5/3) and few fine distinct yellowish brown (10YR 5/8) mottles; moderate medium platy structure parting to weak medium subangular blocky; friable; common fine roots; neutral; clear wavy boundary.

B21t—20 to 30 inches; brown (7.5YR 5/4) fine sandy loam; many medium distinct grayish brown (2.5Y 5/2) mottles; moderate medium subangular blocky structure; friable; few fine roots; yellowish red (5YR 4/6) coatings on faces of peds; black (N 2/0) stains (iron and manganese oxides) on faces of peds;

medium very patchy clay films on faces of peds; slightly acid; clear wavy boundary.

B22t—30 to 48 inches; brown (7.5YR 5/4) sandy clay loam; many coarse faint dark brown (7.5YR 4/4) and many coarse distinct grayish brown (2.5Y 5/2) mottles; moderate coarse prismatic structure; friable; yellowish red (5YR 4/6) coatings on faces of peds; black (N 2/0) stains (iron and manganese oxides) on faces of peds; medium patchy clay films on faces of peds; slightly acid; gradual wavy boundary.

B3—48 to 58 inches; brown (7.5YR 5/4) sandy loam; many coarse faint dark brown (7.5YR 4/4) and many coarse distinct grayish brown (2.5Y 5/2) mottles; weak coarse prismatic structure; friable; black (N 2/0) stains (iron and manganese oxides) on faces of peds; neutral; clear wavy boundary.

C—58 to 60 inches; brown (10YR 5/3) silty clay loam; many medium distinct gray (10YR 5/1) and many medium faint dark brown (10YR 4/3) mottles; massive; firm; laminated; slight effervescence; mildly alkaline.

Thickness of the solum and depth to free carbonates range from 40 to 70 inches.

The Ap horizon has chroma of 1 or 2. The B horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 3 or 4. It is silt loam, sandy clay loam, fine sandy loam, sandy loam, loam, silty clay loam, or very fine sandy loam. The B horizon is stratified in some pedons. It is medium acid to neutral. The C horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 1 to 3. It is sandy loam, fine sand, very fine sandy loam, silty clay loam, or silt loam and is stratified in some pedons.

formation of the soils

This section describes the major factors of soil formation, tells how these factors have affected the soils of Wyandot County, and explains some of the processes of soil formation.

factors of soil formation

Soil is a three dimensional natural body capable of supporting plant growth. The nature of the soil at a specific site is the result of the interaction of many factors and processes. The factors can be grouped into five general categories: parent material, climate, plants and animals, relief, and time.

parent material

The material that a soil formed in is called parent material. Most of the parent material in Wyandot County was deposited by the last glacier that covered the area thousands of years ago or by melt water from this glacier. The other parent material is older dolomitic limestone bedrock, more recent alluvium deposited by modern streams, or organic deposits from decaying plants.

Glacial till was deposited directly beneath glacial ice and was little acted upon by water. The till contains a variety of particles ranging from clay to large stones. Most pebbles are angular, indicating little water action. Although most of the material in the till is of local origin, some igneous stones were carried from parts of Canada. The glacial till at the surface was deposited during the Wisconsinan glaciation.

The till plains are divided into ground moraines and end moraines (*6*). Ground moraine deposits are massive and compact. They are silty clay loam, clay loam, clay, silty clay, or loam. Variations in the content of clay and sand appear to be related to readvances of the glacier into local lacustrine deposits. Silty clay loam till is predominant and is the parent material of Morley, Glynwood, Blount, Elliott, Pandora, and Pewamo soils. Clay loam till is mainly in the northeastern part of the county. It has less lime and more fragments of black shale. Cardington and Bennington soils formed in clay loam till.

End moraine deposits vary more in texture than ground moraine deposits and in places are stratified. They are less compact and more permeable. The relief is more irregular and hummocky and has many short slopes and enclosed depressions. In the western part of Wyandot County the glacial till is silty clay or clay. Nappanee soils formed in this parent material. In the area north of Carey, the till is loam and has more lime because of dolomitic limestone bedrock within a depth of 10 feet.

