Soil Survey of

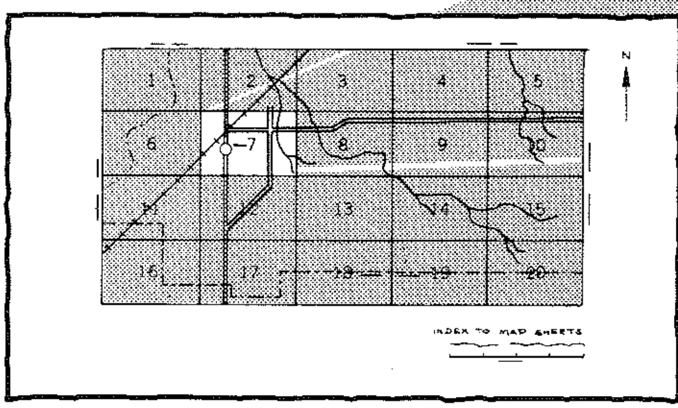
Shelby County, Ohio

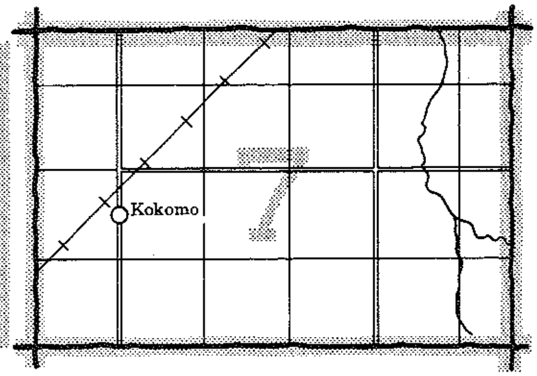
United States Department of Agriculture
Soil Conservation Service

in cooperation with
Ohio Department of Natural Resources, Division of Lands and Soil and
Ohio Agricultural Research and Development Center

HOW TO USE

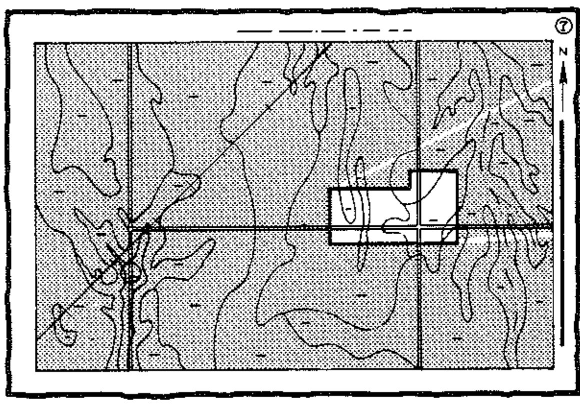
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

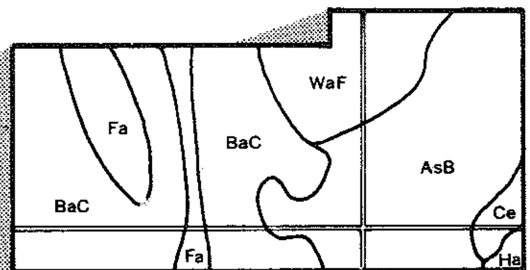




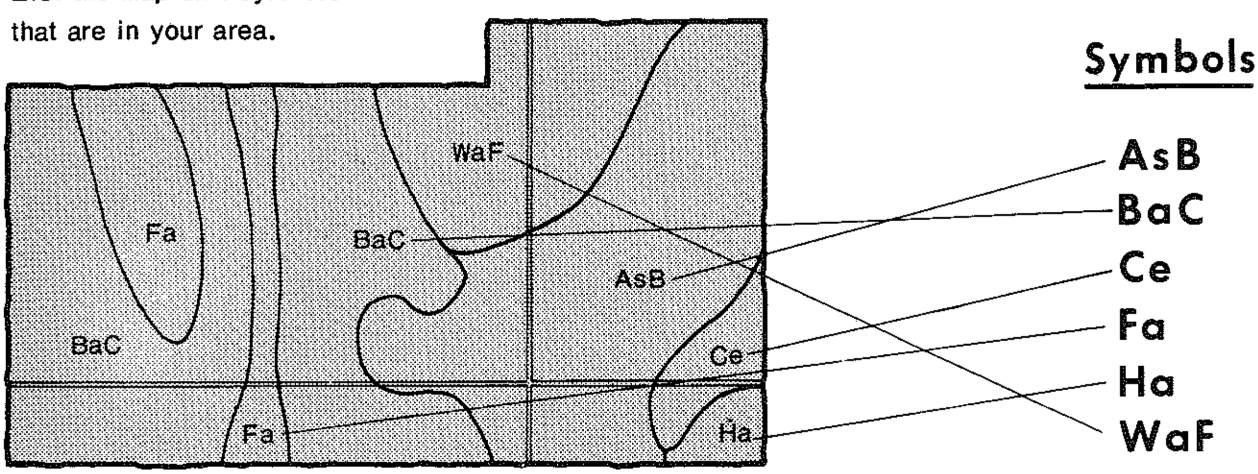
2. Note the number of the map sheet and turn to that sheet.

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



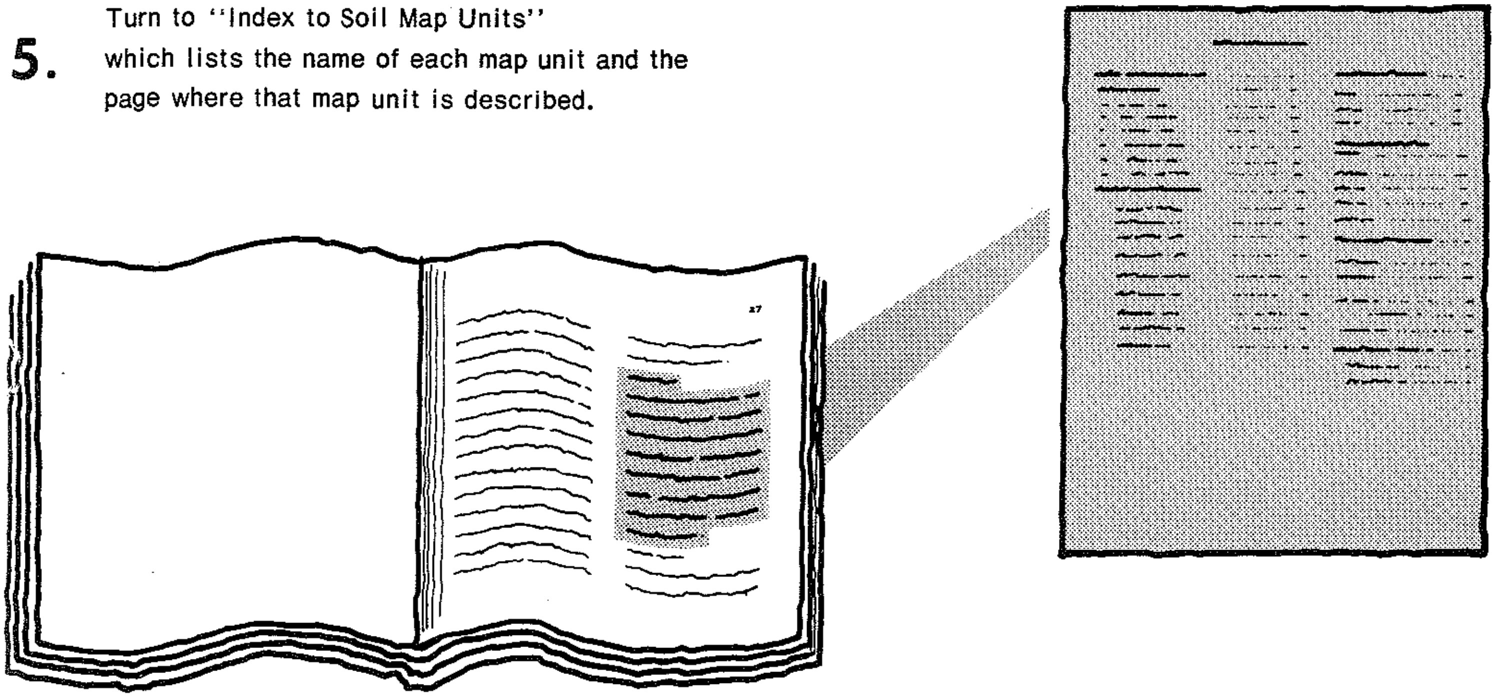


4. List the map unit symbols that are in your area.

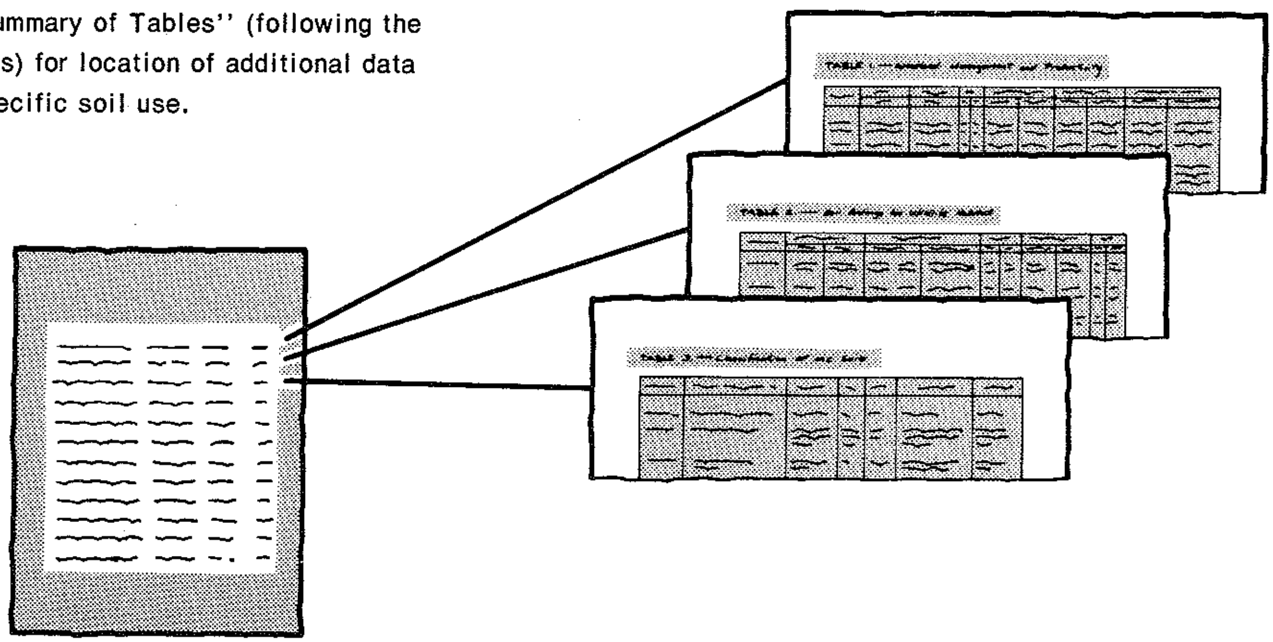


HIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was completed in the period 1972-76. Soil names and descriptions were approved in 1977. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1976. 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 Shelby Soil and Water Conservation District. The survey was materially aided by funds and facilities provided by the Shelby County Commissioners.

Cover: This area of Blount silt loam supports all crops commonly grown in the county.

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Issued April 1980

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Foreword

We introduce the Soil Survey of Shelby County, Ohio. You will find, herein, basic information useful in any land-planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

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

Many people assume that soils are all somewhat alike. They are unaware that great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. This publication also shows, on the general soil map, the location of broad areas of soil and, on detailed soil maps, the location of each kind of soil. It provides descriptions of each kind of soil in the survey area and gives much information about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

We believe that this soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

Robert E. Quilliam

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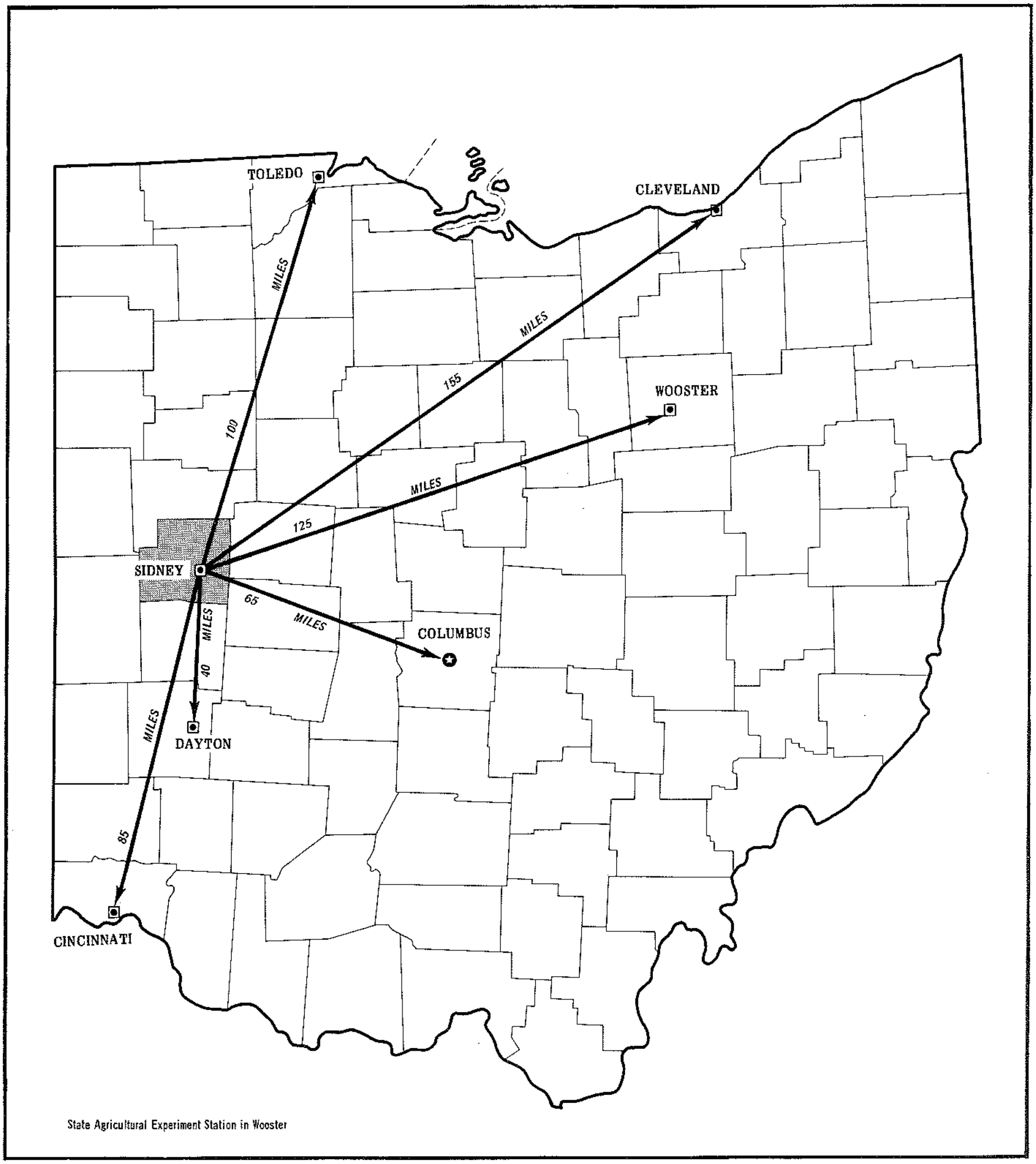
State Conservationist
Soil Conservation Service



Location of Shelby County in Ohio.

SOIL SURVEY OF SHELBY COUNTY, OHIO

By Samuel F. Lehman, V.L. Siegenthaler, George D. Bottrell, Daniel R. Michael, and Larry D. Porter,
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

SHELBY COUNTY is in the west-central part of Ohio, the second tier of counties east of the Indiana State line and the fifth county north of the Ohio River. It is bounded on the west by Darke County, on the south by Miami County, on the east by Champaign and Logan Counties, and on the north by Auglaize County. Shelby County occupies approximately 261,056 acres, or 407.9 square miles. It has 14 townships.

The population of the county in 1970 was 37,748. Sidney, the county seat and the largest city, is near the center of the county. It had a population of 16,332 in 1970. Villages are Anna, Botkins, Fort Loramie, Jackson Center, Kettlersville, Lockington, Port Jefferson, and Russia.

Shelby County is in the Wisconsin age glaciated region of Ohio. Most of the soils formed in calcareous glacial material or its alluvium. In a large part of the county, mainly north and west of the Great Miami River, the till deposits are of silty clay loam or clay loam texture, whereas south and east of the river the till deposits are mostly loam. Shelby County, with its large areas of fertile land, is well suited to farming. Livestock production and cash grain crops, dominantly soybeans, corn, wheat and oats, are the major types of farming. In a few areas there are truck, nursery, and specialized crops. An increasing acreage, particularly around the city of Sidney, has been diverted to nonfarm use.

General nature of the county

On the pages that follow is general information on the climate of the county; physiography, relief, and drainage; geology; and transportation. Also provided are facts about farming and other subjects of general interest.

Shelby County was first settled as part of Miami County and until 1819 was under its jurisdiction. The first seat of government was at Hardin, but in 1820 the seat of government was transferred to Sidney.

The most valuable natural resources are soil and water. Sand and gravel and limestone are other important natural resources. There are no known deposits of coal in the county.

Climate

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

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Celina, Ohio for the period 1957 to 1975. The weather station at Celina, Ohio is outside the survey area, but data from this station represents the climate for Shelby County. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 28 degrees F, and the average daily minimum temperature is 20 degrees. The lowest temperature on record, which occurred at Celina on January 16, 1972, is 19 degrees. In summer the average temperature is 72 degrees, and the average daily maximum temperature is 83 degrees. The highest recorded temperature, which occurred on July 24, 1965, is 99 degrees.

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

Of the total annual precipitation, 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 17 inches. The heaviest 1-day rainfall during the period of record was 4.43 inches at Celina on September 17, 1969. Thunderstorms occur on about 41 days each year, and 20 of these days in summer.

Average seasonal snowfall is 36 inches. The greatest snow depth at any one time during the period of record was 14 inches. On the average, 22 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The percentage of possible sunshine is 70 in summer and 40 in winter. The prevailing wind is from the south-southwest. Average windspeed is highest, 12 miles per hour, in March.

Tornadoes and severe thunderstorms occur occasionally. They are usually of local extent and of short duration, and the resulting damage varies from area to area.

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

Physiography, relief, and drainage

Shelby County is in the Till Plains section of the Central Lowlands physiographic province. The landscape is one of broad, level to moderately steep till plains and of moraines dissected by the Great Miami River and several creeks and tributaries. Slopes are steep and irregular in a few areas, mainly along streams and in areas of kames and moraines. These moraines are long belts of higher land formed during temporary halts in the retreat of the final stage of the Wisconsin glacier.

The highest point in the county, 1,150 feet above sea level, is in the extreme southeast corner. The lowest, 870 feet above sea level, is in the south-central part, south of the city of Lockington, where the Great Miami River flows out of the county. Most of the land in Shelby County lies between the 950 and 1,100 foot contour.

The Great Miami River and its tributaries drain most of the county except for a small area in the northwestern part of the county, which drains northward into the Maumee River.

Geology

Shelby County was glaciated more than once, but former deposits were reworked or covered by the till and outwash of Wisconsin age (*5*). This mantle varies in thickness from a few inches near bedrock exposures to more than 300 feet where it fills old preglacial stream valleys. A buried preglacial valley is known as the Teays drainage system. This valley is approximately a mile wide and extends to the northwest through Port Jefferson and Anna.

The dominant geologic parent material is glacial till. This deposit, a mixture of unassorted boulders, stones, gravel, sand, silt, and clay, is spread across the entire county. Wide, low, slightly hummocky ridges of till were built up where the glacier stopped or moved southward briefly. These ridges are called end moraines. Parts of the St. Johns, Mississinewa, Bloomer, Union, and Powell Moraines and all of the Sidney Moraine extend across Shelby County (*4*). Boulders are common in the till area, associated with the Farmersville Moraine, in the southeast corner of the county. Associated with and occurring between the end moraines are extensive areas of ground moraines (*6*). The moraine is gently sloping to steep, whereas the ground moraine is mostly level to gently sloping.

Glacial melt waters have sorted and deposited many areas of sand and gravel. These glacial outwash deposits are mainly along the major streams but they occur as small scattered areas throughout the county. Some outwash areas are capped with silty sediment. A unique sorting action of the glacier resulted in the deposit of large boulders in the till in the eastern part of the county. This deposit, known as the boulder belt, is shown on the general soil map. Both farming and construction activities can be impeded by these boulders.

A few deposits in the county are lake-laid sediment. This sediment is mostly silt and clay resulting from temporary ponding during the glacial activity.

The uppermost layers of many of the upland soils formed in loess, a windblown silt deposit. This silty layer is seldom more than 12 inches thick in this county. It was mostly deposited during extremely dry periods shortly after the main ice mass of the glacier receded northward, about 15,000 years ago.

The bedrock is a consolidated, parallel-bedded layer of sedimentary rock. A small band of rock outcrop occurs along the Great Miami River Valley in the southern part of the county. The oldest formation is the Brassfield Limestone, which is capped by a thin covering of Cedarville Dolomite. Both are members of the Silurian System (*4*). In other parts of the county no bedrock is exposed, but the bedrock is reported to be underlain by a still younger Silurian System, the Huntington Dolomite.

Transportation and other developments

Eight state highways and Interstate Highway 75, which crosses the county from north to south, link all parts of Shelby County with adjoining areas. The county is also served by two railroads, one extending east to west and the other from north to south.

The area of highest population is Clinton Township, around the city of Sidney. Major industries are concentrated around Sidney. There are also small industries in many of the villages. All townships are served by consolidated school districts. The county hospital is in Sidney.

There are scattered recreational facilities throughout the county. Lake Loramie State Park, near Fort Loramie, is a main attraction.

Farming

According to the 1969 United States Census of Agriculture, there were 1,571 farms in Shelby County, totaling 246,930 acres. The major portion of this total was made up of 260 to 499 acre farms. The average size was 157.1 acres. Approximately 85.7 percent of the farm units was operated by owners or part owners.

About 67 percent of the income from all agricultural products sold in 1969 came from livestock, poultry, and their products. About 33 percent came from crops, including nursery crops and hay. Animal enterprises ranked in order of income were dairy products, hogs and sheep, cattle and calves, and poultry and poultry products. Cropland enterprises were grains, field seeds, hay, forage and silage, and nursery and greenhouse products.

On commercial farms, about 44,300 acres was in soybeans, 42,500 acres in field corn, 21,500 acres in hay, 16,000 acres in wheat, and 15,350 acres in oats.

According to the 1967 Ohio Soil and Water Conservation Needs Inventory (*8*) approximately 80 percent of Shelby County was cropland and only a little more than 53 percent of this acreage was receiving adequate conservation treatment. Approximately one-fourth of the cropland was in need of drainage for optimum crop production.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. 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; the kinds of rock; and many facts about the soils. They dug many holes to expose 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, or underlying material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land use planning" and "Soil maps for detailed planning."

The names, descriptions, and delineations of soil in this published soil survey do not always agree or join fully with soil maps of adjoining counties published at an earlier date. Differences are brought about by better knowledge about soils or modification and refinements in soil series concepts. In addition, the correlation of a recognized soil is based upon the acreage of that soil and the dissimilarity to adjacent soils within the survey area. Frequently it is more feasible to include soils, small in extent, with similar soils where management and response are much the same. The soil descriptions reflect these combinations. Other differences are brought about by the predominance of different soils in taxonomic units made up by two or three series. Still another difference may be caused by the range in slope allowed within the map unit for each survey.

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices 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 is readily available to different groups of users, among them farmers, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land use planning

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

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it 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 kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

1. Blount-Pewamo

Level to gently sloping, somewhat poorly drained and very poorly drained soils formed in loamy glacial till on uplands

This map unit occurs as extensive scattered areas that make up about 37 percent of the county. It is about 60 percent Blount soils, 31 percent Pewamo soils, and 9 percent minor soils.

The somewhat poorly drained Blount soils are on slight rises and low knolls surrounded by the very poorly drained depressional and level Pewamo soils. Blount soils have a silt loam surface layer. They are slowly permeable. Pewamo soils typically have a silty clay loam surface layer. They are moderately slowly permeable.

Among the minor soils in this unit are the moderately well drained Glynwood soils. These soils typically occupy the crests of a few higher knolls.

Most areas of the unit are farmed intensively. A small acreage is in permanent pasture (fig. 1) or woods. The main farm enterprise is cash-grain farming of corn and soybeans along with dairying and raising hogs and beef cattle.

Seasonal wetness is the major limitation of the dominant soils for farming. Much of the unit is artificially drained through surface and subsurface drains. Artificially drained areas of Blount and Pewamo soils dry out more quickly in spring than undrained areas and are well suited to crops grown in the county. Wetness and slow or moderately slow permeability are severe limitations for many nonfarm uses.

2. Blount-Pewamo-Glynwood

Level to gently sloping, somewhat poorly drained, very poorly drained, and moderately well drained soils formed in loamy glacial till on uplands

This map unit occurs as scattered areas that make up about 23 percent of the county. It is about 63 percent Blount soils, 17 percent Pewamo soils, 13 percent Glynwood soils, and 7 percent minor soils.

Blount soils are somewhat poorly drained and are nearly level to gently sloping. They have a silt loam surface layer. They are slowly permeable. Pewamo soils are very poorly drained. They are in depressions and drainageways. They have a silty clay loam surface layer. They are moderately slowly permeable. Glynwood soils are moderately well drained and are mostly gently sloping. They typically have a silt loam surface layer. They are slowly permeable.

Among the minor soils in this unit are the well drained Eldean soils and the very poorly drained Montgomery, gravelly substratum, soils. These soils typically are near streams.