Melt water deposits were laid down by water from the melting glacier. Gravel and sand were deposited in fast moving, sloping streams. Oshtemo, Belmore, Haney, Digby, and Millgrove soils formed in gravel and sand deposits on glacial stream terraces and outwash plains. As the streams became more level, silt particles were deposited as deltas and bars and in local lake basins. Colwood, Fitchville, Glenford, Kibbie, Luray, Martinsville, and Tuscola soils formed in fine sand and silt sediment. Where the streams flowed into local lakes, the finer particles settled out of the still water.

Fine and very fine lacustrine deposits are extensive in Wyandot County. They are near the center or western edge of the basins formed by the melting glacier. Paulding soils formed in the clay or silty clay sediment in the Killdeer Basin. Del Rey, Fulton, Latty, Milford, and Shinrock soils formed in clay and silt sediment in other basins of former glacial lakes.

Dolomitic limestone is the parent material of the Millsdale, Milton, Randolph, and Ritchey soils. It has a very high calcium carbonate equivalent. However, it is not violently effervescent because of the dolomitic nature of the limestone.

Alluvium is the parent material of the soils on flood plains. It is deposited by modern streams and varies widely with the stream gradient and the source of the sediment. Alluvial sediment is stratified because deposition occurs in three basic stages. Gravel and stones are deposited on the streambed, sand is deposited as bars along meander inner banks, and sand, silt, and clay are deposited during flooding. Chagrin, Genesee, Lindside, Medway, Shoals, and Sloan soils formed in alluvium.

Carlisle soils and the upper part of Olentangy soils formed in decayed plant material that accumulated in bogs. The permanent wetness slowed decomposition, and the organic matter accumulated.

climate

Climate in an area as small as Wyandot County is essentially a constant factor of soil formation. None of the soil differences in the county can be directly attributed to differences in climate.

The amount of precipitation varies as a result of microclimate. However, runoff on steep slopes reduces the amount of effective precipitation, and drainage in depressions increases it.

A further description of the climate is in the section "General nature of the county."

plants and animals

The vegetation under which a soil forms influences the color, structure, and content of organic matter. The surface layer of soils that formed under trees is generally lighter in color than that of soils that formed under grass. Grasses generally return more organic matter to the soil than trees do. Grasses also provide shelter for many burrowing animals that alter the structure and thickness of soil horizons. Earthworms, burrowing insects, and small animals are constantly mixing the soil, making it more porous to air and water and adding organic residue. Bacteria, fungi, and other micro-organisms contribute to the breakdown of organic residue. Generally, fungi are more active in acid soils and bacteria in alkaline soils.

About six native plant communities are recognized as the original vegetation of Wyandot County. The dominant type is the beech forest community. Beech, sugar maple, red oak, white ash, white oak, and basswood are the common species (*7, 8*). This community is associated with Bennington, Blount, Cardington, and Glynwood soils. The oak-sugar maple forest community consists of red oak, white oak, and sugar maple. It does not have any beech. This community is a transition to the mixed oak forest community, which consists of white oak, red oak, bur oak, and hickory. The oak-sugar maple and mixed oak communities are associated with Blount, Del Rey, Glynwood, and Shinrock soils and other somewhat poorly drained to well drained soils. The elm-ash swamp forest consists of American elm, black ash, red maple, pin oak, swamp white oak, and hickory. It is associated with Pandora, Pewamo, Luray, and Latty soils and other poorly drained and very poorly drained soils.

The wet-mesic prairie community consists of sedges, rushes, and coarse grasses, for example, indiangrass and cordgrass and in the wettest areas, cattails. This community is associated with the very poorly drained Paulding and Bono soils. The mesic prairie is more extensive than the wet-mesic prairie. It consists of big and little bluestem and sawtooth sunflower, gray headed coneflower, prairie dock, goldenrods, milkweeds, blazing star, and other forbs intermixed with dogwood, plum, and willow. There are also a few open groves of bur oak. This community is associated with Milford, Elliott, Pewamo, Medway, and Luray soils. It is mainly in the southern part of the county.

The bog and fen plant communities are associated with the very poorly drained Carlisle and Olentangy soils. These communities consist of a wide variety of water-tolerant species. Shrubs are common. Trees, however, are rare.

Accelerated erosion caused by clearing and cultivating the sloping soils, for example, Glynwood, Cardington, and Shinrock soils, illustrates the impact of man on soil formation. Loss of surface soil and compaction of the subsoil affect runoff and plant growth. In large areas the Pewamo, Pandora, Milford, and Latty soils have been drained by ditches and subsurface drains. Draining reduces the content of organic matter and affects the processes of soil formation. Adding lime or fertilizer also affects the long-term development of the soil.

relief

Relief, along with parent material, affects the natural drainage of soils. It influences the amount of runoff and the depth to the ground water table. Generally, steeper soils have better drainage than nearly level soils. If the extent of drainage differs, different soils can form in the same parent material. For example, both Glynwood and Pewamo soils formed in glacial till deposits. Glynwood soils are in high positions, and the water table generally is not close to the surface. They are moderately well drained. Pewamo soils, however, are in low, nearly level areas, and the water table is close to or above the surface. These soils are very poorly drained.

A drainage sequence, or soil catena, is a group of soils that formed in the same parent material but differ in the extent of natural drainage. For example, the well drained Morley soils, the moderately well drained Glynwood soils, the somewhat poorly drained Blount soils, the poorly drained Pandora soils, and the very poorly drained Pewamo soils make up a drainage sequence. All of these soils formed in silty clay loam and clay loam glacial till.

time

The length of time parent material has been exposed to the soil-forming processes affects the nature of the soil that forms. The youngest soils in Wyandot County are those that formed in recent stream deposits, for example, Genesee soils. Younger soils have less definite horizons than the older soils.

The glacial deposits in Wyandot County are of Wisconsinan age and are geologically young. Nevertheless, sufficient time has elapsed for the active forces of climate and plants and animals to produce developed horizons. In most of the soils, carbonates have been leached, structure has developed in the subsoil, and organic matter has accumulated in the surface layer.

processes of soil formation

Soil forms through complex, continuing processes that are grouped into four general categories—*addition, removal, transfer*, and *alteration* (*13*).

The accumulation of organic matter in the formation of mineral soils is the addition process. The addition of organic residue has produced a dark surface layer. The upper part of the parent material originally was not darker than the lower part.

The loss of lime from the upper 3 to 6 feet of many of the soils in Wyandot County is the removal process. Although the parent material was limy, water percolating through the soil has leached the lime from the upper part of the soil.

Water is the carrier for most of the transfers that have occurred in the formation of soils in Wyandot County. Clay has been transferred from the A horizon to the B horizon in many of the soils. The A horizon, especially the A2 horizon, has become a zone of eluviation, and the B horizon a zone of illuviation. Thin clay films are in pores and on ped surfaces in the B horizon of some soils. The clay has been transferred from the A horizon. The presence of clay films is an important criterion in soil classification.

The reduction and solution of ferrous iron is the alteration process. This process has taken place in the very poorly drained, poorly drained, and somewhat poorly drained soils. Reduction of iron, or gleying, is evident in Latty, Milford, and Pandora soils. It is the result of a recurring water table. Gray soil indicates gleying. Reduced iron is soluble. However, the iron in the soils in Wyandot County commonly has remained in the horizon where it originated or settled in an underlying horizon. Iron can be reoxidized and segregated in places to form yellowish brown mottles that are brighter than the surrounding soil. The alteration of iron causes mottling in soils that are not well drained.

Each of the four soil-forming processes has affected, to a varying degree, all the soils in Wyandot County. The accumulation of organic matter has been prominent in the formation of Bono and Milford soils. The removal of carbonates and the transfer of clay have been prominent in the formation of Ritchey and Shinrock soils.

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glossary

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

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.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms. The Lco horizon is a limnic layer that contains many fecal pellets.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

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.

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.

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.

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.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration 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—

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.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, 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.)

No-till planting. A method of planting crops that involves no seedbed preparation other than opening the soil for the purpose of placing the seed at the intended depth. This usually involves opening a small slit or punching a hole into the soil. There is usually no cultivation during crop production. Chemical weed control is normally used.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

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.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

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).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A1, A2, or A3) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A horizon. Includes all subdivisions of this horizon (A1, A2, and A3).

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

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.

Underlying material. The part of the soil below the solum.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

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.