Most areas of the unit have been cleared and used as cropland or pasture. A few areas are wooded. The main farm enterprises are dairying and raising hogs and beef cattle. There is some cash-grain farming of corn, soybeans, and wheat.

Seasonal wetness on Blount and Pewamo soils and an erosion hazard on Glynwood soils are the principal limitations for farming. Much of the acreage of Blount and Pewamo soils is artificially drained through surface and subsurface drains. Artificially drained areas, which dry out more quickly in spring than undrained areas, are well suited to crops grown in the county. Wetness on the Blount and Pewamo soils and the slow or moderately slow permeability of all the dominant soils in the unit are severe limitations for many nonfarm uses.

3. Glynwood-Blount

Gently sloping and moderately sloping, moderately well drained and somewhat poorly drained soils formed in loamy glacial till on uplands

This map unit occupies ridges and side slopes that parallel major streams and drainageways. It makes up about 16 percent of the county. It is about 61 percent

Glynwood soils, 29 percent Blount soils, and 10 percent minor soils.

Glynwood soils are moderately well drained and are mostly gently sloping to moderately sloping. They have a silt loam or clay loam surface layer. They are slowly permeable. Blount soils are somewhat poorly drained and are mostly gently sloping. They have a silt loam surface layer. They are moderately slowly or slowly permeable.

Among the minor soils in the unit are the very poorly drained Pewamo soils of the depressional uplands and the moderately well drained Medway and somewhat poorly drained Shoals soils of the flood plains.

Most areas of the unit are used as cropland or pasture. Some of the more sloping areas are wooded. The slope and a severe erosion hazard are the major limitations of the Glynwood soils for farming. Seasonal wetness and a moderate erosion hazard are the major limitations of the Blount soils for farming. Unless artificially drained, Blount soils are slow to dry out in spring.

Restricted permeability of the dominant soils and wetness on the Blount soils are severe limitations for most nonfarm uses. Glynwood soils have fewer limitations for building sites than Blount soils, except where the slope is a limitation.

4. Glynwood-Morley

Moderately sloping to very steep, moderately well drained and well drained soils formed in loamy glacial till on uplands

This map unit occupies the steepest areas that parallel the valley wall along major streams. It makes up about 2 percent of the county. It is about 60 percent Glynwood soils, 26 percent Morley soils, and 14 percent minor soils.

Glynwood soils are moderately well drained and are mostly moderately sloping to moderately steep. They have a silt loam or clay loam surface layer. They are slowly permeable. Morley soils are well drained and are steep to very steep. They have a silt loam surface layer. They are slowly permeable.

Among the minor soils in the unit are the well drained Eldean and the somewhat poorly drained Shoals and Blount soils. Eldean and Shoals soils are near streams. Blount soils are on slight rises of the uplands.

Because slopes are steep, most of the acreage is permanent pasture or woods. A few of the less sloping areas are cropland. The slopes and a severe erosion hazard are the major limitations of the dominant soils for farming and for many nonfarm uses. The steeper areas of the unit have potential recreational uses, for example, hiking and nature trails.

5. Eldean-Genesee-Eel variant

Level to gently sloping, well drained and moderately well drained soils formed in loamy glacial outwash and alluvium on terraces and flood plains

This map unit occupies areas along major streams. It makes up about 3 percent of the county. It is about 33 percent Eldean soils, 12 percent Genesee soils, 9 percent Eel variant soils, and 46 percent minor soils.

The Eldean are well drained soils on outwash terraces. They are mostly nearly level to gently sloping. They typically have a loam surface layer. Permeability is moderate to moderately slow in the subsoil and very rapid in the substratum.

Genesee soils are well drained, and the Eel variant soils are moderately well drained. Both the Genesee and Eel variant soils are level to nearly level. Both are on flood plains. Genesee soils have a silt loam surface layer. They are moderately permeable. The Eel variant soils have a silt loam surface layer. They are moderately slowly permeable.

Among the minor soils in the unit are the well drained Milton, Warsaw, and Ockley soils. These soils are on terraces along streams. Other minor soils are the moderately well drained Eel and the somewhat poorly drained Shoals soils on flood plains and the very poorly drained Patton soils in depressional areas of glacial lakes.

A large part of the acreage along Loramie and Turtle Creeks is farmed intensively. Some areas along the Great Miami River are farmed less intensively because of the moderate depth to limestone and the hazards of flooding and wetness. Because the Eldean soils are only moderately deep over sand and gravel, they are too droughty for farming. Occasional flooding late in winter and in spring moderately limits the Genesee and Eel variant soils for farming. All the dominant soils in the map unit are suited to irrigation.

Flooding is a severe limitation on the Genesee and Eel variant soils for most nonfarm uses. Eldean soils have few limitations for nonfarm uses. They have good natural drainage and favorable topography. The underlying sand and gravel in Eldean soils is suitable for commercial use.

6. Crosby-Brookston

Level and nearly level, somewhat poorly drained and very poorly drained soils formed in loamy glacial till on uplands

This map unit occurs as extensive areas that make up about 14 percent of the county. It is about 66 percent Crosby soils, 29 percent Brookston soils, and 5 percent minor soils.

The somewhat poorly drained Crosby soils are on broad flats and slight rises surrounded by the very poorly drained Brookston soils in broad, level and depressional areas. In cultivated areas, these soils form striking light and dark landscape patterns. Crosby soils have a silt loam surface layer. They are slowly permeable. Brookston soils have a silty clay loam surface layer. They are moderately or moderately slowly permeable.

Among the minor soils in this unit are the somewhat poorly drained Odell soils, the moderately well drained Celina soils, and the well drained Miamian soils. All are on uplands. Odell soils typically occupy positions between areas of Crosby and Brookston soils. Celina and Miamian soils are on the crests of a few higher knolls.

Most of the acreage is farmed intensively. Only a few areas are permanent pasture or woods. The main farm enterprise is cash-grain farming. Corn and soybeans are the dominant crops. There is some dairying. Some farms have hogs and beef cattle.

Seasonal wetness is the major limitation of the dominant soils for farming. Many areas are artificially drained through surface and subsurface drains. Artificially drained areas, which dry out more quickly in spring than undrained areas, are well suited to intensive cropping. Seasonal wetness is a severe limitation for many nonfarm uses.

Part of the acreage is within the boulder belt. Glacial boulders on the surface and within the soil often interfere with cultivation. They also interfere with the installation of closed drains and other construction.

7. Miamian-Celina-Crosby

Gently sloping to very steep, well drained to somewhat poorly drained soils formed in loamy glacial till on uplands

This map unit occupies the steepest areas that parallel the major streams. It makes up about 5 percent of the county. It is about 53 percent Miamian soils, 16 percent Celina soils, 13 percent Crosby soils, and 18 percent minor soils.

Miamian soils are well drained and are mostly gently sloping to very steep. They have a silt loam or clay loam surface layer. They are moderately slowly permeable. Celina soils are moderately well drained and are mostly gently sloping. They have a silt loam surface layer. They are moderate slowly permeable. Crosby soils are somewhat poorly drained and are mostly gently sloping. They have a silt loam surface layer. They are slowly permeable.

Among the minor soils in the unit are the well drained Eldean soils typically on outwash terraces and the somewhat poorly drained Shoals and moderately well drained Eel soils on flood plains.

Because much of this unit is steep, many areas are used as woods and permanent pasture. Some of the less sloping areas are cropland. The slope and an erosion hazard on Miamian soils are severe limitations for farming. Seasonal wetness on the Crosby soils and a moderate erosion hazard on both the Crosby and Celina soils are limitations for farming.

The steep slope in many areas of Miamian soils, the seasonal wetness of the Crosby soils, and the slow permeability in all the dominant soils in the unit are severe limitations for many nonfarm uses. The less sloping areas of the better drained Miamian and Celina soils are more suitable for homesites than other parts of the unit. The steep areas have potential recreational use, for example, hiking and nature trails.

Part of the acreage of this unit is within the boulder belt. Glacial boulders on the surface and within the soil often interfere with cultivation and construction.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have profiles that are almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. The Eldean series, for example, was named for a small community in Miami County.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Glynwood clay loam, 6 to 12 percent slopes, severely eroded, is one of several phases within the Glynwood series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Eldean-Morley complex, 2 to 6 percent slopes, eroded, is an example.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Pits, gravel is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 4, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

Ag—Algiers silt loam. This level to nearly level, somewhat poorly drained soil is on flood plains and stream terraces. It is subject to frequent flooding. Areas are 3 to 8 acres. The slope is 0 to 2 percent.

In a typical profile the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The next layer is dark brown and dark grayish brown, friable silt loam about 15 inches thick. Between depths of about 24 and 42 inches is an older buried soil of very dark gray and dark gray, firm silty clay loam. The substratum to a depth of about 60 inches is mottled, grayish brown, firm clay loam. The buried dark colored layer does not occur in some areas.

Included with this soil in mapping are small areas of higher lying Blount soils near the rims of areas. These included areas make up about 10 percent of the unit.

If drained, this Algiers soil has a deep root zone. It has a high capacity for the storage and release of plant nutrients. Available water capacity is high. Permeability is moderate. Surface runoff is slow. The surface layer is moderate in organic matter content and is slightly acid or neutral.

Most of the acreage is cropland and pasture. A few areas are wooded.

The potential is high for cropland, pasture, and woodland. It is low for most engineering uses because of a seasonal high water table and the flood hazard. The potential is medium to high for wildlife habitat and low to medium for recreational purposes.

If artificially drained, this soil is suitable for corn, soybeans, small grain, and grasses and legumes for hay and pasture. Seasonal wetness and occasional flooding are the main limitations for cropland. Subsurface drainage and open ditches are needed. Diversion terraces are needed to intercept runoff from higher sloping areas. Under high level management, row crops can be grown year after year. Compaction is a concern if the soil is tilled when wet. Keeping the soil in good tilth is essential.

The silt loam surface layer compacts easily and is in poor tilth if the pasture is overgrazed or is grazed when wet. Proper stocking, pasture rotation, deferred grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees that tolerate seasonal wetness. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Site preparation, prescribed spraying, and cutting or girdling are needed. Wetness limits planting and harvesting equipment in winter and spring.

This soil is generally not suitable for building site development and sanitary facilities because of the flood hazard and seasonal wetness.

The capability subclass is IIw.

BlA—Blount silt loam, 0 to 2 percent slopes. This soil is level to nearly level and is somewhat poorly drained. It occupies broad areas on till plains and moraines of the uplands. Most areas are convex and range from 4 to 40 acres. There are a few concave areas where water collects and ponds. This soil is adjacent to the dark colored, depressional Pewamo soils.

In a typical profile the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 19 inches thick. It is mostly mottled, olive brown and yellowish brown, firm silty clay, clay, and clay loam. The substratum to a depth of about 60 inches is mottled, dark yellowish brown and yellowish brown, firm clay loam till.

Included with this soil in mapping are small areas of dark colored, very poorly drained Pewamo soils in drainageways. Also included are small areas of gently sloping Blount and Glynwood soils at the heads of drainageways. These included areas make up about 15 percent of the unit. Some areas are better drained. They are on small knolls, are less than 1 acre in size, and have slopes of 3 to 10 percent.

This Blount soil has a moderately deep root zone and a moderate available water capacity. Permeability is slow. Unless the soil is artificially drained, the water table is high in winter and spring. Surface runoff is slow. The capacity for the storage and release of plant nutrients is medium. Reaction in the subsoil ranges from medium acid to mildly alkaline. It varies in the surface layer, depending on local liming practices. The surface layer is moderate in organic matter content. In unprotected areas it tends to crust or seal after rains.

Most of the acreage is cropland and pasture. Some special crops are grown. The potential is high for crops and pasture and medium for wildlife and recreation. It is medium to low for most engineering uses as a result of seasonal wetness and restricted permeability.

This soil is suitable for corn, soybeans, small grain, hay, and pasture. Seasonal wetness is the principal limitation. Most areas of cropland have been artificially drained. Subsurface drainage, which is commonly used, is often supplemented by surface drainage. Compaction is a concern if the soil is tilled when soft and wet. Cultivated crops can be grown frequently under high level management. The use of crop residue, cover crops, or other organic material helps to maintain good tilth and reduces surface crusting.

If the pasture is overgrazed or is grazed when wet, the silt loam surface layer compacts easily and is commonly in poor tilth. Proper stocking, pasture rotation, deferred grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees that can tolerate seasonal wetness. There are some scattered hardwoods. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Site preparation, prescribed spraying, and cutting or girdling are needed. Wetness limits planting and harvesting equipment in winter and spring.

This soil is generally not suitable for building site development and sanitary facilities because of the seasonal high water table and the moderately slow to slow permeability. In many areas the water table can be lowered by subsurface drains. Onsite investigation is needed to determine whether or not drainage outlets are available. Footer drains and exterior wall coatings help to prevent wet basements. Local roads can be improved if the soil is artificially drained and suitable base material is used.

The capability subclass is IIw.

BlB—Blount silt loam, 2 to 6 percent slopes. This soil is gently sloping and is somewhat poorly drained. It occupies low knolls and ridges along drainageways of the uplands. Most areas are 5 to 100 acres or more. Slopes commonly are convex and 60 to 100 feet long. Areas are dissected by small drainageways. Most of the original surface layer remains; there is only slight evidence of erosion on this soil.

In a typical profile the surface layer is dark grayish brown, grayish brown, friable silt loam about 7 inches thick. The subsoil is about 18 inches thick. It is mostly mottled, olive brown, firm silty clay, clay, and clay loam. The substratum to a depth of about 60 inches is mottled, dark yellowish brown and yellowish brown, firm clay loam.

Included with this soil in mapping are small areas of the steeper, moderately well drained Glynwood soils. Also included are small areas of very poorly drained Pewamo soils in drainageways. In some areas slopes are more than 6 percent. Included areas make up about 10 percent of the unit. Some areas that are better drained are on small knolls, are less than 1 acre in size, and have slopes of 3 to 10 percent.

This Blount soil has a moderately deep root zone and medium capacity for the storage and release of plant nutrients. Available water capacity is moderate. Permeability is moderately slow or slow. Unless this soil is artificially drained, the water table is high in winter and in spring. Surface runoff is medium. The surface layer is moderate in organic matter content. Unless limed, it is acid. In unprotected areas it tends to crust or seal after rains.

Most of the acreage is cropland and pasture. A few areas are wooded. The potential is high for cultivated crops, pasture, and woodland. It is medium to low for most engineering uses as a result of the seasonal high water table and the restricted permeability.

This soil is suitable for corn, soybeans, and small grain and for grasses or legumes for hay or pasture. Seasonal wetness, a moderate erosion hazard, and soil tilth are the main concerns if this soil is cropped. Most areas in cropland have some type of artificial drainage. Subsurface drainage is often supplemented with surface drainage. The design of a drainage system is more difficult on these gentle slopes than on nearly level Blount soils. Compaction is a problem if this soil is tilled when wet. Grasses and legumes included in the cropping system help to control erosion and improve tilth. Crop residue and manure also help to control erosion and maintain soil tilth.

Overgrazing or grazing when this soil is soft and wet is a major concern in pasture management. The soil compacts easily and is commonly in poor tilth. Plants can be damaged if the pasture is grazed when wet. If the plant cover is damaged, surface runoff and erosion increase. Proper stocking, pasture rotation, deferred grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees that can tolerate seasonal wetness. There are a few scattered areas of hardwoods. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Good site preparation, prescribed spraying, and cutting or girdling are needed. Wetness limits planting and harvesting equipment in winter and spring.

This soil is generally not suitable for building site development and sanitary facilities because of seasonal wetness and moderately slow to slow permeability. In most areas the water table can be lowered by subsurface drainage. Footer drains and exterior wall coatings help to prevent wet basements. Local roads can be improved if the soil is artificially drained and suitable base material is used.

The capability subclass is IIe.

Bs—Brookston silty clay loam. This soil is level to nearly level and is very poorly drained. It is subject to frequent flooding. It occurs as large irregularly shaped depressions of 7 to 100 acres or more in the uplands. It is commonly surrounded and interspersed by lighter colored Crosby soils. In some areas this soil occupies narrow bands along drainageways, commonly less than 10 acres, where it is surrounded by the more sloping, lighter colored Celina and Miamian soils. The slope is 0 to 2 percent.

In a typical profile the surface layer is very dark grayish brown silty clay loam about 9 inches thick. The subsurface layer is mottled, very dark grayish brown, firm silty clay loam about 6 inches thick. The subsoil is about 31 inches thick. It is mostly mottled, olive gray and gray, firm silty clay loam. The substratum to a depth of about 60 inches is mottled, yellowish brown, friable loam till.

Included with this soil in mapping are small areas of better drained Odell and Crosby soils in slightly higher positions. Also included are spots of Celina and Miamian soils in the gently sloping areas. These included areas make up about 15 percent of the unit.

If artificially drained, this Brookston soil has a deep root zone. It has a high capacity for the storage and release of plant nutrients. Permeability is moderate or moderately slow. Available water capacity is high. Unless this soil is artificially drained, the water table is high for long periods in winter and spring. Surface runoff is slow, and water often collects or ponds. Ponding as a result of runoff from higher adjacent soils is frequent. The surface layer is high in organic matter content and is neutral or slightly acid. It tends to become hard and cloddy if tilled when wet.

Most of the acreage is used for intertilled crops and small grain. A few areas are pastured or wooded. The potential is high for cropland, pasture, and woodland. It is medium for wildlife and low for recreation. It is low for most engineering uses as a result of the seasonal high water table.

If artificially drained, this soil is well suited to corn, soybeans, small grain, and hay. Most areas in cropland have been drained. A few undrained areas are in woodland and pasture. Wetness is the main limitation for farm use. Subsurface drainage is effective in removing excess water. Diversion terraces are needed to intercept and divert excess runoff from adjacent higher areas. This soil, one of the most productive in the county, can be cultivated year after year if well managed. Careful management is needed to maintain good tilth.

If the pasture is overgrazed or is grazed when the soil is soft and wet, the silty clay loam surface layer compacts easily and is in poor tilth. Proper stocking, pasture rotation, deferred grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees that can tolerate seasonal wetness. It still supports a few scattered hardwoods. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Good site preparation, prescribed spraying, and cutting or girdling are needed. Wetness limits planting and harvesting equipment in winter and spring.

This soil is generally not suited to building site development and sanitary facilities because of seasonal wetness. In some areas the water table can be lowered by subsurface drainage. Onsite investigation is needed to determine whether or not drainage outlets are available. Local roads can be improved if the soil is artificially drained and suitable base material is used.

The capability subclass is IIw.

Ca—Carlisle muck. This soil is level and nearly level and is very poorly drained. It is subject to frequent flooding. It occupies low areas in bogs and swales in stream terraces and in moraines of the uplands. Areas are mostly circular in shape and are about 2 to 20 acres. The slope is 0 to 2 percent.

In a typical profile the upper 17 inches is black and very dark gray granular muck. Below this to a depth of about 60 inches is dark reddish brown and reddish brown muck and partly decomposed fibrous and woody peat fragments.

Included with this soil in mapping are small areas of Wallkill soils. Also included are spots that are underlain by loamy material, sedimentary peat, or marl at a depth of 3 to 4 feet. These included areas make up about 10 percent of the unit.

If drained, this Carlisle soil has a deep root zone. It has a very high available water capacity and a high capacity for the storage and release of plant nutrients. Permeability is moderate or moderately rapid. The surface layer is very high in organic matter content and is acid unless limed. In undrained areas the water table is high for long periods in winter and spring. Ponding as a result of runoff from higher adjacent soils is frequent. Undrained areas are swampy and marshy. Surface runoff is slow, and water collects or ponds after rains. This soil is highly compressible and unstable, and is subject to subsidence, or shrinkage, if drained. Crops are susceptible to frost damage because this soil occurs in low positions on the landscape.

This soil is used as cropland and pasture. A few areas are idle or are used as wildlife habitat. The potential is high for crops and pasture. It is also high for water tolerant plantings that provide habitat for wildlife. The potential is low for woodland, recreation, and for most nonfarm uses because the soil material is wet and unstable.

If adequately drained, this soil is suitable for crops. Cultivated crops can be grown year after year under high level management. Small grain is not as well suited because it lodges easily and is subject to frost heaving. Subsurface drains and open ditches are needed. Some areas are difficult to drain because drainage outlets are inadequate. If dry and bare of vegetation, this soil is subject to blowing. A plant cover is needed. Winter cover crops and crop residue help to control soil blowing.

Grasses for hay or pasture are suited to this soil. Legumes, such as alfalfa, are not as well suited because of frost heaving in winter and spring. Water tolerant grasses, especially canarygrass, grow well. Overgrazing or grazing when the soil is soft and wet results in damage to both pasture and soil.

This soil is generally not suited to trees, building site development, and sanitary facilities because it is wet and unstable.

The capability subclass is IIIw.

CeA—Celina silt loam, 0 to 2 percent slopes. This level to nearly level, moderately well drained soil occurs as small scattered areas occupying low, smooth ridgetops and bordering streams in the uplands. Most areas range from 2 to 10 acres.

In a typical profile the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 24 inches thick. It is mostly mottled, dark yellowish brown, firm clay loam and silty clay. The substratum to a depth of about 60 inches is mottled, yellowish brown, friable loam till. In some areas this soil is mantled with a layer of loess up to 12 inches thick. In some areas it is well drained and has no mottles in the subsoil.

Included with this soil in mapping are small areas of wetter Crosby soils and gently sloping Celina soils. These included areas make up about 10 percent of the unit.

This Celina soil has a moderately deep root zone and a medium capacity for the storage and release of plant nutrients. Permeability is moderately slow. Available water capacity is moderate. Surface runoff is slow. The surface layer is moderate in organic matter content. Unless limed, it is acid. In unprotected areas it tends to crust or seal after rains.

Most of the acreage is cropland. A few areas are pastured or wooded. The potential is high for cultivated crops, hay, pasture, and trees. It is medium to high for wildlife and recreation. It is medium to low for most engineering uses as a result of moderately slow permeability and periodic seasonal wetness.

This soil is suitable for corn, soybeans, small grain, and hay meadow crops. The major concerns are maintaining good soil tilth and high fertility. Compaction is a concern if heavy machinery is used or this soil is tilled when wet. There is little or no erosion hazard. Cultivated crops can be grown frequently under high level management. Large amounts of crop residue and manure help to maintain good tilth and reduce surface crusting.

This soil compacts and is in poor tilth if the pasture is overgrazed or is grazed when wet. Establishing plants is difficult. Proper stocking, pasture rotation, deferred grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. It still supports a few scattered areas of hardwoods. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Site preparation, prescribed spraying, and cutting or girdling are needed. There are no hazards or limitations in planting or harvesting trees.

This soil is generally not suited to building site developments and sanitary facilities because of moderately slow permeability and periodic seasonal wetness. Local roads can be improved if suitable base material is used and the soil is artificially drained. Footer drains and exterior wall coatings help to prevent wet basements.

The capability class is I.

CeB—Celina silt loam, 2 to 6 percent slopes. This gently sloping, moderately well drained soil is on low knolls and ridges of the uplands. It is dissected by many drainageways and is surrounded by larger areas of wetter Crosby and dark colored Brookston soils. Most areas are 2 to 20 acres. Slopes are convex and 60 to 80 feet long. Most of the original surface layer remains; there is only slight evidence of erosion on this soil.

In a typical profile the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 20 inches thick. It is mostly mottled, dark yellowish brown, firm silty clay and clay loam. The substratum to a depth of 60 inches is mottled, brown, firm loam till. In some areas this soil is mantled with a layer of loess up to 12 inches thick.

Included with this soil in mapping are small areas of the wet Crosby and Odell soils. Also included are spots where the soil is less than 18 inches deep over glacial till. These included areas make up about 10 percent of the unit.

The Celina soil has a moderately deep root zone and a medium capacity for the storage and release of plant nutrients. Permeability is moderately slow. Available water capacity is moderate. Surface runoff is medium. The erosion hazard is moderate. The surface layer is moderate in organic matter content. Unless limed, it is acid. In unprotected areas the surface tends to crust or seal after rains.

Most of the acreage is used for cropland. A few areas are pastured or wooded. The potential is high for cultivated crops, hay, pasture, and trees. It is medium to high for wildlife and recreation. It is medium to low for most engineering uses as a result of moderately slow permeability and periodic seasonal wetness.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. There is a moderate hazard of further erosion damage in cultivated areas. Minimum tillage, winter cover crops, and grassed waterways help to prevent excessive soil loss. Crop residue and farm manure help to improve soil tilth and fertility, reduce surface crusting, and increase water intake.

The use of the soil for pasture or hay is effective in controlling erosion. If the pasture is overgrazed or is grazed when wet, the silt loam surface layer compacts and is in poor tilth, causing more runoff and thus more erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas are still wooded. There are no hazards or limitations in planting and harvesting trees. The competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Good site preparation, prescribed spraying, and cutting or girdling are needed.

This soil is generally not suited to building site developments and sanitary facilities because of moderately slow permeability and periodic seasonal wetness. Local roads can be improved if the soil is artificially drained and suitable base material is used. Footer drains and exterior wall coatings help to prevent wet basements.

The capability subclass is IIe.

CnA—Crane silt loam, 0 to 2 percent slopes. This soil is level to nearly level and is somewhat poorly drained. It occupies low benches on stream terraces, generally above the normal level of flooding. Most areas are 2 to 15 acres.

In a typical profile the surface layer is very dark grayish brown, friable silt loam about 10 inches thick. The subsurface layer is about 7 inches thick. It is mostly very dark grayish brown, friable silt loam. The subsoil is about 33 inches thick. The upper part is mottled, dark brown and dark yellowish brown, firm silty clay loam and clay loam. The lower part is mottled, yellowish brown and grayish brown, firm loam and gravelly loam. The substratum to a depth of about 60 inches is loose very gravelly loamy sand.

Included with this soil in mapping are small areas of light colored soils and areas where slopes are more than 2 percent. Also included are small areas of Patton soils in drainageways. Few spots are less than 40 inches deep over sand and gravel. These included areas make up about 15 percent of the unit.

This Crane soil has a deep root zone when the water table is lowered. It has a high capacity for the storage and release of plant nutrients. The surface layer is high in organic matter content and is slightly acid or neutral. Available water capacity is high. Surface runoff is slow. Permeability is moderately slow in the subsoil and very rapid in the underlying material. This soil has a seasonal high water table in winter and spring.

Most of the acreage is cropland and pasture. The potential is high for cultivated crops, pasture, and trees. It is medium for wildlife and recreation and low for most engineering uses as a result of seasonal wetness.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. Seasonal wetness is the main limitation in cropland. This soil warms up slowly and dries out late in spring in undrained areas. Most areas in cropland have been drained. Subsurface drainage is often supplemented with open ditches. Cultivated crops are grown frequently under high level management. The use of crop residue, cover crops, or farm manure helps to maintain good tilth.

Overgrazing or grazing when the soil is wet results in poor tilth because the silt loam surface layer compacts easily. Proper stocking, pasture rotation, deferred grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees that can tolerate seasonal wetness. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Good site preparation, prescribed spraying, and cutting or girdling are needed. Wetness limits planting and harvesting equipment in winter and spring.

This soil is generally not suited to building site developments and sanitary facilities because of seasonal wetness. In some areas the water table can be lowered by artificial drainage. Onsite investigation is needed to determine whether or not drainage outlets are available. Footer drains and exterior wall coatings help to prevent wet basements.

The capability subclass is IIw.

CrA—Crosby silt loam, 0 to 2 percent slopes. This soil is level to nearly level and is somewhat poorly drained. It occupies broad areas of the uplands. Most areas are 10 to 100 acres or more. The areas are mostly convex, but a few areas are concave, where water collects or ponds.

In a typical profile the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 18 inches thick. It is mostly mottled, yellowish brown and olive brown, firm silty clay loam, silty clay, clay, and clay loam. The substratum to a depth of about 60 inches is mottled, brown and yellowish brown loam till. In some areas this soil is mantled with up to 12 inches of loess.

Included with this soil in mapping are small narrow areas of dark colored Brookston and Odell soils in drainageways. Also included are small areas of gently sloping Celina soils at the heads of drainageways and spots where the till is shallower than 18 inches and the root zone is shallower. These included areas make up about

10 percent of the unit. Some areas are better drained. They occupy small knolls, are less than 1 acre, and have slopes of 3 to 10 percent.

This Crosby soil has a moderately deep root zone and a medium capacity for the storage and release of plant nutrients. Permeability is slow. Surface runoff is slow. Available water capacity is moderate. Reaction ranges from medium acid to mildly alkaline in the subsoil. It varies widely in the surface layer, depending on local liming practices. Unless the soil is artificially drained, the water table is high in winter and spring. The surface layer is moderate in organic matter content. In unprotected areas it tends to crust after rains.

Most of the acreage is cropland and pasture. The potential is high for crops and pasture and also for woodland. It is medium to high for wildlife and recreation. It is medium to low for most engineering uses as a result of the seasonal high water table and restricted permeability.

This soil is suitable for corn, soybeans, small grain, hay, and pasture. Seasonal wetness is the principal limitation for cropland. Subsurface drainage is often supplemented with surface drainage. Compaction is a concern if this soil is tilled when soft and wet. Cultivated crops can be grown frequently under a high level of management. The use of crop residue or other organic material helps to maintain good tilth and reduces surface crusting.

Overgrazing or grazing when this soil is soft and wet causes compaction and poor tilth. Proper stocking, pasture rotation, deferred grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees that can tolerate some seasonal wetness. It still supports scattered areas of hardwoods. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Good site preparation, prescribed spraying, and cutting or girdling are needed. Wetness limits planting and harvesting equipment in winter and spring.

This soil is generally not suited to building site developments and sanitary facilities because of seasonal wetness and a slowly permeable substratum. The water table can be lowered by subsurface drains in some areas. Onsite investigation is needed to determine whether drainage outlets are available. Local roads can be improved if the soil is artificially drained and suitable base material is used. Footer drains and exterior wall coatings help to prevent wet basements. The limitation is slight for sewage lagoons.

The capability subclass is IIw.

CrB—Crosby silt loam, 2 to 6 percent slopes. This gently sloping, somewhat poorly drained soil occupies low knolls and areas along drainageways of the uplands. Most areas are about 4 to 25 acres. Slopes are convex and are generally 75 to 100 feet long. Areas are dissected by many small drainageways. Most of the original surface layer remains; there is only slight evidence of erosion on this soil.

In a typical profile the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 17 inches thick. It is mostly mottled, grayish brown and yellowish brown, firm silty clay loam, clay, and clay loam. The substratum to a depth of about 60 inches is mottled, yellowish brown loam till. In some areas this soil is mantled with a layer of loess up to 12 inches thick.

Included with this soil in mapping are small areas of dark colored Brookston and Odell soils in and near drainageways and areas of nearly level Crosby soils in slightly higher areas. Spots of better drained Celina and Miamian soils are also included. These included areas make up about 15 percent of this unit. Some areas that are better drained occupy small knolls, are less than 1 acre, and have slopes of 3 to 10 percent.

This Crosby soil has a moderately deep root zone and a medium capacity for the storage and release of plant nutrients. Permeability is slow, and available water capacity is moderate. Surface runoff is medium. Unless this soil is artificially drained, the water table is high in winter and spring. Reaction ranges from medium acid to mildly alkaline in the subsoil. It varies widely in the surface layer, depending on local liming practices. The surface layer is moderate in organic matter content. It tends to crust or seal after rains.

Most of the acreage is cropland and pasture, but a few scattered areas are wooded. The potential is high for cropland, pasture, and woodland. It is medium to high for wildlife and recreation. It is medium to low for most engineering uses as a result of the seasonal high water table and restricted permeability.

This soil is suitable for corn, soybeans, small grain, hay, and pasture. Seasonal wetness, a moderate erosion hazard, and soil tilth are the principal concerns if this soil is farmed. Most areas in cropland have some type of artificial drainage. Subsurface drainage is common. The design of a drainage system is more difficult on these gentle slopes than on nearly level Crosby soils. Compaction is a problem if this soil is tilled when soft and wet. Row crops can be grown frequently if erosion is controlled and the soil is adequately drained. Grasses and legumes included in the cropping system help to control erosion and improve tilth in cultivated areas. Crop residue, cover crops, and farm manure also help to maintain and improve soil tilth and control erosion.

Overgrazing or grazing when this soil is soft and wet is a major concern in pasture management. It compacts the silt loam surface layer and results in poor tilth. Pasture can be damaged if grazed when wet. If the plant cover is damaged, surface runoff and erosion increase. Proper stocking, pasture rotation, deferred grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees that can tolerate some seasonal wetness. There are only a few scattered areas of hardwoods. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Good site preparation, prescribed spraying, and cutting or girdling are needed. Wetness limits planting and harvesting equipment in winter and spring.

This soil is generally not suited to building site development and sanitary facilities because of seasonal wetness and the slowly permeable substratum. The water table can be lowered by subsurface drainage if outlets are available. Onsite investigation is needed. Local roads can be improved if the soil is artificially drained and suitable base material is used. Footer drains and exterior wall coatings help to prevent wet basements.

The capability subclass is IIe.

Ee—Eel silt loam, occasionally flooded. This level and nearly level, moderately well drained soil is on flood plains along the major streams. It is the dominant soil on many of the narrow flood plains, but generally on the larger flood plains it is farther from the main channel than the nearby Genesee soils. Areas are commonly long and narrow and range from 5 to 100 acres or more. The slope is 0 to 2 percent.

In a typical profile the surface layer is dark brown, friable silt loam about 8 inches thick. The substratum to a depth of about 44 inches is mostly brown, friable silt loam, loam, and clay loam. It is mottled below a depth of about 18 inches. At a depth of about 44 to 60 inches it is brown, loose gravelly loamy sand. Stratified loose sand and gravel commonly occurs at a depth of about 40 inches or more. In some areas the surface layer is loam.

Included with this soil in mapping are small areas of wetter Shoals soils next to the uplands. Also included are spots of the dark colored Medway soils at the base of the more sloping adjacent soils. These included areas make up about 10 percent of the unit.

This Eel soil has a deep root zone and a high capacity for the storage and release of plant nutrients. Permeability is moderate, and available water capacity is high. Surface runoff is slow. The surface layer is moderate in organic matter content and is mildly alkaline. Most areas are calcareous. This soil commonly has good tilth and is easy to work. It is subject to flooding mostly in winter and spring. Flooding during the growing season is not common. In some areas, this soil is extensively dissected by braided flood channels.

This soil is in cropland, mainly row crops, small grain, and meadow. Some areas are in pasture or woodland, especially along the stream valleys. The potential is high for cropland, pasture, and woodland and also for many wildlife and recreation uses. It is low for most engineering uses because of the flood hazard.

This soil is well suited to corn and soybeans. Occasional flooding (fig. 2) is the main hazard in cropland. Flooding is most common late in winter and in spring and often damages winter grain crops in unprotected fields. Internal drainage is generally good, but there are some wet spots that may require artificial drainage. Subsurface drainage is effective in removing excess water. If protected from flooding, row crops can be grown year after year.

Overgrazing or grazing when this soil is wet should be avoided because it causes compaction and poor tilth. Proper stocking, pasture rotation, and deferred grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. It still supports some small areas of hardwoods. Seeds, cuttings, and seedlings do well if competing vegetation is controlled or removed. Good site preparation, prescribed spraying, and cutting or girdling are needed. There are no hazards or limitations in growing or harvesting trees.

This soil is generally not suited to building site development and sanitary facilties because of the flood hazard. Some areas can be used for hiking and golfing. This soil is a good source of topsoil.

The capability subclass is IIw.

Ef—Eel Variant silt loam, occasionally flooded. This level and nearly level soil is moderately well drained. It occupies high positions on flood plains, slightly higher positions than the nearby Genesee and Eel soils. Areas are long and narrow and range from 7 to 85 acres. The slope is 0 to 2 percent.

In a typical profile the surface layer is dark brown, friable silt loam about 9 inches thick. The next layer to a depth of about 25 inches is mottled, brown, friable silty clay loam. The subsoil is about 33 inches thick. It is mostly mottled, brown, firm silty clay loam. The substratum to a depth of about 66 inches is mostly olive brown and grayish brown, friable silty clay loam.

Included with this soil in mapping are small areas of somewhat poorly drained soils and spots where gravelly sandy loam occurs at a depth of less than 4 feet. These included areas make up about 15 percent of the unit.

This Eel variant has a deep root zone and a high capacity for the storage and release of plant nutrients. Permeability is moderately slow. Available water capacity is high. The surface layer is moderate in organic matter content and is neutral in reaction. Surface runoff is slow. There is little or no erosion hazard. This soil has good tilth and is easy to work. It is subject to occasional flooding, mostly in winter and spring. It is seldom flooded during the growing season.

This soil is used as cropland and woodland. The potential is high for cropland, pasture, and woodland. It is low for many engineering uses because of the flood hazard. It is medium for wildlife and recreation.

This soil is suitable for all crops commonly grown in the county. It has few, if any, adverse soil conditions that limit its use for crops. Occasional flooding is the main hazard. Flooding is most common late in winter and in spring and may damage winter small grain in unprotected fields. Row crops often can be planted and harvested during the nonflood period. If protected from flooding, row crops can be grown year after year. Crop residue helps to maintain organic matter content and provides for good tilth. This soil is suited to irrigation. A good source of underground water is generally available.

This soil is well suited to pasture but is rarely used for this purpose because it is well suited to row crops. Overgrazing or grazing when this soil is soft and wet should be avoided because it causes compaction and results in poor tilth. Proper stocking, pasture rotation, and deferred grazing during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. It still supports some areas of hardwoods. Seeds, cuttings, and seedlings grow well if competing vegetation is controlled or removed. Good site preparation, prescribed spraying, and cutting or girdling are needed. There are no hazards or limitations in planting or harvesting trees.

This soil is generally not suited to building site development and sanitary facilities because of the flood hazard. Some areas can be used for hiking and golfing. This soil is a good source of topsoil.

The capability subclass is IIw.

ElA—Eldean loam, 0 to 2 percent slopes. This level and nearly level, well drained soil is in broad areas on outwash terraces near the major streams. Most areas are 10 to 80 acres. There is little or no evidence of past erosion on this soil.

In a typical profile the surface layer is dark brown, friable loam about 8 inches thick. The subsoil is about 26 inches thick. It is mostly brown and dark reddish brown, firm loam, clay loam, clay, and gravelly loam. The substratum to a depth of about 60 inches is loose very gravelly loamy coarse sand. The surface layer is silt loam in some areas.

Included with this soil in mapping are small areas of the dark colored Warsaw variant and the deeper Ockley soils in swales and in slightly more depressed drainageways. A few small areas of gently sloping Eldean and Casco soils are at the heads of drainageways. These included areas make up about 10 percent of the unit.

This Eldean soil has a moderately deep root zone and a medium capacity for the storage and release of plant nutrients. Permeability is moderate or moderately slow in the subsoil and very rapid in the underlying material. Available water capacity is low. Surface runoff is slow. The surface layer is moderate in organic matter content. It is acid unless limed. The soil is droughty.

Most of the acreage is cropland. A few areas are in pasture, woodland, or nursery and truck crops. The potential is good for crops, wildlife, and recreation. It is good for many engineering uses.

This soil is suitable for all field crops commonly grown and to special crops, such as nursery and truck crops. Droughtiness is the main hazard. Surface runoff is slow. There is little or no hazard of erosion. Tilth is good throughout a wide range of moisture content. Crops can be seeded early because the soil warms and dries early in spring. If well managed, row crops can be grown year after year. Crop residue and farm manure help to maintain tilth and retain soil moisture. This soil is well suited to irrigation. A good source of underground water is generally available.

Overgrazing or grazing when this soil is soft and wet should be avoided because it commonly causes compaction and poor tilth. Proper stocking, pasture rotation, and deferred grazing during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees that are tolerant of dryness. There are a few scattered small areas of hardwoods. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Good site preparation, prescribed spraying, and cutting or girdling are needed. There are no hazards or limitations in growing or harvesting trees.

This soil is generally suitable for building site development but is limited for sanitary facilities because of seepage and the possible contamination of ground water. Lawns seeded during the growing season should be mulched and watered because the soil is droughty. This soil is a good source of sand and gravel.

The capability subclass is IIs.

ElB—Eldean loam, 2 to 6 percent slopes. This gently sloping, well drained soil is along drainageways on stream terraces near the major streams and their larger tributaries. A few areas of this soil occupy gravelly knolls and ridges in the uplands. Most areas range from 4 to 45 acres. Slopes are commonly 60 to 75 feet long. There is some evidence of erosion, but most of the original surface soil remains.

In a typical profile the surface layer is dark brown, friable loam about 9 inches thick. The subsoil is about 24 inches thick. It is mostly brown and reddish brown, firm clay loam, clay, and gravelly clay loam. The substratum to a depth of about 60 inches is loose very gravelly loamy coarse sand. In some areas the surface layer is silt loam.

Included with this soil in mapping are small areas of dark colored Warsaw and shallow Casco soils. Also included are small areas of the deeper Ockley soils and small areas where slopes are more than 6 percent. These included areas make up about 10 percent of the unit.

This Eldean soil has a moderately deep root zone and a medium capacity for the storage and release of plant nutrients. Permeability is moderate or moderately slow in the subsoil and very rapid in the underlying material. Available water capacity is low. Surface runoff is medium. The surface layer is acid unless limed. It is moderate in organic matter content. This soil has a moderate erosion hazard. It is commonly droughty for crops that mature late in summer.

Most of the acreage is cropland. A few areas are in pasture or woodland. The potential is high for crops, wildlife, and recreation. It is high for many engineering uses.

This soil is suitable for all field crops commonly grown in the county. Droughtiness and a moderate erosion hazard are the main concerns. Surface runoff is medium. The erosion hazard is moderate, especially in cultivated areas. Tilth is good throughout a wide range of moisture content. Crops can be seeded early because this soil warms and dries early in spring. Under high level management, row crops can be grown intensively on slopes of 4 percent or less. The cropping sequence commonly should include small grain and sod crops. Crop residue or farm manure help to maintain soil tilth, control erosion, and retain soil moisture. This soil is suited to irrigation. A good source of underground water is generally available.

Overgrazing or grazing when this soil is soft and wet should be avoided because it causes compaction and poor tilth. Proper stocking, pasture rotation, and deferred grazing during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees that are tolerant of dryness. It still supports a few scattered small areas of hardwoods. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Good site preparation, prescribed spraying, and cutting or girdling are needed. There are no hazards or limitations in growing or harvesting trees.

This soil is generally suited to building site development but is limited for sanitary facilities because of seepage and the possible contamination of ground water. Lawns seeded during the growing season should be mulched and watered because the soil is droughty. This soil is a good source of sand and gravel.

The capability subclass is IIe.

EoC2—Eldean-Casco complex, 6 to 15 percent slopes, eroded. The soils in this map unit are well drained and somewhat excessively drained. They occupy long and narrow breaks at the heads of drainageways in outwash terraces and on gravelly knolls and ridges of the uplands. Most areas are 2 to 10 acres. Slopes are convex and are commonly 60 to 100 feet long.

This map unit is about 50 percent Eldean loam, 35 percent Casco gravelly loam, and 15 percent other soils. Most of the acreage of Eldean loam is eroded. About half the acreage of the Casco soil is eroded, and half is severely eroded. These soils are so intricately mixed that it is not practical to map them separately.

In a typical profile of an Eldean soil, the surface layer is dark brown heavy loam about 8 inches thick. The subsoil is about 20 inches thick. It is mostly reddish brown, firm clay loam and gravelly clay loam. The substratum to a depth of about 60 inches is loose very gravelly loamy coarse sand.

In a typical profile of a Casco soil, the surface layer is dark grayish brown, friable gravelly loam about 8 inches thick. The subsoil is dark reddish brown, firm sandy clay loam about 8 inches thick. The substratum to a depth of about 60 inches is loose very gravelly loamy coarse sand.

Included with these soils in mapping and making up about 15 percent of the unit are small areas of dark colored soils and soils that have a sandy surface layer.

The Eldean soil has a moderately deep root zone over the sand and gravel, and the Casco soil a shallow root zone. The capacity for the storage and release of plant nutrients is medium in the Eldean soil and low in the Casco soil. In both soils permeability is moderate or moderately slow in the subsoil and very rapid in the underlying material. Because of past erosion, the surface layer of both soils is low in organic matter content. Available water capacity is low. Surface runoff is medium. Unless limed, the plow layer of the Eldean soil is acid and that of the Casco soil is neutral or alkaline.

Most areas of this unit are cropland or pasture. A few areas are wooded. The potential is low to medium for cropland but high for pasture and woodland. It is poor for wildlife, recreation, and most engineering uses.

This unit is limited for use as cropland because the hazards of erosion and drought are severe. The cropping system should include drought resistant grasses and legumes and only an occasional cultivated crop. If the slope is more than 12 percent, a permanent plant cover is needed. Minimum tillage, cover crops, and crop residue help to control erosion and retain soil moisture. Early planting and short-season crops help to prevent damage from drought. A good plant cover is needed for the best erosion control.

The use of this unit as pasture is effective in controlling erosion. During seeding or improving the pasture, the trash mulch or no tillage method helps to control erosion and retains soil moisture. Proper stocking, pasture rotation, and timely deferment of grazing during extremely wet periods help to keep the pasture and the soil in good condition.

This unit is suitable for trees that are tolerant of dryness and that can be established in an eroded soil. There are only a few hardwood forests. Erosion must be controlled and competing vegetation controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Erosion control, site preparation, prescribed spraying, and cutting or girdling are needed.

This unit is generally suited to building site development but is poorly suited to sanitary facilities because of seepage and the possible contamination of ground water. Sloughing is a hazard during excavation. Lawns seeded during the growing season should be mulched and watered because the soils are droughty. The unit is a good source of sand and gravel.

The capability subclass is IVe.

EsB2—Eldean-Morley complex, 2 to 6 percent slopes, eroded. The soils in this map unit are well drained and occupy short, narrow, gently sloping ridges and knolls of moraines in the uplands. Areas are 2 to 8 acres. Slopes are mostly convex and are commonly 60 to 120 feet long.

This map unit is about 50 percent Eldean loam, 35 percent Morley silt loam, and 15 percent other soils. The soils are so intricately mixed that it is not practical to map them separately.

In a typical profile of an Eldean soil, the surface layer is dark brown, friable loam about 8 inches thick. The subsoil is about 20 inches thick. It is mostly reddish brown, firm clay loam and gravelly clay loam. The substratum to a depth of about 60 inches is loose very gravelly loamy coarse sand.

In a typical profile of a Morley soil, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 18 inches thick. It is mostly dark yellowish brown, firm clay loam and clay. The substratum to a depth of about 60 inches is yellowish brown, firm clay loam till. In some areas the surface layer is clay loam.

Included with this unit in mapping are small areas of shallow Casco soils and dark colored soils. Also included are spots where the surface layer is sandy and areas where slopes are more than 6 percent. These included areas make up about 15 percent of the unit.

Eldean and Morley soils have a moderately deep root zone. Both soils have a medium capacity for the storage and release of plant nutrients. Permeability is moderate or moderately slow in the subsoil and very rapid in the underlying material in the Eldean soil. Permeability is slow in the Morley soil. Available water capacity is low in the Eldean soil and moderate in the Morley soil. Because of past erosion, the surface layer of both soils is lower in organic matter content than that of uneroded soils. The organic matter content is moderate to low. The surface layer is acid unless limed. Surface runoff is medium. Both soils are subject to erosion. The Eldean soil is droughty in summer.

Most areas of this unit are cropland or pasture. The potential is high for cropland, pasture, and woodland. It is high in the Eldean soil for many engineering uses but is low in the Morley soil as a result of slow permeability. In both soils the potential is medium or high for wildlife and recreation.

These soils are suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture if erosion is controlled and the unit is well managed. The main limitation in cropland is the hazard of erosion. The Eldean soil is also droughty. Soil compaction is a concern if the soils are tilled when soft and wet. The cropping system should include close-growing crops and grasses and legumes to prevent further damage from erosion. Minimum tillage, winter cover crops, and crop residue also help to prevent excessive soil loss and retain soil moisture. This unit is subject to rapid erosion if plowed in fall.

The use of these soils as pasture is effective in controlling erosion. During seeding or improving the pasture, the trash mulch or no tillage method helps to control erosion and retains soil moisture. Proper stocking, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture and the soil in good condition.

These soils are well suited to trees. Trees should be tolerant of droughtiness, however, on the Eldean soil. Soil erosion must be controlled and competing plants controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Erosion control, good site preparation, prescribed spraying, and cutting or girdling are needed.

These soils have few limitations for building site development and for most sanitary facilities. The Eldean soil is better suited to building site development than the Morley soil because of the more permeable subsoil and substratum.

The capability subclass is IIe.

EsC2—Eldean-Morley complex, 6 to 15 percent slopes, eroded. The soils in this map unit occupy long and narrow ridges and knolls of the uplands. They are in the moraines where kames and eskers are common. Areas are 2 to 28 acres. They are dissected by many small drainageways. Slopes are mostly convex and are 60 to 150 feet long.

This unit is about 40 percent Eldean loam, 30 percent Morley silt loam, and 30 percent other soils. These soils are so intricately mixed that it is not practical to map them separately.

In a typical profile of an Eldean soil, the surface layer is dark brown, friable loam about 8 inches thick. The subsoil is about 18 inches thick. It is mostly reddish brown, firm clay loam and gravelly clay loam. The substratum to a depth of about 60 inches is loose very gravelly loamy coarse sand.

In a typical profile of a Morley soil, the surface layer is a dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 18 inches thick. It is mostly dark yellowish brown, firm clay loam and clay. The substratum to a depth of about 60 inches is yellowish brown, firm clay loam till. In some areas the surface layer is clay loam.

Included with this unit in mapping are small areas of Glynwood, Blount, and somewhat poorly drained dark colored soils. Also included are spots of shallow Casco soils and areas where slopes are less than 6 percent. These included areas make up about 15 percent of the unit.

Eldean and Morley soils have a moderately deep root zone. In both soils the capacity for the storage and release of plant nutrients is medium. Permeability is moderate or moderately slow in the subsoil and very rapid in the underlying material in the Eldean soil. Permeability is slow in the Morley soil. Available water capacity is low in the Eldean soil and moderate in the Morley soil. Because of past erosion, the surface layer of these soils is lower in organic matter content than that of uneroded soils. Surface runoff is medium in the Eldean soil and rapid in the Morley soil. In about 60 percent of the areas the soils are eroded, and in 40 percent they are severely eroded. In a few areas glacial till or sand and gravel is exposed at the surface. The plow layer is acid unless limed. Both soils are subject to erosion if farmed. The Eldean soil is droughty in summer.

Most areas of this unit are cropland or pasture. A few areas are woodland. The potential is low for cropland because of the erosion hazard but is high for pasture and woodland. It is medium in the Eldean soil for most engineering uses but is low in the Morley soil as a result of slow permeability.

These soils are suited to cultivated crops and small grain and to grasses and legumes for hay or pasture if they are well managed and erosion is controlled. The main limitation for cropland is the severe erosion hazard. The Eldean soil is also droughty. The cropping system should include close-growing crops and grasses and legumes to prevent further damage from erosion. Minimum tillage, winter cover crops, and crop residue help to prevent excessive soil loss and retain soil moisture. The soils are subject to rapid erosion if plowed in fall.

The use of these soils for pasture is effective in controlling erosion. During seeding or improving the pasture, the trash mulch or no tillage method helps to control erosion and retain soil moisture. Proper stocking, pasture rotation, and timely deferment of grazing during wet periods help to keep the pasture and the soils in good condition.

Trees are well suited. They should be tolerant of droughtiness, however, in the Eldean soil. Erosion must be controlled and competing plants controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Erosion control, good site preparation, and prescribed spraying or cutting or girdling are needed.

The soils in this unit are generally suited to building site development and sanitary facilities. The Eldean soil is better suited to building site development than the Morley soil because of the more permeable subsoil and substratum. The Eldean soil, however, is not so well suited to sanitary facilities as the Morley soil because of seepage and the possible contamination of ground water.

The capability subclass is IIIe.

Ge—Genesee silt loam, occasionally flooded. This level and nearly level, well drained soil is on flood plains along the major streams and larger tributaries. It generally is nearer the stream channel than the nearby Eel and Shoals soils. Most areas are long and narrow and are about 10 to 100 acres or more. The slope is 0 to 2 percent.

In a typical profile the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The next layer to a depth of about 54 inches is mostly brown and dark yellowish brown, friable silt loam. At a depth of about 54 to 60 inches is mottled, brown, friable silt loam and loam. Stratified loose sand and gravel commonly occurs at a depth of about 40 inches or more. In some areas the surface layer is loam and is 10 to 20 percent pebbles.

Included with this soil in mapping are small areas of Medway and Shoals soils next to the uplands and coarse textured Stonelick soils next to the stream channel. These included areas make up about 10 percent of the unit.

This Genesee soil has a deep root zone and a high capacity for the storage and release of plant nutrients. Permeability is moderate, and available water capacity is high. Surface runoff is slow. The surface layer is moderate in organic matter content. It is mildly alkaline and commonly contains free carbonates. The soil has good tilth and is easy to work. It is subject to occasional flooding mostly in winter and spring. Flooding during the growing season is not common. In some areas, this soil is extensively dissected by braided flood channels.

Most of the acreage is cropland, mainly row crops, small grain, and meadow. A few areas are pastured or wooded. The potential is high for cropland, pasture, and woodland and also for many wildlife and recreational uses. It is low for most engineering uses because of the flood hazard.

This soil is suitable for all field crops commonly grown. It has few limitations. Occasional flooding is the main hazard. Flooding is most common late in winter and in spring and may damage winter grain in unprotected fields. Row crops can often be planted and harvested during the nonflood period. If protected from flooding, row crops can be grown year after year.

Overgrazing or grazing when this soil is wet should be avoided because it causes compaction and poor tilth. Proper stocking, pasture rotation, and deferred grazing during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. It still supports some small areas of hardwoods. Seeds, cuttings, and seedlings grow well if competing vegetation is controlled or removed. Good site preparation, prescribed spraying, and cutting or girdling are needed. There are no hazards or limitations in growing or harvesting trees.

This soil is generally not suitable for building site development and sanitary facilities because of the flood hazard. Some areas can be used for hiking and other recreation in summer. The soil is a good source of topsoil.

The capability subclass is IIw.

GlB—Glynwood silt loam, 2 to 6 percent slopes. This soil is gently sloping and is moderately well drained. It occupies knolls, ridges, and side slopes at the heads of drainageways of the uplands. Most areas are irregular in shape and are between 2 and 20 acres. Areas have convex slopes and are dissected by small drainageways. Slopes are commonly 60 to 100 feet long. Nearly all the original surface layer remains; there is only slight evidence of erosion.

In a typical profile the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 21 inches thick. It is mostly mottled, brown and dark yellowish brown, firm clay loam and clay. The substratum to a depth of about 60 inches is mottled, yellowish brown, firm clay loam till.

Included with this soil in mapping are small areas of wetter Blount soils and areas where slopes are more than 6 percent. Also included are small areas of dark colored Pewamo soils in narrow drainageways. These included areas make up about 15 percent of the unit.

This Glynwood soil has a moderately deep root zone and a medium capacity for the storage and release of plant nutrients. Permeability is slow. Available water capacity is moderate. Surface runoff is medium. The surface layer is moderate in organic matter content. It is acid unless limed. In unprotected areas it tends to crust or seal after rains. Internal drainage is generally good, but on the lower slopes the soil is wetter in spring.

Most of the acreage is cropland and pasture. A few areas are wooded. The potential is high for such uses. It is medium for wildlife and recreation. It is low to medium for most engineering uses as a result of slow permeability and periodic seasonal wetness.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes. There is a moderate erosion hazard and a slight wetness hazard if this soil is used as cropland. Compaction is a problem if this soil is tilled when soft and wet. Under high level management, row crops can be grown intensively. When management is less than high level, the cropping sequence should include small grain or other close-growing crops and sod crops to help maintain soil tilth and control erosion. Minimum tillage, winter cover crops, and grassed waterways also help to prevent excessive soil loss. Crop residue, cover crops, and farm manure improve soil tilth and organic matter content and thus reduce surface crusting and increase water intake.

The use of this soil for pasture is effective in controlling erosion. Overgrazing or grazing when the soil is soft and wet compacts the surface layer, results in poor tilth, and causes excess runoff and erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. There are still a few scattered areas of native hardwoods. There are no hazards or limitations in planting and harvesting trees except for plant competition. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Good site preparation, prescribed spraying, and cutting or girdling are needed.

This soil is generally not suitable for building site developments and sanitary facilities because of slow permeability and periodic seasonal wetness. Footer drains and exterior wall coatings help to prevent wet basements. Local roads can be improved by using suitable base material and by using artificial drainage where drainage outlets are available.

The capability subclass is IIe.

GlB2—Glynwood silt loam, 2 to 6 percent slopes, eroded. This gently sloping, moderately well drained soil is on knolls, ridges, and side slopes at the heads of drainageways in the uplands. Most areas are irregular in shape and are between 3 to 40 acres. Areas have convex slopes and are dissected by many small drainageways. Slopes are commonly about 50 to 100 feet long. Large areas of wetter Blount and dark colored Pewamo soils surround the soil. Most areas have been cultivated. The plow layer is a mixture of the original surface layer and the upper part of the subsoil.

In a typical profile the surface layer is brown, friable heavy silt loam about 8 inches thick. The subsoil is about 16 inches thick. It is mostly mottled, yellowish brown, firm silty clay and clay. The substratum to a depth of about 60 inches is mottled, yellowish brown, firm clay loam till. In some areas the surface layer is clay loam.

Included with this soil in mapping are small areas of wetter Blount soils and areas where slopes are more than 6 percent. Also included are small areas of dark colored Pewamo soils in narrow drainageways and spots of severely eroded soils that are less than 18 inches deep over till. These included soils make up about 15 percent of the unit.

This Glynwood soil has a moderately deep root zone and a medium capacity for the storage and release of plant nutrients. Permeability is low. Available water capacity is moderate. Surface runoff is medium because of the gentle slopes and the eroded surface layer. The surface layer is moderate or low in organic matter content. It is acid unless limed. In unprotected areas it tends to crust or seal after rains. Internal drainage is generally good, but some areas on the lower slopes are wetter in spring.

Most of the acreage is cropland and pasture. The potential is low for cropland but is high for pasture and woodland. It is medium for wildlife and recreation. It is low to medium for most engineering uses as a result of slow permeability and periodic seasonal wetness.

This soil is suitable for corn, soybeans, and small grain and for grasses and legumes for hay and pasture if it is well managed and erosion is controlled. The main limitation is a severe erosion hazard. The soil has already lost a significant amount of the original surface layer. Compaction is a problem if the soil is tilled when soft and wet. The cropping system should include close-growing crops and grasses and legumes to prevent further erosion. Minimum tillage, winter cover crops, and grassed waterways also help to prevent excessive soil loss. Crop residue and farm manure help to improve soil tilth, reduce surface crusting, and increase water intake. This soil is susceptible to erosion if plowed in fall.

The use of this soil for pasture or hay is effective in controlling erosion. Overgrazing or grazing when the soil is soft and wet compacts the moderately eroded surface layer, results in poor tilth, and causes excessive runoff and more erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees that can be established in sites where the surface layer is eroded. There are only a few hardwood forests. Erosion must be controlled, and competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Erosion control, good site preparation, prescribed spraying, and cutting or girdling are needed.

This soil is generally not suitable for most building site development and sanitary facilities because of slow permeability and periodic seasonal wetness. This soil is suited to pond construction (fig. 3). Footer drains and exterior wall coatings help to prevent wet basements. Local roads can be improved by using suitable base material and by using artificial drainage where drainage outlets are available.

The capability subclass is IIIe.

GlC2—Glynwood silt loam, 6 to 12 percent slopes, eroded. This soil is moderately sloping and is moderately well drained. It is on knolls, ridges, and side slopes near drainageways of the uplands. Most areas are irregular in shape and are 3 to 35 acres. Slopes are 40 to 100 feet long and are commonly dissected by small narrow drainageways. Most areas have been cultivated. The plow layer is a mixture of the original surface layer and the upper part of the subsoil. In a few severely eroded spots, short gullies 1 to 2 feet deep have formed.

In a typical profile the surface layer is brown, friable heavy silt loam about 8 inches thick. The subsoil is about 14 inches thick. It is mostly mottled, yellowish brown, firm silty clay and clay. The substratum to a depth of about 60 inches is mottled, yellowish brown, firm clay loam till. In some areas the surface layer is clay loam.

Included with this soil in mapping are small areas of gently sloping Blount soils and areas where slopes are more than 12 percent. Also included are small areas of well drained Morley soils and severely eroded spots where the soil is less than 18 inches deep over till. These included areas make up about 15 percent of the unit.

This Glynwood soil has a moderately deep root zone and a medium capacity for the storage and release of plant nutrients. Available water capacity is moderate. Permeability is slow. Surface runoff is medium to rapid because of the slope and the eroded surface layer. The surface layer is low or moderate in organic matter content. It is acid unless limed. In unprotected areas it tends to crust or seal after rains.

Most of the acreage is cropland and pasture. The potential is medium for cropland because of the erosion hazard. It is high for pasture and woodland. The potential is low for most engineering uses as a result of slow permeability and is medium for most wildlife and recreation.

This soil is suited to cultivated crops, small grain, and hay. The hazard of erosion is severe in cultivated areas. Minimum tillage, cover crops, grassed waterways, and grasses and legumes in the cropping system are used to control erosion and maintain soil tilth. Crop residue and manure improve soil tilth, reduce surface crusting, and increase water intake. Tilling within the proper range of moisture content reduces soil compaction. This soil is susceptible to erosion if plowed in fall.

The use of this soil for pasture or hay is effective in controlling erosion. The hazard of erosion is severe if the soil is plowed or if the pasture is overgrazed. During seeding, the use of cover crops or companion crops and trash mulching or no-till seeding help to control erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees that can be established in sites where the surface layer is eroded. There are only a few areas of hardwoods. Erosion must be controlled and competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Erosion control, site preparation, prescribed spraying, and cutting or girdling are needed. If practical, logging roads and skid trails should be constructed on the contour to prevent excess erosion.

This soil is generally not suitable for building site development and sanitary facilities as a result of slow permeability. Footer drains and exterior wall coatings help to prevent wet basements. Local roads can be improved by using suitable base material.

The capability subclass is IIIe.

GlD2—Glynwood silt loam, 12 to 18 percent slopes, eroded. This moderately steep, moderately well drained soil occupies knolls and side slopes at the heads of drainageways of the uplands. Most areas are about 3 to 25 acres. Slopes are mostly 50 to 100 feet long and are dissected by small drainageways. Erosion has removed part of the original surface layer. The present plow layer is a mixture of the original surface layer and the upper part of the subsoil. In some areas there are severely eroded spots, and a few short gullies 1 to 2 feet deep have formed.

In a typical profile the surface layer is brown, friable heavy silt loam about 8 inches thick. The subsoil is about 12 inches thick. It is mostly mottled, yellowish brown, firm silty clay and clay. The substratum to a depth of 60 inches is mottled, yellowish brown, firm clay loam till.

Included with this soil in mapping are small areas of uneroded Glynwood soils, mainly in woodland or pasture, and small areas where slopes are more than 18 percent. Also included are small areas of well drained Morley soils and severely eroded spots where the soil is less than 18 inches deep over till and the surface layer is clay loam. These included areas make up about 15 percent of the unit.

This Glynwood soil has a moderately deep root zone and a medium capacity for the storage and release of plant nutrients. Available water capacity is moderate. Permeability is low. Surface runoff is rapid because of the moderately steep slope and the eroded surface layer. The surface layer is low or moderate in organic matter content and is acid unless limed. In unprotected areas it tends to crust or seal after rains.

Most of the acreage is pasture and cropland. The potential is high for pasture and woodland but is low for cropland because of the severe erosion hazard. It is low for most engineering uses as a result of slope and slow permeability, and is medium for wildlife and recreation.

This soil is limited for use as cropland. Erosion is a severe hazard in cultivated areas. The cropping system should include grasses and legumes and only an occasional cultivated crop. Minimum tillage, cover crops, crop residue, and manure help to control erosion and improve soil tilth. A good plant cover is needed for the best erosion control. Tilling within the proper range of moisture content helps to reduce soil compaction. This soil is susceptible to erosion if plowed in fall.

The use of this soil for pasture is effective in controlling erosion. The hazard of erosion is severe if the soil is plowed or if the pasture is overgrazed. During seeding, the use of cover crops or companion crops and trash mulching or no-till seeding help to control erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees that can be established in sites where the surface layer is eroded. There are only a few areas of hardwoods. Erosion must be controlled and competing vegetation controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Erosion control, site preparation, prescribed spraying, and cutting or girdling are needed. If practical, logging roads and skid trails should be constructed on the contour to prevent excess soil loss.

This soil is generally not suitable for building site development and sanitary facilities as a result of slow permability and the slope. The hazard of erosion is very high if vegetation is removed. Trails in recreational areas should be protected from erosion.

The capability subclass is IVe.

GmC3—Glynwood clay loam, 6 to 12 percent slopes, severely eroded. This soil is moderately sloping and is moderately well drained. It occupies knolls, ridges, and side slopes at the heads of drainageways of the uplands. Areas are about 2 to 40 acres. Slopes are commonly 50 to 100 feet long. Shallow short gullies 1 to 3 feet deep are common in many areas. Erosion has removed most or all of the original surface layer, and the present plow layer is mostly subsoil material.

In a typical profile the plow layer is dark yellowish brown clay loam about 7 inches thick. The subsoil is about 8 inches thick. It is mostly mottled, yellowish brown, firm clay loam and silty clay. The substratum to a depth of about 60 inches is mottled, yellowish brown, firm clay loam till. In some areas, spots of the substratum are exposed.

Included with this soil in mapping are small areas of uneroded Glynwood soils and areas where slopes are more than 12 percent. Also included are small areas of gently sloping Blount soils near and around the drainageways. These included areas make up about 15 percent of the unit.

This Glynwood soil has a shallow root zone and a low or medium capacity for the storage and release of plant nutrients. Permeability is slow. Available water capacity is moderate. The surface layer is low in organic matter content. Reaction is commonly alkaline. Surface runoff is rapid because of the slope and the eroded surface layer. This soil has poor tilth and can be worked only within a narrow range of moisture content.

Most of the acreage has been cultivated. Some is used for pasture and some for cropland. The potential is poor for cultivated crops because of the very severe erosion hazard. It is good for pasture and woodland and is fair for wildlife and many recreational purposes. It is poor for most engineering uses as a result of the slow permeability and the slope.

This soil is limited for use as cropland. Erosion is a severe hazard in cultivated areas. The cropping system should include grasses and legumes and only an occasional cultivated crop. Minimum tillage, cover crops, crop residue, and manure help to control erosion and improve soil tilth. A good plant cover is needed for the best erosion control. This soil is susceptible to rapid erosion if plowed in fall.

The use of this soil for pasture is effective in controlling erosion. The hazard of erosion is severe if the soil is plowed or if the pasture is overgrazed. During seeding, cover crops or companion crops and trash mulching or no-till seeding help to control erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees that can be established in sites where the surface layer is alkaline and severely eroded. There are only a few areas of hardwoods. Erosion must be controlled and competing vegetation controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Erosion control, site preparation, prescribed spraying, and cutting or girdling are needed.

This soil is generally not suitable for building site development and sanitary facilities as a result of slow permeability. Houses without basements are better suited to this soil than those with basements. Footer drains and exterior wall coatings help to prevent wet basements. Local roads can be improved by using suitable base material. Establishing a lawn is difficult on this soil. Good topsoil is needed before seeding. The soil is highly erodible if left bare.

The capability subclass is IVe.

GmD3—Glynwood clay loam, 12 to 18 percent slopes, severely eroded. This moderately steep, moderately well drained soil is on narrow side slopes or breaks at the heads of drainageways in the uplands. Most areas are 2 to 14 acres. Slopes are commonly 50 to 120 feet long. Shallow short gullies 1 to 3 feet deep are common in most areas. Erosion has removed most or all of the original surface layer. The present plow layer is mostly subsoil material.

In a typical profile the plow layer is dark yellowish brown clay loam about 7 inches thick. The subsoil is about 8 inches thick. It is mostly mottled, yellowish brown, firm clay loam and silty clay. The substratum to a depth of about 60 inches is mottled, yellowish brown, firm clay loam till. In some areas, spots of the substratum are exposed.

Included with this soil in mapping are small areas of uneroded Glynwood soils, spots of well drained soils, and spots where the slope is more than 18 percent. These included areas make up about 15 percent of the unit.

This Glynwood soil has a shallow root zone and a low to medium capacity for the storage and release of plant nutrients. Permeability is slow. Available water capacity is moderate. The surface layer is low in organic matter content. Reaction is commonly alkaline. Surface runoff is rapid because of the moderately steep slope and the eroded soil. The soil has poor tilth and can be worked within only a narrow range of moisture content.

Most of the acreage has been cultivated but is now used mainly for pasture. Only a few acres are cropped. The soil has low potential for cropland mainly because of the very severe erosion hazard. Its best potential use is for pasture or woodland. The potential is low for most engineering uses as a result of the slope and slow permeability. It is medium for wildlife and recreation.

This soil is not suited to cultivated crops, but it is suited to grasses and legumes for permanent pasture and meadow. Erosion is serious unless an adequate plant cover is maintained. The trash mulch method of tillage helps to control erosion when seeding or improving the pasture. Proper stocking, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture and soil in better condition.

This soil is suited to trees that can be established in sites where the surface layer is alkaline and severely eroded. All the native hardwoods have been removed. Erosion must be controlled and competing vegetation controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Erosion control, site preparation, prescribed spraying, and cutting or girdling are needed.

This soil is generally not suitable for building site development and sanitary facilities as a result of slow permeability and the slope. The erosion hazard is high. Trails in recreational areas should be protected. Establishing lawns is difficult. Good topsoil is needed. The soil is highly erodible if left bare.

The capability subclass is VIe.

Md—Medway silt loam, occasionally flooded. This soil is level to nearly level and is moderately well drained. It occupies long narrow areas on flood plains mainly along the major streams. It generally is at the base of the adjacent sloping soils and farther from the stream channel than the nearby Eel and Shoals soils. Areas are 5 to 60 acres. The slope is 0 to 2 percent.

In a typical profile the surface layer is very dark grayish brown, friable silt loam about 10 inches thick. The subsurface layer, about 8 inches thick, is very dark grayish brown, friable silt loam. The subsoil is about 12 inches thick. It is mostly mottled, dark brown, friable silt loam. The substratum to a depth of about 60 inches is mottled, grayish brown, friable loam and sandy loam. Stratified loose sand and gravel commonly occurs at a depth of 40 inches or more. In some areas the surface layer is silty clay loam.

Included with this soil in mapping and making up about 10 percent of the unit are small areas of wetter Shoals soils and lighter colored Eel soils.

This Medway soil has a deep root zone and a high capacity for the storage and release of plant nutrients. Permeability is moderate. Available water capacity is high. The surface layer is high in organic matter content. It is neutral or mildly alkaline. Surface runoff is slow. The soil has good tilth and is easy to work. It is subject to flooding mostly in winter and spring. Flooding during the growing season is not common.

This soil is used for cropland, mainly row crops, small grain, and meadow. A few areas are in pasture. The potential is high for cropland, pasture, and woodland. It is medium to high for wildlife and many recreational uses. It is low for most engineering uses because of the flood hazard.

This soil is well suited to corn and soybeans. Occasional flooding is the main hazard in cropland. Flooding is most common late in winter and in spring and may damage winter grain crops if not protected. Internal drainage is generally good, but there are wet spots that may require artificial drainage. Subsurface drainage is effective in removing excess water. Row crops can be grown year after year if they are protected from flooding.

Overgrazing or grazing when this soil is soft and wet should be avoided because it causes compaction and poor tilth. Proper stocking, pasture rotation, and deferred grazing during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. Competing vegetation should be controlled or removed if seeds, cuttings, and seedlings are to survive and do well. Good site preparation, prescribed spraying, and cutting or girdling are needed. There are no hazards or limitations in growing or harvesting trees.

This soil is generally not suitable for building site development and sanitary facilities because of the flood hazard. Some areas can be used for recreation during the nonflood season. The soil is a good source of topsoil.

The capability subclass is IIw.

MhB—Miamian silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on low knolls and ridges of the uplands. Most areas are about 2 to 25 acres. The soil is cut by many small drainageways and is surrounded by larger areas of Crosby and Celina soils. Slopes are convex and are commonly 60 to 100 feet long. In most areas there is only slight evidence of erosion.

In a typical profile the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 21 inches thick. It is mostly dark yellowish brown and dark brown, firm clay loam, silty clay loam, and clay. The substratum to a depth of about 60 inches is yellowish brown, firm loam till. In some areas the soil has a mantle of loess up to 12 inches thick.

Included with this soil in mapping are small areas of nearly level Celina and Crosby soils and dark colored, very poorly drained Brookston soils in drainageways. In a few areas slopes are more than 6 percent. These included areas make up about 10 percent of the unit.

This Miamian soil has a moderately deep root zone and a medium capacity for the storage and release of plant nutrients. Permeability is moderately slow. Available water capacity is moderate. Surface runoff is medium. The hazard of erosion is moderate. The surface layer is moderate in organic matter content. Unless limed, it is acid. In unprotected areas it tends to crust or seal after rains.

Most of the acreage is cropland. A few areas are pasture and woodland. The potential is high for cultivated crops, hay, pasture, and woodland and for wildlife and most recreational purposes. It is medium or low for many engineering uses as a result of the moderately slow permeability.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. The major management practices are maintaining soil tilth and high fertility and controlling erosion. The soil is subject to a moderate erosion hazard if it is used for cultivated crops. Minimum tillage, winter cover crops, and grassed waterways help to prevent excessive soil loss. Crop residue and manure or other organic material improve soil tilth and fertility, reduce surface crusting, and increase water intake.

The use of this soil for pasture is effective in controlling erosion. Overgrazing or grazing when the soil is soft and wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. There are only a few small areas of hardwoods. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Good site preparation, prescribed spraying, and cutting or girdling are needed. There are no hazards or limitations in planting or harvesting trees.

This soil is generally suited to building site development and sanitary facilities. It is well suited to sanitary landfills and sewage lagoons. The moderately slow permeability is a limitation for septic tank absorption fields. Local roads can be improved by using a suitable base material.

The capability subclass is IIe.

MhC2—Miamian silt loam, 6 to 12 percent slopes, eroded. This eroded soil is moderately sloping and is well drained. It is on knolls, ridges, and side slopes at the head of drainageways of the uplands. Most areas are 3 to 15 acres. Slopes are convex and are generally 40 to 100 feet long. The soil is dissected by small narrow drainageways. Most areas have been cultivated. The present plow layer is a mixture of the original surface layer and the upper part of the subsoil. There are a few scattered short gullies 1 to 2 feet deep in some areas.

In a typical profile the surface layer is brown heavy silt loam about 8 inches thick. The subsoil is about 16 inches thick. In most areas of this Miamian soil, it is dark yellowish brown, firm clay loam and clay. The substratum to a depth of about 60 inches is yellowish brown, firm loam till.

Included with this soil in mapping are small areas of gently sloping Crosby and Celina soils, areas where the slopes are more than 12 percent, and spots of severely eroded soils less than 18 inches deep over till. These included areas make up about 15 percent of the unit.

The Miamian soil has a moderately deep root zone and a medium capacity for the storage and release of plant nutrients. Permeability is moderately slow. Available water capacity is moderate. Surface runoff is medium or rapid. The erosion hazard is moderately severe. The surface layer is low or moderate in organic matter content. Unless limed, it is acid. In unprotected areas, the surface tends to crust or seal after rains.

Most of the acreage is cropland and pasture. The potential is medium for cropland and high for pasture and woodland. It is low for most engineering uses as a result of the moderately slow permeability. It is medium to high for wildlife and most recreational uses.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If it is cultivated, there is a hazard of further erosion damage. Minimum tillage, cover crops, grassed waterways, and grasses and legumes in the cropping system help to prevent excessive soil loss. Crop residue or the regular addition of other organic material improves soil tilth, reduces surface crusting, and increases water intake. Tilling within the proper range of moisture content reduces soil compaction. The soil is subject to erosion if plowed in fall.

The use of this soil for pasture or hay is effective in controlling erosion. Overgrazing or grazing when the soil is soft and wet causes surface compaction, excessive runoff, and poor tilth. During seeding or improving the pasture, cover crops or companion crops and trash mulching or no-till seeding help to control erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. There are no native hardwoods on this soil. Erosion must be controlled and competing vegetation controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Erosion control, good site preparation, prescribed spraying, and cutting or girdling are needed.

This soil is generally not suited to building site development and sanitary facilities as a result of the moderately slow permeability and the slope. It is well suited to sanitary landfills. It is poorly suited to septic tank absorption fields as a result of the moderately slow permeability. Local roads can be improved by using a suitable base material.

The capability subclass is IIIe.

MhD2—Miamian silt loam, 12 to 18 percent slopes, eroded. This soil is moderately steep and is well drained. It occupies side slopes that parallel drainageways of the uplands. In a few areas it occupies knolls. Most areas are 2 to 15 acres. Slopes are convex and are commonly 60 to 120 feet long. Areas are dissected by small drainageways. Most areas have been cultivated, and erosion has removed part of the original surface layer. The present plow layer is a mixture of the original surface layer and moderate amounts of the subsoil. In some spots where the surface layer is severely eroded, the plow layer is mostly subsoil material. Scattered short gullies 1 to 2 feet deep have formed in some areas.

In a typical profile the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 17 inches thick. It is mostly dark yellowish brown, firm clay loam and clay. The substratum at a depth of about 60 inches is yellowish brown, firm loam till.

Included with this soil in mapping are small areas of uneroded Miamian soils, mainly in woodland or pasture, and areas where slopes are more than 18 percent. Also included are severely eroded spots where the soil is less than 18 inches deep over till and small areas where slopes are less than 12 percent. These included areas make up about 15 percent of the unit.

This Miamian soil has a moderately deep root zone and a medium capacity for the storage and release of plant nutrients. Permeability is moderately slow. Available water capacity is moderate. Surface runoff is rapid. The soil is subject to severe erosion if cultivated. The surface layer is low or moderate in organic matter content. Unless limed, it is acid. In unprotected areas, the surface tends to crust or seal after rains.

Most of the acreage is cropland and pasture. A few areas are wooded. The potential is high for pasture and woodland. It is low for cultivated crops because of the severe erosion hazard. It is medium for wildlife and most recreational purposes. It is low for many engineering uses as a result of the moderately slow permeability and the slope.

This soil is limited for use as cropland. If used for cultivated crops, there is a severe hazard of further erosion damage. The cropping system should include grasses and legumes and only an occasional cultivated crop. Minimum tillage, cover crops, grassed waterways, and grasses and legumes in the cropping system help to prevent excessive soil loss. The use of crop residue or other organic material improves soil tilth, reduces surface crusting, and increases water intake. Tilling within the proper range of moisture content reduces soil compaction. The soil is susceptible to erosion if plowed in fall.

The use of this soil for pasture is effective in controlling erosion. The hazard of erosion is severe if the soil is plowed or if the pasture is overgrazed. During seeding, the use of cover crops or companion crops and trash mulching or no-till seeding help to prevent excessive soil loss. Proper stocking, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees that can be established in sites where the surface layer is eroded. Native hardwoods have been removed. Erosion must be controlled and competing vegetation controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Erosion control, good site preparation, prescribed spraying, and cutting or girdling are needed.

This soil is generally not suitable for many building site developments and sanitary facilities as a result of the slope and the moderately slow permeability. The hazard of erosion is high if vegetation is removed. Trails and paths in recreational areas should be protected from erosion.

The capability subclass is IVe.

MhE—Miamian silt loam, 18 to 25 percent slopes. This well drained soil occupies steep side slopes of the uplands. It is near and is parallel to the major streams. Most areas are 3 to 40 acres. Slopes are 80 to 160 feet long and are mostly smooth and uniform. In some areas the upper part of the slope is slightly convex, and the toeslopes are slightly concave. Most areas are dissected by many small drainageways.

In a typical profile in a wooded area, the surface layer is very dark gray, friable silt loam about 4 inches thick. The next layer is brown, friable silt loam about 6 inches thick. The subsoil is about 26 inches thick. It is mostly dark yellowish brown, firm clay loam and light clay. The substratum to a depth of about 60 inches is yellowish brown, firm loam till.

Included with the soil in mapping are small areas where slopes are more than 25 percent, spots where shallow soils on very steep escarpments are less than 16 inches deep over till, and areas where streams have undercut the side slopes. These included areas make up about 10 percent of the unit.

This Miamian soil has a moderately deep root zone and a medium capacity for the storage and release of plant nutrients. Permeability is moderately slow. Available water capacity is moderate. Surface runoff is rapid. Unless a permanent plant cover is maintained, this soil is subject to severe erosion. The organic matter content is high in the upper 4 inches of the surface layer but is low in the lower part. Reaction is slightly acid or neutral.

This soil is used for woodland, pasture, and wildlife. The potential is low for cropland because of the steep slope. It is high for woodland and pasture and is medium for wildlife plantings. The potential is low for most engineering uses and for recreation because of the steep slope.

This soil is not suited to cropland, but it is suited to grasses and legumes for permanent pasture and meadow. Unless an adequate plant cover is maintained, erosion is a hazard. The trash mulch method of tillage helps to control erosion when seeding meadows or improving pastures. Proper stocking, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. It still supports sizable areas of hardwoods. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Site preparation, prescribed spraying, and cutting or girdling are needed. If practical, logging roads and skid trails should be constructed on the contour to control erosion.

This soil is generally not suitable for building site development and sanitary facilities because of the steep slopes. The hazard of erosion is high if vegetation is removed. Trails and paths in recreational areas should be protected from erosion and laid out across the slope if possible.

The capability subclass is VIe.

MhF—Miamian silt loam, 25 to 50 percent slopes. This well drained soil occupies very steep side slopes of the uplands. It is near and is parallel to the major streams. Areas are about 7 to 100 acres or more. Slopes are 70 to 160 feet long and are mostly smooth and uniform. In some areas, the upper fourth of the slope is slightly convex and the lower fourth is slightly concave. Most areas are dissected by many small drainageways.

In a typical profile in a wooded area, the surface layer is very dark gray, friable silt loam about 4 inches thick. The next layer is brown, friable silt loam about 6 inches thick. The subsoil is about 26 inches thick. It is mostly dark yellowish brown, firm clay loam and light clay. The substratum to a depth of about 60 inches is yellowish brown, firm loam till.

Included in mapping are small areas where slopes are less than 25 percent, spots of shallow soils less than 16 inches deep over till where slopes are more than 50 percent, and areas where streams have undercut the side slopes. These included areas make up about 10 percent of the unit.

This Miamian soil has a moderately deep root zone and a medium capacity for the storage and release of plant nutrients. Permeability is moderately slow. Available water capacity is moderate. Surface runoff is rapid. Unless permanent plant cover is maintained, this soil is subject to severe erosion. The organic matter content is high in the upper 4 inches of the surface layer but is low in the lower part. Reaction is slightly acid or neutral.

This soil is used for woodland, pasture, and wildlife. The potential is low for cropland because of the steep slope. It is high for woodland and is medium for pasture and many wildlife plantings. It is low for most engineering uses and recreation because of the steep slope.

This soil is not suited to cultivated crops, but it is suited to adapted grasses and legumes for permanent pasture and meadow. Unless an adequate plant cover is maintained, erosion is a hazard. The trash mulch method of tillage helps to control erosion when seeding meadows or improving pastures. Proper stocking, pasture rotation, timely deferment of grazing and restricted grazing during wet periods help to keep the pasture and soil in good condition. Areas that are too steep for machinery are best suited to trees.

This soil is well suited to trees. It still supports sizable areas of hardwoods. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Site preparation, prescribed spraying, and cutting or girdling are needed. Logging roads and skid trails should be constructed to control erosion.

This soil is generally not suitable for building site development and sanitary facilities because of the very steep slopes. The hazard of erosion is high if vegetation is removed. Trails and paths in recreational areas should be protected from erosion and laid out across the slope if possible.

The capability subclass is VIIe.

MlC3—Miamian clay loam, 6 to 12 percent slopes, severely eroded. This soil is moderately sloping and well drained. It is on knolls, ridges, and side slopes at the heads of drainageways in the upland. Most areas are 2 to 14 acres. Slopes are convex and are commonly 50 to 100 feet long. Shallow short gullies 1 to 3 feet deep are common. Erosion has removed most or all of the original surface layer. The present plow layer is mostly subsoil material.

In a typical profile the plow layer is yellowish brown clay loam about 7 inches thick. The subsoil is about 8 inches thick. It is dark yellowish brown, firm clay loam and clay. The substratum to a depth of about 60 inches is yellowish brown, firm loam till. Spots of the substratum are exposed in some areas.

Included with this soil in mapping are small areas of uneroded, gently sloping Miamian and Celina soils near the base of slopes. These areas have a deeper root zone and better tilth. A few areas where slopes are more than 12 percent are also included. These included areas make up about 10 percent of the unit.

This Miamian soil has a shallow root zone and a low to medium capacity for the storage and release of plant nutrients. Permeability is moderately slow. Available water capacity is moderate. The surface layer is low in organic matter content. Reaction is neutral or alkaline. Surface runoff is rapid because of the slope and the eroded surface layer. The soil has poor tilth and can be tilled within only a narrow range of moisture content.

Most of the acreage has been cultivated. Some of the acreage is pasture and some is cropland. The potential is low for cultivated crops because of the severe erosion hazard. It is high for pasture and woodland and is medium for wildlife and many recreational purposes. The potential is low for most engineering uses as a result of the moderately slow permeability.

This soil is limited for use as cropland. Erosion is a hazard if cultivated crops are grown. The cropping system should include grasses and legumes and only an occasional cultivated crop. Minimum tillage, cover crops, grassed waterways, and crop residue or manure help to control erosion and improve soil tilth. A good plant cover is needed. The soil is susceptible to erosion if plowed in fall.

The use of this soil for pasture is effective in controlling further erosion. The hazard of erosion is severe if the soil is plowed or if the pasture is overgrazed. During seeding, cover crops or companion crops and trash mulching or no-till seeding help to control excessive soil loss. Proper stocking, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees that can be established in sites where the surface layer is alkaline and severely eroded. All the native hardwoods have been removed. Erosion must be controlled and competing vegetation controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Erosion control, site preparation, prescribed spraying, and cutting or girdling are needed.

This soil is generally not suitable for building site development and sanitary facilities as a result of the moderately slow permeability and the slope. It is well suited to sanitary landfills but is poorly suited to septic tank absorption fields. Local roads can be improved if suitable base material is used. Establishing a lawn is difficult. An application of a good topsoil is needed before seeding. The soil is highly erodible if left bare.

The capability subclass is IVe.

MoB—Milton silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil occupies knolls and side slopes at the heads of drainageways and in depressions. It is on terraces where relief is affected by the underlying bedrock. Most areas are 2 to 25 acres. The slopes are commonly 60 to 100 feet long. On about 30 percent of the acreage the soil is eroded. The plow layer in these eroded areas is a mixture of the original surface layer and material from the upper part of the subsoil. There are a few severely eroded spots where the plow layer is mostly subsoil material.

In a typical profile the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 16 inches thick. It is mostly brown and dark yellowish brown, firm silt loam, clay loam, and clay. A thin layer at a depth of 25 to 26 inches is light yellowish brown sandy loam. Limestone bedrock is at a depth of about 26 inches.

Included with this soil in mapping are small areas where the soil is less than 20 inches deep over limestone bedrock. Also included are small areas of very poorly drained soils in drainageways and areas where slopes are more than 6 percent. These included areas make up about 10 percent of the unit.

This Milton soil has a moderately deep root zone over limestone bedrock and a medium capacity for the storage and release of plant nutrients. Permeability is moderate or moderately slow. Available water capacity is low. Surface runoff is medium. The surface layer is moderate in organic matter content. Unless limed, it is acid. In unprotected areas, it tends to crust after rains. Depth to the underlying fractured limestone bedrock is 20 to 40 inches. Water moves rapidly through the bedrock.

Most of the acreage is cropland and pasture. A few areas are wooded. The potential is high for crops, pasture, and trees and also wildlife and recreation. The soil has low potential for many engineering uses because it is only moderately deep over limestone.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. The erosion hazard is moderate. Under high level management, row crops can be grown intensively. If management is less than high level, the cropping sequence should include small grain or other close-growing crops and sod crops to help maintain soil tilth and control erosion.

The use of this soil for pasture or for hay is effective in controlling erosion. Overgrazing or grazing when this soil is soft and wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, deferred grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. It still supports a few small areas of hardwood. On this soil competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Site preparation, spraying, and cutting or girdling are needed. Plant competition is the only limitation in growing or harvesting trees.

This soil is generally not suitable for most building site development and sanitary facilities because of the limited depth to bedrock and the moderately slow permeability. It is suited to area sanitary landfills. Local roads can be improved if a suitable base material is used. Houses without basements are better suited to this soil than those with basements.

The capability subclass is IIe.

Mt—Montgomery silty clay loam. This soil is level to nearly level and is very poorly drained. It occupies depressional areas on slack water terraces that formerly were glacial lakes. A few small areas are in depressional uplands. Most areas are about 2 to 45 acres. This soil commonly is at a slightly higher elevation than the nearby muck soils and at a slightly lower elevation than the surrounding Pewamo or Brookston soils. Water often collects or ponds on this soil during wet periods, especially in areas near the larger streams. The slope is 0 to 2 percent.

In a typical profile the surface layer is black or very dark gray silty clay loam about 13 inches thick. The subsoil is about 23 inches thick. It is mostly mottled, dark gray and grayish brown, firm silty clay. The substratum to a depth of about 66 inches is mottled, grayish brown, firm silty clay loam. In some areas the surface layer is silty clay.

Included with this soil in mapping are small areas of Algiers, Wallkill, Brookston, and Pewamo soils. These included areas make up about 15 percent of the unit.

If drained, this Montgomery soil has a deep root zone. It has a high capacity for the storage and release of plant nutrients. Permeability is slow or very slow. Available water capacity is high. Unless the soil is artificially drained, the water table is high for long periods in winter and spring. Surface runoff is slow, and water often collects or ponds after rains. The surface layer is high in organic matter content. It is neutral or mildly alkaline. It compacts readily and becomes cloddy if tilled when wet.

Most of the acreage is cropland and pasture. A few undrained areas are used as wildlife habitat. The potential is high for crops and pasture. It is medium for woodland and wildlife. It is low for most engineering uses and for recreation as a result of the seasonal wetness and the slow to very slow permeability.

If artificially drained, this soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If well managed, row crops can be grown year after year. Most areas in cropland have been drained. Surface runoff is slow and there is little or no hazard of erosion. Seasonal wetness is the main limitation for cropland. Subsurface drainage and open ditches are needed. Diversion terraces and open ditches are sometimes needed to intercept and divert excess runoff from adjacent higher areas. The soil compacts readily and becomes cloddy if tilled when wet. Careful management is needed to maintain good tilth.

Overgrazing and grazing when this soil is soft and wet causes the silty clay loam surface layer to compact and results in poor tilth. Proper stocking, pasture rotation, deferred grazing, and restricted grazing during wet periods help to keep the soil and pasture in good condition.

This soil is suited to trees that can tolerate seasonal wetness. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Good site preparation, prescribed spraying, and cutting or girdling are needed. Wetness limits planting and harvesting equipment in winter and spring.

This soil is generally not suitable for most building site development and sanitary facilities as a result of seasonal wetness, slow permeability, and high shrink-swell potential. It is well suited to sewage lagoons.

The capability subclass is IIIw.

Mw—Montgomery silty clay loam, gravelly substratum. This level to nearly level, very poorly drained soil is in slightly depressed flats in stream terraces. It is subject to frequent flooding. Areas are narrow and long and are about 5 to 15 acres. The slope is 0 to 2 percent.

In a typical profile the surface layer is very dark gray silty clay loam about 12 inches thick. The subsoil is about 24 inches thick. It is mostly mottled, gray, firm silty clay, heavy clay loam, and gravelly clay loam. The substratum to a depth of about 60 inches is grayish brown, friable gravelly loam and gravelly sandy loam.

Included in mapping and making up about 15 percent of the unit are small areas of Patton and Algiers soils.

This Montgomery soil has a deep root zone when the water table is low. It has a high capacity for the storage and release of plant nutrients. Permeability is slow in the upper part of the subsoil and is moderately rapid or rapid in the underlying material. Available water capacity is high. The surface layer is high in organic matter content and is neutral or mildly alkaline. The soil can be tilled within only a narrow range of moisture content. The water table is high for long periods in winter and spring unless the soil is artificially drained. Surface runoff is slow, and water often collects or ponds after rains.

Most of the acreage is cultivated and pastured. A few areas are wooded. The potential is high for cultivated crops and small grain and for grasses and legumes for hay and pasture. It is high for trees that are tolerant of wetness and for wetland wildlife habitat. It is low for recreation and for most engineering uses as a result of the seasonal wetness and the restricted permeability.

If artificially drained, this soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Most areas in cropland have been drained. Surface runoff is slow. There is little or no hazard of erosion. Seasonal wetness is the main limitation for cropland. Subsurface drainage and open ditches are needed. If well managed, row crops can be grown year after year. Keeping the soil in good tilth is essential because it compacts and becomes cloddy if tilled when wet.

Overgrazing or grazing when this soil is soft and wet causes the silty clay loam surface layer to compact easily and results in poor tilth. Proper stocking, pasture rotation, deferred grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees that are tolerant of wetness. It still supports a few scattered small areas of hardwoods. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Good site preparation, spraying, and cutting or girdling are needed. Wetness limits planting and harvesting equipment in winter and spring.

This soil is generally not suitable for many building site developments and sanitary facilities as a result of seasonal wetness, slow permeability, and high shrink-swell potential. It is well suited, however, to sewage lagoons.

The capability subclass is IIw.

MxE—Morley silt loam, 18 to 25 percent slopes. This soil is well drained. It occupies steep side slopes of the uplands. It is near and is parallel to the major streams. Most areas are 5 to 60 acres. Slopes are 80 to 150 feet long and are mostly smooth and uniform. In some areas the upper part of the slope is slightly convex, and the toeslopes are slightly concave. Areas are dissected by many small drainageways.

In a typical profile in a wooded area, the surface layer is very dark gray, friable silt loam about 4 inches thick. The subsurface is brown, friable silt loam about 6 inches thick. The subsoil is about 16 inches thick. It is mostly dark yellowish brown, firm, heavy silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, firm silty clay loam till.

Included with this soil in mapping are small areas where slopes are more than 25 percent and spots, mainly on steeper slopes, where the soils are less than 15 inches deep over till. These included areas make up about 10 percent of the unit.

This Morley soil has a moderately deep root zone and a medium capacity for the storage and release of plant nutrients. Permeability is slow. Available water capacity is moderate. Surface runoff is rapid. Unless a permanent plant cover is maintained, the soil is subject to severe erosion. The organic matter content is high in the upper 4 inches of the surface layer but is low in the lower part. Reaction is slightly acid or neutral.

This soil is mainly wooded. A few areas are in pasture or wildlife plantings. The potential is low for cropland because of the steep slope. It is high for trees and pasture and is medium for wildlife plantings. It is low for recreation and for engineering uses as a result of the steep slope and the slow permeability.

This soil is too steep for cropland but is suited to grasses and legumes for permanent pasture and meadows. Unless an adequate plant cover is maintained, erosion is serious. The trash mulch method of tillage helps to control erosion when seeding meadows or improving pastures. Proper stocking, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. It still supports some hardwoods. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Good site preparation, prescribed spraying, and cutting or girdling are needed. If practical, logging roads and skid trails should be constructed across the slope to control erosion.

This soil is generally not suitable for building site development and sanitary facilities because of the steep slope and the slow permeability. The hazard of erosion is high if vegetation is removed. Trails and paths in recreational areas should be laid out across the slope where possible and protected from erosion.

The capability subclass is VIe.

MxF—Morley silt loam, 25 to 50 percent slopes. This well drained soil is on very steep side slopes of the uplands. It is near and is parallel to the major streams. Most areas are 5 to 45 acres. Slopes are smooth and uniform and 80 to 160 feet long. In some areas the upper slopes are slightly convex, and the toeslopes are slightly concave. Areas are dissected by many small drainageways.

In a typical profile in a wooded area, the surface layer is very dark grayish brown, friable silt loam about 4 inches thick. The subsurface layer is brown, friable silt loam about 5 inches thick. The subsoil is about 18 inches thick. It is mostly dark yellowish brown and dark brown, firm silty clay loam. The substratum to a depth of about 60 inches is mottled, dark yellowish brown, firm silty clay loam till.

Included with this soil in mapping are small areas where slopes are more than 50 percent and spots where the soils are less than 15 inches deep over till. The shallow soils are mainly in the steeper areas and in areas where streams have undercut the side slopes. These included areas make up about 10 percent of the unit.

This Morley soil has a moderately deep root zone and a medium capacity for the storage and release of plant nutrients. Permeability is slow. Available water capacity is moderate. Surface runoff is rapid. Unless a permanent plant cover is maintained, the soil is subject to very severe erosion. The organic matter content is high in the upper 4 inches of the surface layer but is low in the lower part. Reaction is slightly acid or neutral.

This soil is mainly wooded. A few areas are in pasture or wildlife plantings. The potential is low for crops because of the steep slope. It is high for trees and is medium for pasture and wildlife. It is low for most engineering uses because of the steep slope and the slow permeability.

This soil is too steep for crops but is suited to adapted grasses and legumes for permanent pasture and meadows. Unless an adequate plant cover is maintained, erosion is a hazard. The trash mulch method of tillage helps to control erosion when seeding meadows or improving pastures. Proper stocking, pasture rotation, timely deferment of grazing and restricted grazing during wet periods help to keep the pasture and soil in good condition. Areas that are too steep for farm machinery are best suited to trees.

This soil is well suited to trees. It still supports a few areas of hardwoods. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Good site preparation, prescribed spraying, and cutting or girdling are needed. If practical, logging roads and skid trails should be constructed on the contour to control erosion.

This soil is generally not suitable for building site development and sanitary facilities as a result of the very steep slopes and the slow permeability. The hazard of erosion is very high if vegetation is removed. Trails and paths in recreational areas should be laid out across the slope if possible and protected from erosion.

The capability subclass is VIIe.

OcA—Ockley silt loam, 0 to 3 percent slopes. This level to nearly level, well drained soil is on stream terraces bordering the major streams in the county. Most terraces are high enough above the adjacent flood plain that they are seldom flooded. A few areas in the low positions of some terraces are occasionally flooded. Most areas are 2 to 20 acres.

In a typical profile the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 43 inches thick. It is mostly dark yellowish brown and dark brown, firm silty clay loam, clay loam, and gravelly clay loam. The substratum to a depth of about 60 inches is yellowish brown, loose very gravelly loamy coarse sand. Some areas are moderately well drained and have mottles in the subsoil.

Included with this soil in mapping are small areas on short breaks at the heads of drainageways where slopes are more than 3 percent and spots of Genesee soils. Also included are small areas of dark colored soils near the base of the sloping uplands. These included areas make up about 10 percent of the unit.

This Ockley soil has a deep root zone and a high capacity for the storage and release of plant nutrients. Permeability is moderate in the subsoil and very rapid in the underlying material. Available water capacity is high. The surface layer is moderate in organic matter content. Unless limed, it is acid. Internal drainage is good. Surface runoff is slow and there is little or no hazard of erosion. The soil has good tilth throughout a wide range of moisture content. It has few limitations that restrict farm and nonfarm uses.

This soil is used for cropland and pasture. A few areas have been excavated for sand and gravel. The potential is high for cropland, pasture, and trees. It is also high for wildlife, recreation, and most engineering uses.

This soil is well suited to all field crops commonly grown and to nursery and truck crops. If well managed, this soil can be used year after year for cultivated crops. There is little or no erosion hazard. In areas that are farmed intensively the major concerns are maintaining soil tilth and high fertility. Crop residue helps to maintain organic matter content and provides for good tilth. The soil is well suited to irrigation. A good supply of underground water generally is available.

This soil is well suited to pasture but rarely is used for permanent pasture because it is also well suited to row crops. Overgrazing or grazing when the soil is soft and wet should be avoided because it causes compaction and results in poor tilth. Proper stocking, pasture rotation, and deferred grazing during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Good site preparation, prescribed spraying, and cutting or girdling are needed. There are no hazards or limitations in planting or harvesting trees.

This soil has few limitations for building site development. It is limited for most sanitary facilities because of seepage and the possible contamination of ground water. It is a good source of sand and gravel. It is also a fairly good source of topsoil.

The capability class is I.

OdA—Odell silt loam, 0 to 2 percent slopes. This level to nearly level soil is somewhat poorly drained. It occupies irregularly shaped, scattered areas of the uplands that are about 3 to 15 acres. The soil is at a slightly higher elevation than the nearby depressional Brookston soils and at a slightly lower elevation than the nearby light colored Crosby and Celina soils.

In a typical profile the surface layer is very dark grayish brown, friable silt loam about 17 inches thick. The subsoil is about 20 inches thick. The upper part of the subsoil is olive brown, firm clay loam, and the lower part is mottled, light olive brown, firm clay loam. The substratum to a depth of about 60 inches is mottled, dark yellowish brown, friable loam till.

Included with this soil in mapping are small areas of depressional Brookston soils and small areas of light colored Crosby soils in a slightly higher position. Also included are small areas of better drained Celina soils. These included areas make up about 15 percent of the unit.

This Odell soil has a moderately deep root zone and a high capacity for the storage and release of plant nutrients. Permeability is moderately slow. Available water capacity is high. The surface layer is high in organic matter content. Unless limed, it is acid. Surface runoff is slow. Unless this soil is artificially drained, the water table is high in winter and spring.

This soil and the nearby larger areas of Brookston and Crosby soils mostly are in cultivated crops and small grain. The potential is high for crops, pasture, and trees. It is medium or high for wildlife and recreation. It is medium or low for many engineering uses because of seasonal wetness.

If artificially drained, this soil is suited to corn, soybeans, small grain, and hay. The tilth of the plow layer is generally good. Seasonal wetness is the principal limitation for cropland. Subsurface drainage is common and is effective in removing excess water.

If the pasture is overgrazed or is grazed when wet, the silt loam surface layer compacts and results in poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees that can tolerate some seasonal wetness. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Good site preparation, prescribed spraying, and cutting or girdling are needed. Wetness limits planting and harvesting equipment in winter and spring.

This soil is generally not suitable for many building site developments and sanitary facilities because of the seasonal wetness and the slowly permeable substratum. The water table can be lowered by subsurface drains in some areas. Onsite investigation is needed to determine whether drainage outlets are available. Local roads can be improved by artificial drainage and the use of suitable base material. Footer drains and exterior wall coatings help to prevent wet basements. This soil is suited to sewage lagoons.

The capability subclass is IIw.

OdB—Odell silt loam, 2 to 6 percent slopes. This gently sloping soil is somewhat poorly drained. It occupies irregularly shaped areas near the base of the more sloping upland soils. It is at a slightly higher elevation than the nearby Brookston soils which are in depressions. Slopes are mostly convex and are 80 to 120 feet long. Most areas are about 2 to 12 acres.

In a typical profile the surface layer is very dark grayish brown, friable silt loam about 16 inches thick. The subsoil is about 19 inches thick. It is mottled, light olive brown, firm clay loam. The substratum to a depth of about 60 inches is mottled, yellowish brown loam till.

Included with this soil in mapping are small areas of wetter Brookston soils in depressions and light colored Crosby and Celina soils in slightly higher positions. There are also small areas of well drained soils. These included areas make up about 15 percent of the unit.

This Odell soil has a moderately deep root zone and a high capacity for the storage and release of plant nutrients. Permeability is moderately slow. Available water capacity is high. Surface runoff is medium because of the gentle slope. The surface layer is high in organic matter content. Unless limed, it is acid. Unless the soil is artificially drained, the water table is high in winter and spring.

This soil is used mostly for crops and pasture. The potential is high for crops, pasture, and trees. It is medium for wildlife and recreation and is low or medium for most engineering uses as a result of the seasonal wetness.

This soil is suited to corn, soybeans, and small grains and to grasses and legumes for hay or pasture if artificially drained. Surface runoff is medium. The tilth of the plow layer is generally good. Seasonal wetness and a moderate erosion hazard are the main limitations for cropland. Subsurface drainage is effective in removing excess water. If well managed, this soil can be cultivated frequently. Minimum tillage, winter cover crops, and grassed waterways help to prevent excessive soil loss and to maintain good tilth.

The use of this soil for pasture or hay is effective in controlling erosion. Overgrazing or grazing when the soil is soft and wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees that can tolerate some seasonal wetness. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Good site preparation, prescribed spraying, and cutting or girdling are needed. Wetness limits planting and harvesting equipment in winter and spring.

This soil is generally not suitable for building site development and sanitary facilities because of the seasonal wetness and the slowly permeable substratum. The water table can be lowered by subsurface drainage. Onsite investigation is needed to determine whether drainage outlets are available. Local roads can be improved by using artificial drainage and suitable base material. Footer drains and exterior wall coatings help to prevent wet basements.

The capability subclass is IIe.

Pa—Patton silty clay loam. This level and nearly level, very poorly drained soil occupies depressional areas that formerly were small glacial lakes. Most areas range from 2 to 100 acres. The slope is 0 to 2 percent.

In a typical profile the surface layer is very dark gray, friable silty clay loam about 10 inches thick. The subsoil is about 27 inches thick. It is mostly mottled, gray, firm silty clay loam. The substratum to a depth of about 60 inches is mottled, gray, friable silt loam and silty clay loam. In most areas the soil is 5 to 6 feet deep over loam till.

Included with this soil in mapping are small areas of light colored Algiers and Shoals soils and spots where soils have free carbonates at the surface. These included areas make up about 10 percent of the unit.

In drained areas, this Patton soil has a deep root zone. It has a high capacity for the storage and release of plant nutrients. Permeability is moderate. Available water capacity is high. Unless artificially drained, the water table is high for long periods in winter and spring. Surface runoff is slow. Water often collects or ponds after rains (fig. 4). The surface layer is high in organic matter content and is neutral or slightly alkaline in reaction. This soil can be tilled within only a narrow range of moisture content.

Most of the acreage is cultivated. Few areas are in pasture. The potential is high for cultivated crops, small grain, and pasture. It is medium for woodland and for wildlife habitat and is low for most recreational and engineering uses because of the seasonal wetness.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture if artifically drained. Most areas in cropland have been drained. Surface runoff is slow and there is little or no hazard of erosion. If the soil is farmed seasonal wetness is the principal limitation. Subsurface drainage and open ditches are needed. If well managed, this soil can be cultivated year after year. Careful management is needed to maintain good tilth because this soil becomes compact and cloddy if tilled when wet.

Overgrazing and grazing when this soil is soft and wet causes the silty clay loam surface layer to compact and results in poor tilth. Proper stocking, pasture rotation, and deferred grazing during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees that are tolerant of wetness. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Site preparation, spraying, and cutting or girdling are needed. Wetness limits planting and harvesting equipment in winter and spring.

This soil is generally not suitable for building site development and sanitary facilities because of the seasonal wetness. In some areas, the water table can be lowered by subsurface drainage. Onsite investigation is needed to determine whether drainage outlets are available. Local roads can be improved by artificial drainage and suitable base material.

The capability subclass is IIw.

Pd—Pewamo silt loam. This level and nearly level, very poorly drained soil occupies depressions and drainageways of the uplands. It is mantled with recent alluvial deposits 12 to 20 inches thick. It is similar to Pewamo silty clay loam, but the surface layer contains less clay and is slightly lighter colored. Most areas are 2 to 10 acres. The slope is 0 to 2 percent.

In a typical profile the surface layer is very dark gray, friable to firm silty clay loam about 10 inches thick. The subsoil is about 34 inches thick. It is mostly gray and dark gray, firm silty clay loam, clay loam, and silty clay. The substratum to a depth of about 60 inches is mottled, brown, firm clay loam till. In some areas, the surface layer is silt loam 6 to 8 inches thick.

Included with this soil in mapping are small areas of lighter colored Blount and Algiers soils. These included areas make up about 15 percent of the unit.

In drained areas, this Pewamo soil has a deep root zone and a high capacity for the storage and release of plant nutrients. Permeability is moderately slow. Available water capacity is high. Surface runoff is slow, and water often collects or ponds after rains. The surface layer is moderate or high in organic matter content and is slightly acid or neutral in reaction. The surface layer tends to crack and crust when dry.

Most of the acreage is cropland and pasture. The potential is high for cultivated crops, small grain, and pasture and for woodland and wildlife habitat. It is low for recreational and most engineering uses as a result of the seasonal wetness.

If artificially drained, this soil is well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. Seasonal wetness is the main limitation in farming. Subsurface drainage and open ditches are needed. Diversion terraces are needed to intercept and divert excess runoff from adjacent high areas. If well managed, crops can be grown year after year. Compaction is a concern if this soil is tilled when wet. Maintaining good tilth is essential.

Overgrazing or grazing when this soil is soft and wet readily compacts the silt loam surface layer and results in poor tilth. Proper stocking, pasture rotation, deferred grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees that can tolerate seasonal wetness. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Good site preparation, prescribed spraying, and cutting and girdling are needed. Wetness limits planting and harvesting equipment in winter and spring.

This soil is generally not suitable for building site development and sanitary facilities because of the seasonal wetness and the moderately slow permeability. In some areas, the water table can be lowered by subsurface drainage. Onsite investigation is needed to determine whether drainage outlets are available. Local roads can be improved by using artificial drainage and suitable base material.

The capability subclass is IIw.

Pe—Pewamo silty clay loam. This soil is level and nearly level and is very poorly drained. It is subject to frequent flooding. It occupies broad depressions in the till plains of the uplands and is surrounded by light colored Blount soils. In some areas, mainly in the moraines, it occupies small narrow drainageways and is surrounded by light colored sloping Blount and Glynwood soils. Most areas are irregularly shaped and range from 4 to 100 acres or more. The slope is 0 to 2 percent.

In a typical profile the surface layer is very dark gray silty clay loam about 10 inches thick. The subsoil is about 34 inches thick. It is mostly mottled, dark gray and dark yellowish brown, firm silty clay, clay loam, and silty clay loam. The substratum to a depth of about 60 inches is mottled, brown, firm clay loam till. In some areas, the dark colored surface layer is about 6 to 8 inches thick.

Included with this soil in mapping are small areas of light colored Blount and Glynwood soils at the heads of drainageways and small areas of Montgomery soils in the extremely low depressions. These included areas make up about 15 percent of the unit.

In drained areas, this Pewamo soil has a deep root zone. It has a high capacity for the storage and release of plant nutrients. Permeability is moderately slow. Available water capacity is high. Unless artificially drained, the water table is high for long periods in winter and spring. Surface runoff is slow, and water often ponds or collects after rains. The surface layer is high in organic matter content and is slightly acid or neutral in reaction. The surface layer can be tilled within only a narrow range of moisture content.

Most of the acreage is used for cultivated crops and small grain. A few areas are wooded or pastured. The potential is high for cultivated crops, small grain, and pasture and for woodland and wildlife habitat. It is low for recreational and most engineering uses as a result of the seasonal wetness and moderately slow permeability.

If artificially drained, this soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Most areas in cropland have been drained. Seasonal wetness is the principal limitation for cropland. Subsurface drainage and open ditches are needed. Diversion terraces are needed to intercept and divert excess runoff from adjacent higher areas. If well managed, row crops can be grown year after year. Keeping the soil in good tilth is important. It becomes compact and cloddy if tilled when wet or if heavy machinery is used.

Overgrazing or grazing when this soil is soft and wet are the principal concerns in pasture management. The silty clay loam surface compacts easily and results in poor tilth if grazed when wet. Proper stocking, pasture rotation, deferred grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees that can tolerate seasonal wetness. It still supports small scattered areas of hardwoods. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Good site preparation, prescribed spraying, and cutting or girdling are needed. Wetness limits planting and harvesting equipment in winter and spring.

This soil is generally not suitable for building site development and sanitary facilities as a result of the seasonal wetness and moderately slow permeability. In some areas, the water table can be lowered by subsurface drainage. Onsite investigation is needed to determine whether drainage outlets are available. Local roads can be improved by using artificial drainage and suitable base material.

The capability subclass is IIw.

Pg—Pits, gravel. Pits are open excavations from which gravel and sand have been removed. A few are excavations from which limestone has been removed. Gravel pits typically occupy outwash terraces along the major streams where they are associated with Casco, Eldean, Ockley and Warsaw soils. A few are on glacial kames and eskers of the uplands.

The pits vary considerably in size and depth. Most are about 2 to 40 acres. Pits smaller than 2 acres are identified by spot symbols on the soil map. The small pits are normally 6 to 15 feet deep, whereas the larger pits are 20 to 30 feet or more. Many of the larger pits contain water and some of these are used for fishing and other recreational purposes. The spoil banks at some abandoned sites are quickly overgrown with weeds and trees.

The stripped soil material in the spoil banks from these sites varies in thickness and composition within short distances. It is gravelly and sandy, has poor physical properties, commonly is droughty, and is poorly suited to the growth of plants. Most of the material is unstable. It is subject to erosion in sloping areas and is a potential source of siltation. Establishing a plant cover on abandoned sites reduces the hazards of erosion and siltation. Only grasses and trees that tolerate droughtiness and somewhat unfavorable soil properties should be selected for seeding and plantings.

Ponded areas generally can be developed for wildlife and recreation.

The capability subclass is not assigned.

Sh—Shoals silt loam, occasionally flooded. This level and nearly level, somewhat poorly drained soil is on flood plains. It occupies the entire flood plain along many of the smaller streams, but commonly occupies low areas away from the larger stream channels, adjacent to the uplands. Areas are large and narrow and range from 3 to 60 acres. The slope is 0 to 2 percent.

In a typical profile the surface layer is dark grayish brown friable silt loam about 8 inches thick. The substratum to a depth of about 45 inches is mostly mottled, grayish brown and brown, friable silt loam and loam. At a depth of about 45 to 60 inches, it is pale brown, loose gravelly loamy coarse sand. Stratified loose sand and gravel commonly occurs at a depth of 40 to 50 inches or more. In some areas the surface layer is loam.

Included with this soil in mapping are small areas of better drained Eel and Genesee soils next to the stream channel and spots of dark colored Medway soils at the base of the sloping uplands. Also included are a few areas where the soil is only 30 to 40 inches deep over till and has a shallower root zone than is typical. These included areas make up about 15 percent of the unit.

This Shoals soil has a deep root zone when the water table is low. It has a high capacity for the storage and release of plant nutrients. The surface layer is moderate in organic matter content and is mildly alkaline or calcareous. Permeability is moderate. Available water capacity is high. Surface runoff is slow. The water table is high in winter and spring, and flooding is a hazard (fig. 5). In some areas the soil receives additional water through seepage from adjacent uplands. In some areas it is dissected by braided flood channels.

Most drained areas of this soil are used for cropland. Undrained areas are wooded or used for pasture. The potential is high for cropland, pasture, and woodland. It is medium for wildlife and for many recreational uses. It is low for most engineering uses because of the flood hazard.

This soil is suitable for corn and soybeans under high level management. Flooding is common late in winter and early in spring but is less frequent during the growing season. It often damages winter grain crops in unprotected fields. Seasonal wetness and flooding are the main hazards for cropland. The seasonal high water table can be lowered by subsurface drainage, which is often supplemented by surface drainage. A few areas are difficult to drain because drainage outlets are inadequate. Row crops can be grown year after year if this soil is drained and protected from flooding. Keeping the soil in good tilth is a problem because it is commonly worked when wet.

If pasture is overgrazed or is grazed when wet, the silt loam surface layer compacts easily and is in poor tilth. Proper stocking, pasture rotation, deferred grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees that can tolerate sites where the water table is seasonally high. There are numerous, small scattered areas of native hardwoods on this soil. Tree seeds, cuttings, and seedlings do well if competing vegetation is controlled or removed. Site preparation, prescribed spraying, and cutting or girdling are needed. Wetness limits the use of planting and harvesting equipment in winter and spring.

This soil is generally not suitable for building site development and sanitary facilities because of the flood hazard and seasonal wetness. Some areas can be used for hiking and golfing. The soil is a good source of topsoil.

The capability subclass is IIw.

St—Stonelick sandy loam, occasionally flooded. This level and nearly level, well drained soil is on flood plains. It occupies long, narrow areas of about 4 to 90 acres. The topography is undulating in some areas because of the old braided streams and oxbows. The slope is 0 to 2 percent.

In a typical profile the surface layer is very dark grayish brown, friable sandy loam about 8 inches thick. At a depth of about 8 to 66 inches, it is brown, loose, stratified gravelly loamy coarse sand, sandy loam, and gravelly and very gravelly coarse sand.

Included with this soil in mapping are small areas of Genesee soils and spots where gravel and sand are exposed. These included areas make up about 10 percent of the unit.

This Stonelick soil has a shallow root zone and a low capacity for the storage and release of plant nutrients. Permeability is moderately rapid. Available water capacity is low. Surface runoff is slow. The surface layer is low in organic matter content and is alkaline in reaction. In most areas free carbonates are at the surface. The soil is subject to droughtiness in summer and to flooding in winter and spring. Flooding during the growing season is not common.

Most of the acreage is used for pasture and recreation. The potential is medium for cropland and pasture and is high for woodland. It is low for many engineering uses because of the flood hazard. It is medium or high for wildlife and recreation.

This soil is suited to cultivated crops. Fall-planted small grain is more likely to be damaged by flooding in winter and spring than row crops. Early planting of early maturing crops is needed to avoid damage from drought.

This soil is suited to pasture. Grasses and legumes do not grow well during dry periods. Crop residue helps to retain moisture. Overgrazing or grazing when the soil is soft and wet should be avoided because it causes compaction and poor tilth. Proper stocking, pasture rotation, and deferred grazing during extreme wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees that are tolerant of dryness. Competing vegetation must be controlled or removed if seeds, cuttings, or seedlings are to survive and grow well. Site preparation, prescribed spraying, and cutting or girdling are needed. There are few hazards or limitations in growing or harvesting trees.

This soil is generally not suitable for building site development and sanitary facilities because of the flood hazard. Some areas can be used for hiking and other recreational uses during the nonflood season. The soil is a good source of material for roadfill.

The capability subclass is IIIs.

Ud—Udorthents. This unit consists of nearly level to moderately sloping, dominantly loamy soils that have been greatly altered by construction activities. Areas include the highway interchanges along Interstate Highway 75, railroad embankments, industrial site developments, and a few areas of borrow pits. Also included is a sanitary landfill. Areas range from 5 to 100 acres. Most occur in the glaciated uplands.

In some places, there has been appreciable removal of the surface layer, subsoil, or substratum, and in other places there have been additions of soil material. Much of the original land surface has been graded. The higher areas have been cut away and filled into depressions so that the soil material is mixed and cannot be classified at the series level. A few areas are covered with bricks, cinders, stones, industrial waste, and trash.

The soil material is typically loam or clay loam that is a mixture of till, subsoil material, and a small amount of surface soil. In many areas, the till is exposed. A few areas along major streams are mixed with gravelly loamy sand.

This unit is not used as cropland. The organic matter content and natural fertility are very low. Many graded areas have only sparse vegetation and are easily eroded. Grasses and legumes can be established by mulching, fertilizing, and seeding. Most areas are also suitable for trees, especially trees that can tolerate alkaline soil.

The capability subclass is not assigned.

Wb—Wallkill silty clay loam. This level to nearly level, very poorly drained soil has a mineral surface layer that is underlain by muck. It is subject to frequent flooding. It occurs as scattered depressional areas in stream terraces and depressional areas within the uplands. It is commonly near the moderately fine textured glacial till soils. Areas are about 2 to 10 acres. The slope is 0 to 2 percent.

In a typical profile the surface layer is dark grayish brown, friable silty clay loam about 14 inches thick. The subsoil is about 8 inches thick. It is mottled, very dark grayish brown, firm silty clay loam. The underlying material to a depth of about 60 inches is black muck.

Included with this soil in mapping and making up about 10 percent of the unit are small areas of Montgomery, Pewamo, and Algiers soils.

This Wallkill soil has a deep root zone when the water table is low. It has a high capacity for the storage and release of plant nutrients. The surface layer is high in organic matter content and is neutral or mildly alkaline in reaction. Permeability is moderate in the mineral part and moderately rapid or rapid in the underlying muck. Available water capacity is high. Surface runoff is slow, and water often collects or ponds after rains. Unless artificially drained, the water table is high for long periods in winter and spring. In most areas, the soil receives additional water as seepage from adjacent uplands.

Areas that are artificially drained are used mostly for cultivated crops. Undrained areas are too wet for crops. The potential is high for cropland and pasture and is medium for woodland and wildlife. It is low for most engineering and recreational uses as a result of the seasonal wetness.

If artificially drained, this soil is suitable for corn, soybeans, and small grain and for grasses and legumes for hay and pasture. Surface runoff is slow, and there is little or no hazard of erosion. Seasonal wetness is the main limitation for cropland. Subsurface drainage and open ditches are needed to lower the water table. Diversion terraces are often needed to intercept runoff from higher sloping areas. Some areas may be difficult to drain because of inadequate drainage outlets.

Overgrazing and grazing when the soil is soft and wet compacts the silty clay loam surface and results in poor tilth. Proper stocking, pasture rotation, deferred grazing, and restricted grazing during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees that are tolerant of wetness. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Good site preparation, spraying, and cutting or girdling are needed. Wetness limits planting or harvesting trees.

This soil is generally not suitable for building site development and sanitary facilities because of seasonal wetness.

The capability subclass is IIIw.

WdA—Warsaw Variant silt loam, 0 to 2 percent slopes. This level to nearly level well drained soil occupies narrow, low bench terraces along the major streams. In most areas this soil is only a few feet above the flood plain and is occasionally flooded. Most areas are about 3 to 10 acres.

In a typical profile the surface layer is very dark grayish brown and dark brown, friable silt loam about 15 inches thick. The subsoil is about 24 inches thick. It is mostly dark yellowish brown and dark brown and has layers of firm silty clay loam, clay loam, clay, and gravelly clay loam. The substratum to a depth of about 60 inches is brown, loose, very gravelly loamy coarse sand.

Included with this soil in mapping are small areas of Eldean soils and areas of slightly concave dark colored soils more than 40 inches deep over sand and gravel. Also included are spots where the soil is less than 24 inches deep over sand and gravel. These included areas make up about 15 percent of the unit.

This Warsaw soil has a moderately deep root zone and a medium capacity for the storage and release of plant nutrients. Available water capacity is moderate. Permeability is moderate or moderately slow in the subsoil and rapid in the underlying material. Surface runoff is slow. The surface layer is high in organic matter content and is slightly acid or neutral. The soil is droughty in summer. Crops are often damaged by lack of moisture during the growing season. Most areas are subject to occasional flooding, mainly in winter and spring. Flooding is not common during the growing season.

Most areas are in pasture and cropland. A few are idle or are excavated for sand and gravel. The potential is high for cropland, pasture, and woodland. It is medium or high for wildlife and many recreational uses. It is low for most engineering uses because of the flood hazard.

This soil is suitable for row crops and small grain and for grasses and legumes for hay and pasture. It is also suited to special crops, such as nursery and truck crops. Droughtiness is the main hazard for crops. Crops can be seeded early because this soil warms up and dries out early in the spring. Surface runoff is slow, and there is little or no hazard of erosion. Tilth is good throughout a wide range of moisture content. Row crops can be grown year after year under high level management. Large amounts of crop residue help to retain soil moisture and maintain good tilth. The soil is well suited to irrigation. Generally, there is a good source of underground water available.

Overgrazing or grazing when this soil is soft and wet causes compaction and poor tilth. Proper stocking, pasture rotation, and deferred grazing during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees that are tolerant of dryness. Competing vegetation must be controlled or removed if seeds, cuttings, and seedlings are to survive and grow well. Good site preparation, prescribed spraying, and cutting or girdling are needed. There are few or no hazards or limitations in growing or harvesting trees.

This soil is generally not suitable for building site development and sanitary facilities because of the flood hazard and the possible contamination of ground water as a result of seepage. The soil is a good source of sand and gravel.

The capability subclass is IIs.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use (*10*) including urbanization, to the limitations and potentials of natural resources and the environment (*13*). Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture and woodland, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock or wetness, which cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

Raymond Naylor, district conservationist, Soil Conservation Service, assisted in preparing this section.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil are discussed; 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 presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

More than 211,000 acres in the survey area was used for crops and pasture in 1967, according to the Conservation Needs Inventory(*8*). Of this total, 106,000 acres was used for row crops, mainly soybeans and corn; 36,000 acres for close-grown crops, mainly wheat and oats; 34,000 acres for rotation hay and pasture; and 15,800 for permanent pasture. The rest was idle cropland.

The potential is good for increased production of food in Shelby County. About 21,000 acres of potentially good cropland is currently woodland, and about 15,000 acres is pasture. Food production could also be increased considerably by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology.

The acreage in crops and pasture is gradually decreasing as more and more land is used for urban development. In 1967 an estimated 14,000 acres of the county was urban and built-up land. The use of this soil survey can help in making land use decisions that will influence the future role of farming in the county. See "General soil map for broad land use planning."

Soil fertility. About one-fourth of the soils in the county have a dark colored surface layer. These soils are nearly neutral in reaction and contain moderate amounts of phosphorus and large amounts of potassium. Many of the light colored upland soils are naturally acid and are generally below the optimum plant nutrient level. The soils on the flood plains are neutral or mildly alkaline and are naturally higher in plant nutrients than most upland soils. The organic or muck soils are usually deficient in boron and other trace elements. The addition of lime and fertilizer to all soils should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kind and amount of fertilizer and lime to be applied. Also see the current "Ohio Agronomy Guide."

Crop residue. Many of the soils in the county, particularly the light colored ones, are not naturally high in organic matter content. To offset this deficiency, all crop residue should be incorporated into the soil to maintain or increase the content of organic matter. Regular additions of manure and other oganic material can also help to maintain the organic matter content. Soybeans and similar crops supply only a small amount of residue. If these crops are grown, the cropping system should include cover crops or sod crops. Maintaining the organic matter content of the soil helps to insure good soil structure and tilth. The organic matter content also affects the amount of nitrogen in the soil.

Drainage. Soil drainage is the major management need on about three-fourths of the acreage used for crops and pasture. Crops grow well on very poorly drained and somewhat poorly drained soils if excess water is removed. Wetness results from a seasonal high water table and periodic flooding. Some of the clayey, very poorly drained soils are subject to ponding.

The efficiency of artificial drainage varies with different kinds of soil. Most of the seasonally wet soils on uplands have moderate to slow permeability. Examples are the Blount, Brookston, Crosby, and Pewamo soils. Montgomery soils, formed in lacustrine material, have slow or very slow permeability. Subsurface drainage, open ditches (fig. 6), or land smoothing, or a combination of these are most commonly used in draining these soils. Subsurface drains have to be more closely spaced in soils that have slower permeability than in the more permeable soils. Obtaining adequate outlets for subsurface drainage systems is commonly difficult in most areas of Montgomery and Patton soils and in most areas of organic soils.

Unless artifically drained, the very poorly drained and somewhat poorly drained soils are so wet that crops are often damaged. Soils that are not adequately drained dry out and warm up slowly in spring, thus delaying tillage and planting.

Little or no artificial drainage is needed on the moderately well drained and well drained soils. Some seepage spots may required random tile drains. Information on drainage design for each kind of soil is contained in the Technical Guide, which is available in the local office of the Soil Conservation Service.

Erosion. Soil erosion is the major hazard on about one-sixth of the cropland and pastureland in Shelby County. Erosion is a hazard if the slope is more than 2 percent. On the Blount and Crosby soils of 2 to 6 percent slopes, erosion is a hazard. In addition, wetness is a limitation.

Loss of part of the surface layer through erosion reduces productivity and the available water capacity. The heavier textured subsoil material is mixed with the surface layer in plowing. This heavier surface layer often causes serious tilth limitations. Many of the soils in Shelby County have a surface layer that is fairly high in silt content and low in organic matter content and have a subsoil layer that is clayey. Such soils are highly susceptible to erosion. In many sloping fields, preparing a good seedbed and tilling are more difficult on these clayey spots because the original friable surface layer has been eroded away. Such spots are common in areas of the Blount and eroded Glynwood soils.

Soil erosion also results in sediment entering streams. Control of erosion minimizes the pollution of streams by sediment and improves quality of the water for municipal and recreational use and for fish and wildlife.

Erosion control should provide a protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps a plant cover on the soil for extended periods can hold soil loss to amounts that will not reduce the productive capacity of the soil. On livestock farms requiring pasture and hay, the legume and grass forage crops in the cropping system reduce erosion on sloping land. They also provide nitrogen and improve tilth for the following crop.

Erosion control measures commonly used in the county are contour tillage, minimum tillage or no tillage and waterways, diversion terraces, crop residue, and close-growing crops.

For information on the design of erosion control measures on each kind of soil, see the Technical Guide available in the local office of the Soil Conservation Service.

Tilth. Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils in good tilth are friable and porous.

Most of the soils used for crops and pasture in the county have a light colored silt loam surface layer that is only moderate in organic matter content. The structure of such soils is generally weak, and intense rainfall causes the formation of a crust on the surface. The crust is hard when dry, and is impervious to water. Once the crust forms, it reduces infiltration and increases runoff. Regular additions of crop residue, manure, and other organic material can improve soil structure and reduce crusting.

Fall plowing is generally not a good practice on the light colored soils that have a silt loam surface layer because of the crust that forms in winter and spring. Many of these soils are nearly as dense and hard at planting time after fall plowing as they were before they were plowed. Also, much of the cropland consists of sloping soils that are subject to damaging erosion if they are plowed in fall.

The dark colored Brookston, Montgomery, Patton, and Pewamo soils are clayey. Tilth is a limitation because these soils often stay wet until late in spring. If wet when plowed they tend to be very cloddy when dry and are difficult to work into a good seedbed. Fall plowing generally results in good tilth in spring.

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. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 5.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; 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 residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

The estimated yields reflect the productive capacity of the soils 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 included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment.

The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit (*14*). The capability class and subclass are defined in the following paragraphs. A survey area may not have soils of all classes.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms 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 too cold or too 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, though 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 indicated in table 6. All soils in the survey area except those named at a level higher than the series are included. Some of the soils that are well suited to crops and pasture may be in low-intensity use, for example, soils in capability classes I and II. Data in this table can be used to determine the farming potential of such soils.

The capability subclass is identified in the description of each soil mapping unit in the section "Soil maps for detailed planning."

Engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers (fig. 7).

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 7 shows, for each kind of soil, the degree and kind of limitations for building site development; table 8, for sanitary facilities; and table 10, for water management. Table 9 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

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 are indicated in table 7. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of bedrock or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 7 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 7 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Lawns and landscaping require soils that are suitable for the establishment and maintenance of turf for lawns and ornamental trees and shrubs for landscaping. The best soils are firm after rains, are not dusty when dry, and absorb water readily and hold sufficient moisture for plant growth. The surface layer should be free of stones. If shaping is required, the soils should be thick enough over bedrock to allow for necessary grading. In rating the soils, the availability of water for sprinkling is assumed.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 8 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold 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. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 8 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 9 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 13 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

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

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 13.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel or stones; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 10 the soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Aquifer-fed excavated ponds are bodies of water made by excavating a pit or dugout into a ground-water aquifer. Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Ratings in table 10 are for ponds that are properly designed, located, and constructed. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table, permeability of the aquifer, quality of the water, and ease of excavation.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

The potential is good for developing natural resources for recreation in Shelby County. Natural attractions were instrumental in attracting Indian tribes to the area; the county has a rich historical Indian heritage.

These natural attractions along with some recent manmade developments are increasingly drawing people to the county.

The rolling topography and wooded areas along streams and the Great Miami River are suitable for camping and recreational facilities. Loramie State Lake Park in the northwestern part of the county and Kiser Lake State Park just outside the county line in the southeastern part of the county are main attractions for public and private recreational facilities.

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the 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 11 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 8, and interpretations for dwellings without basements and for local roads and streets, given in table 7.

Camp areas require such site preparation as shaping and leveling for 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 for this use 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 camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as 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 will 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 or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have 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 should have a surface that is free of stones and boulders and have moderate slopes. Suitability of the soil for traps, tees, or greens was not considered in rating the soils. Irrigation is an assumed management practice.

Wildlife habitat

Wildlife, an important natural resource in Shelby County, include pheasants, rabbits, quail, deer, waterfowl, and squirrels. Also numerous are raccoons, opossums, skunks, muskrats, woodchucks, foxes, and many species of birds.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 12, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and 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* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties 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 soybeans.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties 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, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are foxtail, goldenrod, smartweed, ragweed, and fall panicum.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of native plants are oak, poplar, wild cherry, grape, apple, hawthorn, dogwood, hickory, blackberry, and black walnut. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated *good* are shrub honeysuckle, autumn-olive, and crabapple.

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, northern white-cedar, and eastern red cedar.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, willow, rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and shallow ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat 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 kinds of wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail rabbit, and red fox.

Woodland habitat consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and white-tailed deer.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, muskrat, mink, and beaver.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features, and engineering test data.

Engineering properties

Table 13 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 13 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 13 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 soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*3*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*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, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging 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. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO estimated classification, without group index numbers, is given in table 13. Also in table 13 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index is estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterburg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 14 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation

is difficult to establish. They are generally not suitable for crops.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing 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, but crops can be grown if measures to control soil blowing 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, and 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, and crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 15 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received 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 chiefly of deep, well drained to excessively drained sands or gravels. 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 that have a layer that impedes the downward movement of water or soils that have 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 clay soils 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 is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding; and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 15 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

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

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Physical and chemical analyses of selected soils

The Department of Agronomy, Ohio Agricultural Research and Development Center (OARDC), Columbus, Ohio sampled and determined the laboratory data for many of the soils in Shelby County. The physical and chemical data obtained in most samples include particle size distribution (*11*), reaction, organic matter content (*9*), calcium carbonate equivalent, and extractable cations.

These data were used in classifying and correlating these soils and in evaluating their behavior characteristics under various land uses. Eight of the profiles sampled were selected as representative of the respective series and are described in this survey. The series and laboratory identification numbers are Blount (SH-8), Brookston (SH-10), Crosby (SH-7), Eldean (SH-9), Medway (SH-13), Morley (SH-17), Odell (SH-14), and Patton (SH-18).

In addition to the Shelby County data, laboratory data for many of the same soils are also available from nearby counties in west-central Ohio. These data and the Shelby County data are on file at the Department of Agronomy, OARDC, Columbus, Ohio; the Ohio Department of Natural Resources, Division of Lands and Soil, Columbus, Ohio; and the Soil Conservation Service, State Office, Columbus, Ohio.

Engineering test data

The results of analyses of engineering properties of several typical soils of the survey area are given in table 16.

The data presented are for soil samples that were collected from carefully selected sites. The soil profiles sampled are typical of the series discussed in the section "Soil series and morphology." The soil samples were analyzed by the State of Ohio, Department of Transportation, Division of Highways, Testing Laboratory.

The methods used in obtaining the data are listed by code in the next paragraph. Most of the codes, in parentheses, refer to the methods assigned by the American Association of State Highway and Transportation Officials. The codes for Unified classification are those assigned by the American Society for Testing and Materials.

The methods and codes are AASHTO classification (M-145-66); Unified classification (D-2487-69); mechanical analysis (T88-57); liquid limit (T89-60); plasticity index (T90-56); moisture-density, method A (T99-57).

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*15*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 17, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Haplaquolls (*Hapl*, meaning simple horizons, plus *aquoll*, the suborder of Mollisols that have an aquic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Haplaquolls.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-silty, mixed, mesic, Typic Haplaquolls.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*12*). Unless otherwise noted, colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or mapping units, of each soil series are described in the section "Soil maps for detailed planning."

Algiers series

The Algiers series consists of somewhat poorly drained soils on flood plains and stream terraces. These soils formed in medium textured recent alluvium over moderately fine textured older alluvium. Permeability is moderate. The slope is 0 to 2 percent.

Algiers soils, commonly adjacent to Carlisle, Medway, Montgomery, Patton, and Shoals soils, are similar to Eel, Shoals, and Wallkill soils. Carlisle and Wallkill soils have an organic layer within a depth of 40 inches. Medway, Montgomery, and Patton soils have a mollic epipedon. Eel and Shoals soils do not have a buried dark colored A horizon within 40 inches.

Typical pedon of Algiers silt loam, 100 feet east and 40 feet north of the southwest corner sec. 30, T. 7 S., R. 6 E., Dinsmore Township:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; weak medium granular structure; friable; neutral; abrupt smooth boundary.

C1—9 to 20 inches; dark brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; neutral; clear smooth boundary.

C2—20 to 24 inches; dark grayish brown (10YR 4/2) silt loam; massive; friable; neutral; abrupt smooth boundary.

IIAb—24 to 36 inches; very dark gray (I0YR 3/1) silty clay loam; moderate medium subangular blocky structure; firm; neutral; clear wavy boundary.

IIB2bg—36 to 42 inches; dark gray (I0YR 4/1) silty clay loam; few medium distinct yellowish brown (I0YR 5/4) and grayish brown (2.5Y 5/2) mottles; moderate medium subangular blocky structure; firm; few reddish brown (5YR 4/4) iron streaks; 2 percent pebbles; mildly alkaline; clear wavy boundary.

IICg—42 to 60 inches; grayish brown (I0YR 5/2) clay loam; common medium distinct olive brown (2.5Y

4/4) mottles; massive; firm; 5 percent pebbles; strong effervesence; moderately alkaline.

The medium textured recent alluvium is 20 to 28 inches thick over the IIAb horizon of the buried soil. Reaction is slightly acid to neutral in the recent alluvium and neutral to moderately alkaline in the buried soil horizon.

The Ap horizon is brown (10YR 4/3) or dark grayish brown (10YR 4/2). Some pedons have an A1 horizon 1 to 3 inches thick. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is silt loam or light silty clay loam.

The IIAb horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or less. It is clay loam or silty clay loam that is 1 to 5 percent coarse fragments. It is 8 to 12 inches thick. The IIB2g horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or less. It is silty clay loam, clay loam, or heavy loam that is 1 to 10 percent pebbles.

The IICg horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 2 or 3. It is clay loam or silty clay loam that is 5 to 15 percent coarse fragments.

Blount series

The Blount series consists of somewhat poorly drained soils formed in calcareous moderately fine textured till on the uplands. Permeability is slow. The slope is 0 to 6 percent.

Blount soils, commonly adjacent to Glynwood, Morley, and Pewamo soils, are similar to Celina and Crosby soils. Glynwood soils have dominant high chroma below the Ap horizon. Morley soils do not have low chroma in the upper 10 inches of the argillic horizon. Pewamo soils have a mollic epipedon and are in depressions. Celina and Crosby soils have less clay in the B and C horizons than Blount soils.

Typical pedon of Blount silt loam, 2 to 6 percent slopes, 600 feet south and 200 feet east of the northwest corner sec. 1, T. 10 N., R. 5 E., Turtle Creek Township:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam; weak medium granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

B21t—7 to 11 inches; olive brown (2.5Y 4/4) silty clay; many fine distinct light brownish gray (2.5Y 6/2) mottles; weak medium prismatic structure parting to moderate fine and medium subangular blocky; firm; common fine roots; thin patchy grayish brown (10YR 5/2) silt coatings; medium acid; clear smooth boundary.

B22t—11 to 22 inches; olive brown (2.5Y 4/4) clay; common fine and medium distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to moderate fine and medium angular blocky; firm; few fine roots; few very dark gray (10YR 3/1) iron and manganese oxide concretions; patchy grayish brown (10YR 5/2) silt coatings; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; 5 percent pebbles; medium acid; clear wavy boundary.

B3t—22 to 26 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct grayish brown (2.5Y 5/2) mottles; weak medium subangular blocky structure; firm; thin patchy dark grayish brown (10YR 4/2) clay films on faces of peds; 5 percent pebbles; slight effervescence; mildly alkaline; gradual wavy boundary.

C1—26 to 48 inches; dark yellowish brown (10YR 4/4) clay loam; common coarse distinct light brownish gray (10YR 6/2) mottles; massive; firm; 10 percent pebbles; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—48 to 60 inches; yellowish brown (10YR 5/4) clay loam; few medium distinct grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) mottles; massive; firm; 10 percent pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. The depth to free carbonates ranges from 16 to 36 inches.

The Ap horizon is dark gray (10YR 4/1) or dark grayish brown (10YR 4/2). In wooded areas, pedons have an A1 horizon 3 to 4 inches thick and an A2 horizon 2 to 3 inches thick. The solum is 2 to 10 percent coarse fragments below the Ap horizon.

The B horizon has hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 2 to 4. It is medium or slightly acid in the upper part and neutral to mildly alkaline in the lower part. Most pedons have free carbonates in the B3 horizon.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. It is silty clay loam or clay loam that is 5 to 15 percent coarse fragments.

Brookston series

The Brookston series consists of very poorly drained soils in depressions or along narrow drainageways of the uplands. These soils formed in calcareous medium textured till. Permeability is moderate or moderately slow. The slope is 0 to 2 percent.

The Brookston soils in this county differ from the typical Brookston soils. They have more silt and less sand in the B horizon, and there is no evidence of translocated clay. This difference, however, does not alter use and management.

Brookston soils, commonly adjacent to Celina, Crosby, Miamian, and Odell soils, are similar to Patton and Pewamo soils. Celina, Crosby, and Miamian soils do not have a mollic epipedon. Odell soils have high chroma below the Ap horizon. Patton soils are similar to Brookston soils in the solum but are underlain by lacustrine sediment. Pewamo soils have more clay in the B and C horizons than Brookston soils.

Typical pedon of Brookston silty clay loam, 660 feet west and 1,060 feet north of the southeast corner sec. 23, R. 12, T. 2, Green Township:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silty clay loam; weak medium subangular blocky structure; friable; common fine roots; slightly acid; abrupt, smooth boundary.

A12—9 to 15 inches; very dark grayish brown (2.5Y 3/2) silty clay loam; few fine faint olive brown (2.5Y 4/4) mottles; moderate fine and medium angular blocky structure; firm; few fine roots; few yellowish red (5YR 5/8) iron stains; 2 percent pebbles; slightly acid; clear smooth boundary.

B1g—15 to 20 inches; olive gray (5Y 4/2) silty clay loam; common medium distinct olive (5Y 4/4) mottles; moderate medium angular blocky structure; firm; few fine roots; few iron and manganese oxide concretions; 2 percent pebbles; neutral; clear smooth boundary.

B21g—20 to 28 inches; olive gray (5Y 5/2) silty clay loam; common medium distinct olive (5Y 4/4) and yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium angular blocky; firm; few fine roots; few very dark gray (10YR 3/1) iron and manganese oxide concretions; 2 percent pebbles; neutral; clear smooth boundary.

B22g—28 to 40 inches; olive gray (5Y 5/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium angular blocky; firm; 5 percent pebbles; neutral; clear smooth boundary.

B3g—40 to 46 inches; gray (5Y 5/1) light silty clay loam; common medium distinct light olive brown (2.5Y 5/4) mottles; weak medium subangular blocky structure; firm; 5 percent pebbles; slight effervescence; mildly alkaline; clear smooth boundary.

C—46 to 60 inches; yellowish brown (10YR 5/4) loam; few fine distinct grayish brown (2.5Y 5/2) and brown (7.5YR 5/4) mottles; massive; friable; 10 percent pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 60 inches. Reaction ranges from slightly acid to neutral in the upper part of the solum and neutral to mildly alkaline in the lower part. Most pedons have free carbonates in the B3 horizon.

The A horizon is very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), or black (10YR 2/1).

The B2 horizon has hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 1 or 2. The texture of the B2 horizon is silty clay loam. Some pedons have subhorizons of silty clay or clay loam 4 to 6 inches thick. The lower part of the B2 horizon is 2 to 5 percent coarse fragments. The B3 horizon has color similar to that of the B2 horizon. It is silty clay loam or clay loam that is 5 to 10 percent coarse fragments.

The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 or 4. It is loam or silt loam that is 5 to 15 percent coarse fragments.

Carlisle series

The Carlisle series consists of very poorly drained organic soils. These soils formed in bogs on stream terraces or on moraines. The layer of muck is a result of decomposition of plant remains—trees, grasses, sedges, and reeds. Permeability is moderate or moderately rapid. The slope is 0 to 2 percent.

Carlisle soils are commonly adjacent to Algiers and Wallkill soils. Algiers and Wallkill soils have a mineral soil overburden more than 20 inches thick.

Typical pedon of Carlisle muck, 620 feet south and 100 feet east of the northwest corner sec. 23, T. 7 S., R. 5 E., Van Buren Township:

Oap—0 to 9 inches; black (N 2/0) broken face and rubbed sapric material; 5 percent fiber, 0 percent rubbed; weak fine and very fine granular structure; very friable; few fine roots; slightly acid; abrupt smooth boundary.

Oa2—9 to 17 inches; very dark gray (5YR 3/1) broken face, dark reddish brown (5YR 2/2) rubbed sapric material; 15 percent fiber, 5 percent rubbed; weak medium and coarse subangular blocky structure; friable; neutral; gradual wavy boundary.

Oa3—17 to 34 inches; dark reddish brown (5YR 2/2) broken face and rubbed sapric material; 15 percent fiber, 0 percent rubbed; massive; friable; few woody fragments; slightly acid; diffuse wavy boundary.

Oa4—34 to 60 inches; reddish brown (5YR 5/3) broken face, dark reddish brown (5YR 2/2) rubbed sapric material; 30 percent fiber, 10 percent rubbed; massive; nonsticky; many reddish brown (5YR 5/4) woody fibers with black (5YR 2/1) coats; slightly acid.

The thickness of the organic deposits is more than 51 inches. Reaction is medium acid to neutral in the upper 40 inches. The upper tier is black (10YR 2/1 or N 2/0) or very dark brown (10YR 2/2). The subsurface tier has hue of 5YR or 7.5YR, value of 2 or 3, and chroma of 2 or 4. The organic material is mostly sapric, but some pedons contain 6 to 10 inches of hemic material in the lower tier.

Casco series

The Casco series consists of somewhat excessively drained soils formed in loamy glacial outwash over sand

and gravel (fig. 8). These soils are on outwash terraces along the larger streams and on kames and eskers of the uplands. Permeability is moderate in the subsoil and very rapid in the underlying material. The slope is 6 to 15 percent.

Casco soils are commonly adjacent to Eldean and Warsaw variant soils. Eldean soils have a solum more than 20 inches thick. Warsaw soils have a mollic epipedon. The Casco soils in Shelby County are mapped only with Eldean soils.

Typical pedon of Casco gravelly loam in an area of Eldean-Casco complex, 6 to 15 percent slopes, eroded, 2,555 feet east and 90 feet north of the southwest corner sec. 11, R. 13, T. 2, Perry Township:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) gravelly loam; weak fine and medium granular structure; friable; many fine roots; 20 percent coarse fragments; neutral; abrupt smooth boundary.

B2t—8 to 16 inches; dark reddish brown (5YR 3/3) sandy clay loam; moderate medium subangular blocky structure; firm; common fine roots; thin continuous clay film on faces of peds and pebbles; 12 percent coarse fragments; neutral; clear wavy boundary.

IIC—16 to 60 inches; light brownish gray (10YR 6/2) very gravelly loamy coarse sand; single grained; loose; strong effervescence; moderately alkaline.

Solum thickness ranges from 12 to 20 inches. Depth to free carbonates ranges from 10 to 18 inches. Reaction in the solum is neutral or mildly alkaline. In some pedons the lower part of the B horizon has free carbonates.

The Ap horizon is dark grayish brown (10YR 4/2) or dark brown (10YR 4/3).

The Bt horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 3 or 4. It is typically sandy clay loam or clay loam, but in some pedons it has subhorizons of clay 2 to 3 inches thick. This horizon is 10 to 20 percent coarse fragments. In many pedons tongues of the Bt horizon extend into the C horizon to a depth of as much as 1 to 2 feet.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 4. It is very gravelly sand or very gravelly loamy coarse sand.

Celina series

The Celina series consists of moderately well drained soils of the uplands. These soils formed in calcareous medium textured till. Permeability is moderately slow. The slope is 0 to 6 percent.

Celina soils, commonly adjacent to Brookston, Crosby, and Miamian soils, are similar to Blount and Glynwood soils. Brookston soils have a mollic epipedon. Crosby soils have dominant low chroma just below the Ap horizon. Miamian soils do not have low chroma in the upper 10 inches of the argillic horizon. Blount and Glynwood soils have more clay in the B and C horizons than Celina soils.

Typical pedon of Celina silt loam, 2 to 6 percent slopes, 1,915 feet north and 100 feet east of the southwest corner sec. 6, R. 12, T. 2, Green Township:

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam; weak medium subangular blocky structure parting to weak fine and medium granular; friable; few fine roots; neutral; abrupt smooth boundary.

IIB21t—10 to 13 inches; dark yellowish brown (10YR 4/4) clay loam; few fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin patchy grayish brown (10YR 5/2) clay films on faces of peds; 2 percent pebbles; neutral; clear smooth boundary.

IIB22t—13 to 18 inches; dark yellowish brown (10YR 4/4) clay loam; few medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few strong brown (7.5YR 5/6) iron stains; thin patchy dark brown (7.5YR 3/2) clay film on faces of peds; 5 percent pebbles; neutral; clear wavy boundary.

IIB23t—18 to 27 inches; dark yellowish brown (10YR 4/4) silty clay; few fine distinct dark grayish brown (10YR 4/2) mottles; moderate medium and coarse subangular blocky structure; firm; few strong brown (7.5YR 5/6) iron stains; few very dark gray (10YR 3/1) iron and manganese oxide concretions; thin patchy dark brown (7.5YR 3/2) clay film on faces of peds; 5 percent pebbles; neutral; clear wavy boundary.

IIB3—27 to 30 inches; dark yellowish brown (10YR 4/4) clay loam; few medium distinct grayish brown (10YR 5/2) and brown (10YR 5/3) mottles; weak coarse subangular blocky structure; firm; few very dark gray (10YR 3/1) iron and manganese oxide concretions; 5 percent pebbles; common weathered limestone fragments; slight effervescence; mildly alkaline; clear wavy boundary.

IIC—30 to 60 inches; brown (10YR 5/3) loam; common medium distinct grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) mottles; massive; friable; common very dark gray (10YR 3/1) iron and manganese oxide concretions; 10 percent pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges form 20 to 40 inches. The depth to free carbonates ranges from 18 to 36 inches. The thickness of the loess mantle ranges from 1 to 12 inches. Reaction is medium acid to neutral in the upper part of the solum and mildly alkaline in the lower part. In most pedons the B3 horizon has free carbonates. The content of coarse fragments ranges from 2 to 10 percent in the solum below the loess.

The Ap horizon is dark grayish brown (10YR 4/2) or dark brown (10YR 4/3). In wooded areas there is an Al horizon 3 to 4 inches thick and an A2 horizon 4 to 8 inches thick.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam, silty clay loam, silty clay, or clay.

The C horizon has hue of 10YR, value of 5, and chroma of 3 or 4. It is loam or silt loam and commonly is 5 to 15 percent coarse fragments.

Crane series

The Crane series consists of somewhat poorly drained soils formed in loamy glacial outwash material. These soils occur on outwash terraces bordering the major streams. Permeability is moderately slow in the subsoil and very rapid in the underlying material. The slope is 0 to 2 percent.

Crane soils, commonly adjacent to Eldean and Warsaw soils, are similar to Odell soils. Eldean soils lack a mollic epipedon. Warsaw variant soils have a solum less than 40 inches thick. Odell soils formed in till.

Typical pedon of Crane silt loam, 0 to 2 percent slopes, 500 feet south and 650 feet east of the northwest corner, NWl/4SWl/4 sec. 21, R. 13, T. 2, Perry Township:

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam; moderate medium and coarse granular structure; friable; common fine roots; neutral; abrupt smooth boundary.

IIA12—10 to 17 inches; very dark grayish brown (10YR 3/2) heavy silt loam; moderate fine and medium granular structure; friable; few fine roots; 2 percent gravel; neutral; clear wavy boundary.

IIB21t—17 to 26 inches; dark brown (10YR 4/3) silty clay loam; few fine distinct grayish brown (10YR 5/2) mottles; moderate fine and medium subangular blocky structure; firm; few fine roots; thin patchy clay films and continuous very dark grayish brown (10YR 3/2) organic coatings on faces of peds; 2 percent gravel; neutral; clear smooth boundary.

IIB22t—26 to 32 inches; dark yellowish brown (10YR 4/4) clay loam; common medium distinct grayish brown (10YR 5/2) and brown (10YR 5/3) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; thin patchy clay films and continuous very dark grayish brown (10YR 3/2) organic coatings on faces of peds; 5 percent gravel; neutral; clear wavy boundary.

IIB31—32 to 36 inches; yellowish brown (10YR 5/6) loam; few medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; few strong brown (7.5YR 5/6) iron stains; 10 percent gravel; slight effervescence; mildly alkaline; clear wavy boundary.

IIB32g—36 to 50 inches; grayish brown (10YR 5/2) gravelly loam; many medium distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; firm; 25 percent gravel; few cobbles; common weathered limestone fragments; slight effervescence; mildly alkaline; clear wavy boundary.

IIIC—50 to 60 inches; brown (10YR 5/3) and pale brown (10YR 6/3) very gravelly loamy sand; single grained; loose; 55 percent gravel; 10 percent cobbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 40 to 60 inches. The depth to free carbonates ranges from 30 to 48 inches. Reaction in the solum is neutral or slightly acid in the upper part and mildly or moderately alkaline in the lower part. Most pedons have free carbonates in the B3 horizon. The content of coarse fragments ranges from 0 to 5 percent in the Ap horizon and increases with increasing depth to 5 to 20 percent in the B3 horizon.

The Ap horizon is very dark grayish brown (10YR 3/2) or very dark gray (10YR 3/1).

The B2t horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam or silty clay loam in the upper part and clay loam or sandy clay loam in the lower part. The B3 horizon has texture of loam, sandy clay loam, gravelly clay loam, or gravelly loam.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is very gravelly sand or very gravelly loamy sand.

Crosby series

The Crosby series consists of somewhat poorly drained soils formed in calcareous medium textured till. Permeability is slow. The slope is 0 to 6 percent.

Crosby soils, commonly adjacent to Brookston, Celina, Miamian, and Odell soils, are similar to Blount soils. Brookston and Odell soils have a mollic epipedon. Celina soils have dominant high chroma below the Ap horizon. Miamian soils lack low chroma in the upper 10 inches of the argillic horizon. Blount soils have more clay in the B and C horizons than Crosby soils.

Typical pedon of Crosby silt loam, 0 to 2 percent slopes, 2,150 feet west and 2,225 feet south of the northeast corner sec. 2, R. 13, T. 1, Orange Township:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; weak medium and coarse granular structure; friable; many roots; few worm holes; neutral; abrupt smooth boundary.

B1—9 to 11 inches; brown (10YR 5/3) silty clay loam; many medium faint yellowish brown (10YR 5/4) mottles; weak fine and medium subangular blocky structure; firm; patchy light brownish gray (10YR 6/2) silt coatings on faces of peds; common roots; few worm holes; neutral; clear smooth boundary.

IIB21t—11 to 18 inches; olive brown (2.5Y 4/4) silty clay; many fine and medium faint grayish brown (2.5Y 5/2) mottles; weak medium prismatic structure parting to fine and medium angular blocky; firm; patchy light brownish gray (10YR 6/2) silt coatings; thin continuous grayish brown (2.5Y 5/2) clay films on faces of peds; few very dark gray (10YR 3/1) iron and manganese oxide concretions; 2 percent pebbles; slightly acid; gradual wavy boundary.

IIB22t—18 to 24 inches; olive brown (2.5Y 4/4) light clay, many medium faint, light brownish gray (2.5Y 6/2) mottles; weak medium prismatic structure parting to moderate medium angular blocky; firm; thin patchy grayish brown (2.5Y 5/2) clay films on faces of peds; 5 percent pebbles; neutral; clear wavy boundary.

IIB3t—24 to 27 inches; yellowish brown (10YR 5/6) clay loam; many medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; firm; thin patchy clay films on faces of peds; 10 percent pebbles and light gray (10YR 7/2) weathered limestone fragments; slight effervescence; mildly alkaline; clear wavy boundary.

IIC1—27 to 47 inches; brown (10YR 5/3) heavy loam; few medium distinct light brownish gray (10YR 6/2) mottles; massive; friable; 10 percent pebbles; 2 percent cobbles, 3 to 6 inches in diameter; strong effervescence; moderately alkaline; gradual wavy boundary.

IIC2—47 to 68 inches; yellowish brown (10YR 5/4) loam; few medium distinct light brownish gray (10YR 6/2) mottles; massive; friable; 10 percent pebbles; strong effervescence; moderately alkaline.

The solum thickness ranges from 20 to 38 inches. The depth to free carbonates ranges from 18 to 36 inches. Some pedons have up to 12 inches of loess.

The Ap horizon is grayish brown (10YR 5/2) or dark grayish brown (10YR 4/2). In wooded areas there is an A1 horizon 2 to 3 inches thick and an A2 horizon 4 to 7 inches thick.

The B2t horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is silty clay loam, clay loam, silty clay, or clay. The B2 and B3 horizons are 2 to 10 percent coarse fragments. Reaction in the B2t horizon is medium acid to neutral. The B3 horizon is 3 to 6 inches thick. It is mildly or moderately alkaline. Most pedons have free carbonates in the B3 horizon.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is loam or silt loam that is 5 to 15 percent coarse fragments.

Eel series

The Eel series consists of moderately well drained soils on flood plains. These soils are mostly next to the larger streams. They formed in medium textured alluvial deposits. Permeability is moderate. The slope is 0 to 2 percent.

Eel soils in this county differ from the typical Eel soils. They have carbonates throughout the control section and are dominantly mildly alkaline in the surface layer. This difference, however, does not alter use and management.

Eel soils are commonly adjacent to Eel variant, Genesee, Medway, Shoals, and Stonelick soils and are similar to Algiers, Eel variant, and Genesee soils. Eel variant soils have buried older alluvium at 20 to 30 inches. Genesee soils do not have low chroma within a depth of 20 inches. Medway soils have a mollic epipedon. Shoals soils have dominant low chroma just below the Ap horizon. Algiers soils have a buried dark colored A horizon within a depth of 40 inches. Stonelick soils are in the coarse-loamy family.

Typical pedon of Eel silt loam, occasionally flooded, 925 feet north and 140 feet east of the southwest corner sec. 28, T. 8 N., R.6 E., in Turtle Creek Township:

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam; weak medium granular structure; friable; common fine roots; few tunnels, 1/4 inch diameter; slight effervescence; mildly alkaline; clear smooth boundary.

C1—8 to 18 inches; brown (10YR 4/3) silt loam; weak fine subangular blocky structure parting to weak fine and medium granular; friable; few fine roots; few worm channels, 1/4 inch diameter; 2 percent pebbles; slight effervescence; mildly alkaline; clear smooth boundary.

C2—18 to 24 inches; brown (10YR 4/3) silt loam; common fine distinct grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) mottles; moderate fine and medium subangular blocky structure; friable; few fine roots; few worm channels, 1/4 to 1/2 inch diameter; 2 percent pebbles; few reddish brown (5YR 4/4) iron stains; slight effervescence; mildly alkaline; clear wavy boundary.

C3—24 to 34 inches; brown (10YR 4/3) loam; many medium distinct dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; friable; 2 percent pebbles; common fine reddish brown (5YR 4/4) iron stains; slight effervescence; mildly alkaline; clear wavy boundary.

C4—34 to 44 inches; brown (10YR 4/3) light clay loam; many medium distinct grayish brown (10YR 5/2) mottles; massive, friable; 5 percent pebbles; few fine reddish brown (5YR 4/4) iron stains; slight effervescence; mildly alkaline; clear wavy boundary.

C5—44 to 60 inches; brown (10YR 5/3) sandy loam; single grained; loose; 10 percent gravel; strong effervescence; moderately alkaline.

Reaction in the upper 40 inches is mildly alkaline or moderately alkaline. Most pedons have free carbonates throughout. The content of coarse fragments ranges from 0 to 15 percent to a depth of 40 inches.

The Ap horizon is brown (10YR 4/3 or 10YR 5/3) or dark grayish brown (10YR 4/2). Some pedons have an A1 horizon. Depth to mottling ranges from 10 to 20 inches.

The C horizon has hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 1 to 3. It is silt loam, loam, or light clay loam. Some pedons have subhorizons of sandy loam 1 to 4 inches thick within a depth of 40 inches. Some pedons are stratified with sand and gravel below 40 inches.

Eel variant

The Eel variant consists of deep, moderately well drained soils formed in recent alluvium over older alluvium. These soils are on flood plains. Permeability is moderately slow. The slope is 0 to 2 percent.

Eel variant soils, commonly adjacent to Eel, Eldean, Genesee, and Ockley soils, are similar to Eel soils. Eel and Genesee soils do not have an argillic horizon. Eldean and Ockley soils do not have surface layers formed in recent alluvium.

Typical pedon of Eel variant silt loam, occasionally flooded, 2,480 feet east and 200 feet south of the northwest corner sec. 19, T. 7 N., R. 6 E., Washington Township:

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam; weak coarse subangular blocky structure parting to weak fine granular; friable; few roots; neutral; clear smooth boundary.

C—9 to 25 inches; brown (10YR 4/3) light silty clay loam; few medium faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; thin continuous dark grayish brown (10YR 4/2) organic coatings; few roots; neutral; clear wavy boundary.

IIB2tb—25 to 39 inches; brown (10YR 4/3) silty clay loam; few fine faint grayish brown (10YR 5/2) mottles; moderate, medium, subangular blocky structure; firm; thin patchy brown (10YR 5/3 and 10YR 4/3) clay films on faces of peds; few iron and manganese oxide concretions; neutral; gradual wavy boundary.

IIB31tb—39 to 51 inches; brown (10YR 4/3) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; firm; thin very patchy brown (10YR 4/3) and grayish brown (10YR 5/2) clay films on faces of peds; few iron and manganese oxide concretions; neutral; diffuse wavy boundary.

IIB32b—51 to 58 inches; dark brown (10YR 4/3) silty clay loam; many coarse distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; common iron and manganese oxide concretions; neutral; clear wavy boundary.

IIC—58 to 66 inches; olive brown (2.5Y 4/4) silty clay loam; many meduim distinct (2.5Y 5/2) mottles; massive; friable; 2 percent pebbles; slight effervescence; mildly alkaline.

The solum thickness typically ranges from 48 to 60 inches but in some pedons it is 80 inches or more. The recent alluvium is 20 to 30 inches thick. Reaction is slightly acid or neutral in the recent alluvium and the upper part of the IIB horizon. The lower part of the IIB horizon is neutral or mildly alkaline. Some pedons have free carbonates in the lower part of the IIB3 horizon. The content of coarse fragments ranges from 0 to 10 percent above the IIC horizon.

The Ap horizon is dark grayish brown (10YR 4/2) or dark brown (10YR 4/3).

The IIBt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silty clay loam or clay loam.

The IIC horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 3 or 4. It is silty clay loam, or gravelly sandy loam and commonly is 2 to 10 percent coarse fragments.

Eldean series

The Eldean series consists of well drained soils formed in loamy glacial outwash material. These soils are on outwash terraces along the larger streams. A few areas are on kames and eskers of the uplands. These soils have moderate or moderately slow permeability in the subsoil and very rapid permeability in the underlying material. The slope is 0 to 15 percent.

Eldean soils, commonly adjacent to Casco, Crane, Eel variant, Miamian, Morley, Ockley, and Warsaw soils, are similar to Miamian and Milton soils. Casco soils have a solum less than 20 inches thick. Crane and Warsaw soils have a mollic epipedon. Eel variant soils have surface layers formed in recent alluvium. Miamian and Morley soils formed in till. Ockley soils have a solum more than 40 inches thick. Milton soils are underlain by limestone bedrock at 20 to 40 inches.

Typical pedon of Eldean loam, 0 to 2 percent slopes, 2,570 feet west and 1,320 feet north of the southeast corner sec. 18, T. 7 N., R. 6 E., Washington Township:

Ap—0 to 8 inches; dark brown (7.5YR 4/2) loam; weak medium granular structure; friable; common roots; 5 percent gravel; neutral; clear smooth boundary.

B1—8 to 12 inches; brown (10YR 4/3) heavy loam; weak medium subangular blocky structure; slightly firm; few roots; 10 percent gravel; neutral; clear smooth boundary.

B21t—12 to 20 inches; dark reddish brown (5YR 3/4) clay; moderate medium subangular blocky structure; firm; sticky; thin patchy clay films on faces of peds; few roots; 10 percent coarse fragments; slightly acid; gradual wavy boundary.

B22t—20 to 26 inches; dark reddish brown (5YR 3/4) heavy clay loam; moderate fine and medium subangular blocky structure; firm; sticky; thin patchy clay films on faces of peds; 10 percent coarse fragments; few roots; neutral grading to mildly alkaline in the lower part; clear wavy boundary.

B3t—26 to 34 inches; dark brown (7.5YR 3/2) gravelly loam; weak coarse subangular blocky structure; slightly firm; thin patchy clay films on faces of peds; 30 percent coarse fragments; common soft very pale brown (10YR 7/3) fragments of limestone; slight effervescence; mildly alkaline; clear wavy boundary.

IIC—34 to 60 inches; brown (10YR 5/3) very gravelly loamy coarse sand; single grained; loose; 55 percent coarse fragments; strong effervescence; moderately alkaline.

The solum thickness ranges from 20 to 40 inches. The depth to free carbonates ranges from 18 to 36 inches. Reaction of the solum is medium acid to neutral in the upper part and neutral to mildly alkaline in the lower part. In most pedons the B3 horizon has free carbonates. The content of coarse fragments increases with depth from 2 to 10 percent in the Ap horizon to 5 to 35 percent in the B3 horizon.

The Ap horizon is brown (10YR 4/3), dark grayish brown (10YR 4/2), or dark brown (7.5YR 4/2). In wooded areas, there is an A1 horizon 3 to 4 inches thick and an A2 horizon.

The B2t horizon has hue of 10YR or 5YR, value of 3 to 5, and chroma of 3 to 5. It is heavy clay loam or clay. The B3 horizon ranges from 5 to 12 inches thick. It has texture of gravelly loam, gravelly sandy loam, or gravelly clay loam. The B3 horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 or 3. In some pedons, tongues of the B3 horizon extend into the C horizon for 2 to 3 feet.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is very gravelly sand to gravelly loamy sand.

Genesee series

The Genesee series consists of well drained soils on flood plains. These soils formed in medium textured alluvial deposits. They occur in areas next to the larger streams. Permeability is moderate. The slope is 0 to 2 percent.

The Genesee soils in this county differ from the typical Genesee soils. They have carbonates throughout the control section and are dominantly mildly alkaline in the surface layer. This difference, however, does not alter use and management.

Genesee soils, commonly adjacent to Eel, Eel variant, Medway, Shoals, and Stonelick soils, are similar to Eel soils. Eel and Shoals soils have low chroma above a depth of 20 inches. Eel variant soils have an argillic horizon. Stonelick soils are a coarse-loamy texture in the control section.

Typical pedon of Genesee silt loam, occasionally flooded, 2,375 feet west and 530 feet south of the northeastern corner of sec. 9, T. 9 N., R. 5 E. in Loramie Township.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam; weak medium subangular blocky structure parting to moderate fine and medium granular; friable; many fine roots; few worm holes; slight effervescence; mildly alkaline; clear smooth boundary.

C1—10 to 17 inches; dark brown (10YR 4/3) silt loam; moderate medium subangular blocky structure; friable; common fine roots; few very dark grayish brown (10YR 3/2) organic coatings; few very dark gray (10YR 3/1) plant remains; slight effervescence; mildly alkaline; clear smooth boundary.

C2—17 to 26 inches; brown (10YR 4/3) silt loam; weak medium and coarse subangular blocky structure; friable; common fine roots; few very dark grayish brown (10YR 3/2) organic coatings; slight effervescence; mildly alkaline; gradual smooth boundary.

C3—26 to 34 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine and medium subangular blocky structure; friable; few fine roots; few very dark grayish brown (10YR 3/2) organic coatings; 5 percent pebbles; slight effervescence; mildly alkaline; clear smooth boundary.

C4—34 to 39 inches; brown (10YR 4/3) silt loam; massive; friable; few fine roots; 5 percent pebbles; strong effervescence; moderately alkaline; clear wavy boundary.

C5—39 to 54 inches; dark yellowish brown (10YR 4/4) silt loam; many medium distinct grayish brown (10YR 5/2) mottles; massive; friable; 10 percent pebbles; strong effervescence; moderately alkaline; clear wavy boundary.

C6—54 to 60 inches; brown (10YR 4/3) stratified silt loam and loam; common medium distinct yellowish brown (10YR 5/4) mottles; massive; friable; 10 percent pebbles; strong effervescence; moderately alkaline.

Reaction in the upper 40 inches is mildly alkaline or moderately alkaline. Most pedons have free carbonates throughout.

The Ap horizon is dark grayish brown (10YR 4/2) or brown (10YR 5/3). Wooded areas have a 2- or 3-inch very dark brown (10YR 2/2) or very dark gray (10YR 3/1) A1 horizon.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or loam. Some pedons have subhorizons of sandy loam or clay loam 1 to 4 inches thick. In most pedons the C horizon is 5 to 10 percent coarse fragments. In many places the C horizon is stratified with sand and gravel below a depth of 40 inches.

Glynwood series

The Glynwood series consists of moderately well drained soils on uplands. These soils formed in calcareous clay loam or silty clay loam till. Permeability is slow. The slope ranges from 2 to 18 percent.

Glynwood soils, commonly adjacent to Blount, Morley, and Pewamo soils, are similar to Celina and Miamian soils. Blount soils have dominant low chroma just below the Ap horizon. Morley soils do not have low chroma in the upper 10 inches of the argillic horizon. Pewamo soils have a mollic epipedon and commonly are in depressions. Celina and Miamian soils have less clay in the B and C horizons than Glynwood soils.

Typical pedon of Glynwood silt loam, 2 to 6 percent slopes, 2,310 feet south and 1,320 feet west of the northeast corner sec. 10, T. 1 N., R. 7 E. in Salem Township:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; moderate coarse granular structure; friable; common fine roots; neutral; clear smooth boundary.

IIB21t—9 to 14 inches; brown (10YR 4/3) clay loam; few fine distinct grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) mottles; weak fine prismatic structure parting to moderate medium angular and subangular blocky; firm; few very dark gray (10YR 3/1) iron and manganese oxide concretions; thin very patchy dark brown (10YR 3/3) clay films on faces of peds; few fine roots; 2 percent pebbles; neutral; clear smooth boundary.

IIB22t—14 to 20 inches; dark yellowish brown (10YR 4/4) light clay; common medium distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; common very dark gray (10YR 3/1) iron and manganese oxide concretions; thin patchy dark grayish brown (10YR 4/2) clay films on faces of peds; few fine roots; 2 percent pebbles; slightly acid; clear smooth boundary.

IIB3t—20 to 30 inches; brown (10YR 5/3) clay loam; common medium distinct grayish brown (10YR 5/2) mottles; weak medium coarse subangular blocky structure; firm; common very dark grayish brown (10YR 3/2) clay films on faces of peds and fillings in root channels; 5 percent pebbles; neutral and grading to mildly alkaline in the lower part; clear wavy boundary.

IIC1—30 to 42 inches; yellowish brown (10YR 5/4) clay loam; few fine distinct grayish brown (10YR 5/2) mottles; massive; firm; few very dark gray (10YR 3/1) iron and manganese oxide concretions; some very dark grayish brown (10YR 3/2) organic fillings in channels; few discontinuous lenses of loam, 1 or 2 inches thick, occurring every 6 to 8 inches; few light gray (10YR 7/1) limestone fragments; 10 percent pebbles; strong effervescence; moderately alkaline; gradual wavy boundary.

IIC2—42 to 60 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct dark grayish brown (10YR 4/2) mottles; massive; firm; many light gray (10YR 7/1) lime streaks; 10 percent pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 22 to 36 inches. The depth to free carbonates ranges from 16 to 32 inches. In severely eroded areas it is less than 10 inches. Reaction is neutral to medium acid in the upper part and neutral to mildly alkaline in the lower part. In most pedons the B3 horizon has free carbonates. The solum is 2 to 10 percent coarse fragments below the A horizon.

The Ap horizon is dark grayish brown (10YR 4/2) or brown (10YR 4/3). In wooded areas there is a very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2) A1 horizon 3 to 5 inches thick and a light brownish gray (10YR 6/2) A2 horizon 4 to 6 inches thick. The A horizon is typically silt loam. In severely eroded areas, it is clay loam.

The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is silty clay loam, clay loam, silty clay, or clay.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. It is clay loam or silty clay loam that is 5 to 15 percent coarse fragments.

Medway series

The Medway series consists of moderately well drained soils on flood plains. These soils formed in medium textured alluvial deposits. Permeability is moderate. The slope is 0 to 2 percent.

Medway soils are commonly adjacent to the Algiers, Eel, Genesee, and Shoals soils. Algiers soils have a buried dark colored A horizon within 40 inches. Genesee, Eel, and Shoals soils do not have a mollic epipedon.

Typical pedon of Medway silt loam, occasionally flooded, 2,480 feet east and 1,160 feet north of the southwest corner sec. 31, T. 2 N., R. 7 E., Franklin Township:

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam; weak medium granular structure; friable; common roots; neutral; clear smooth boundary.

A12—10 to 18 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine and medium subangular blocky structure; friable; common roots; neutral; clear smooth boundary.

B2—18 to 30 inches; dark brown (10YR 4/3) silt loam; many fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; few dark gray (10YR 4/1) coatings on faces of peds; few roots; 5 percent pebbles; mildly alkaline; clear wavy boundary.

C1—30 to 40 inches; grayish brown (2.5Y 5/2) loam; many medium distinct olive brown (2.5Y 4/4) mottles; massive; friable; 10 percent pebbles; slight effervescence; mildly alkaline; clear wavy boundary.

C2—40 to 60 inches; grayish brown (10YR 5/2) sandy loam; common medium distinct yellowish brown (10YR 5/4) mottles; massive; very friable; 10 percent pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 28 to 36 inches. Thickness of the mollic epipedon ranges from 16 to 24 inches. The solum is neutral or mildly alkaline. Some pedons have free carbonates throughout.

The A horizon is very dark gray (10YR 3/1) to dark brown (10YR 3/3).

The B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is silt loam or loam. Some pedons have thin subhorizons of clay loam or sandy clay loam.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 6. It is loam, silt loam, sandy loam, light silty clay loam, or light clay loam. Stratified sand and gravel is common below a depth of 40 inches.

Miamian series

The Miamian series consists of well drained soils on uplands. These soils formed in calcareous medium textured till. Permeability is moderately slow. The slope is 2 to 50 percent.

Miamian soils, commonly adjacent to Brookston, Celina, Crosby, and Eldean soils are similar to Eldean, Glynwood, Milton, and Morley soils. Brookston soils have a mollic epipedon and are in depressions. Celina and Crosby soils have low chroma in the upper 10 inches of the argillic horizon. Eldean soils have sandy or sandy-skeletal material within a depth of 40 inches. Glynwood and Morley soils have more clay in the B and C horizons than Miamian soils. Milton soils are underlain by limestone bedrock at 20 to 40 inches.

Typical pedon of Miamian silt loam, 2 to 6 percent slopes, 265 feet east and 265 feet south of the northwest corner sec. 21, R. 13, T. 2, Perry Township:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; weak fine and medium granular structure; friable; few fine roots; slightly acid; abrupt smooth boundary.

IIB1t—9 to 11 inches; brown (10YR 4/3) silty clay loam; weak medium subangular blocky structure; firm; few fine roots; thin patchy clay films on faces of peds; 2 percent pebbles; slightly acid; clear smooth boundary.

IIB21t—11 to 14 inches; dark yellowish brown (10YR 4/4) heavy clay loam; moderate medium subangular blocky structure; firm; few worm holes and root channels; thin continuous brown (10YR 5/3) clay films on faces of peds; 5 percent pebbles; neutral; clear wavy boundary.

IIB22t—14 to 19 inches; dark yellowish brown (10YR 4/4) clay; weak medium prismatic structure parting to moderate medium subangular blocky; firm; thin continuous brown (10YR 4/3) clay films on faces of peds; 5 percent pebbles; neutral; clear wavy boundary.

IIB3t—19 to 30 inches; yellowish brown (10YR 5/4) clay loam; weak coarse subangular blocky structure; firm; thick continuous very dark grayish brown (10YR 3/2) clay films on faces of peds; 10 percent pebbles; slight effervescence; mildly alkaline; gradual wavy boundary.

IIC—30 to 60 inches; yellowish brown (10YR 5/4) loam; few fine distinct grayish brown (10YR 5/2) mottles; massive; firm; few gray (10YR 6/1) streaks of lime; 10 percent pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. The depth to free carbonates typically ranges from 18 to 38 inches, but in severely eroded areas it is less than 10 inches. The thickness of the loess cap ranges from 0 to 12 inches. The content of coarse fragments ranges from 2 to 10 percent in the solum below the loess. Reaction is medium acid to neutral in the upper part of the solum and mildly alkaline in the lower part. The B3 horizon contains free carbonates in most places.

The Ap horizon is dark grayish brown (10YR 4/2), dark brown to brown (10YR 4/3), or brown (10YR 5/3). In wooded areas, there is a dark gray (10YR 3/1) or black (10YR 2/1) A1 horizon 3 to 4 inches thick and a brown (10YR 5/3) or yellowish brown (10YR 5/4) A2 horizon 4 to 8 inches thick. The A horizon is typically silt loam. In severely eroded areas it is clay loam.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 or 5. It is silty clay loam, clay loam, silty clay, or clay.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. It is loam or silt loam and commonly is 5 to 15 percent coarse fragments.

Milton series

The Milton series consists of moderately deep, well drained soils. These soils formed in glacial till and in material weathered from limestone bedrock. They occupy terraces mostly along the larger streams. Permeability is moderate or moderately slow. The slope is 2 to 6 percent.

Milton soils, commonly adjacent to Eldean and Ockley soils, are similar to Eldean and Miamian soils. Eldean and Ockley soils are underlain by sandy and gravelly material and do not have limestone bedrock within a depth of 40 inches. Miamian soils do not have limestone bedrock within 40 inches.

Typical pedon of Milton silt loam, 2 to 6 percent slopes, 1,122 feet north and 790 feet east of the southwest corner sec. 13, R. 13, T. 1, Orange Township:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; friable; common roots; neutral; abrupt smooth boundary.

B1—9 to 13 inches; brown (10YR 5/3) silt loam; moderate medium subangular blocky structure; firm; common roots; dark grayish brown (10YR 4/2) organic coatings; neutral; clear smooth boundary.

IIB21t—13 to 15 inches; dark yellowish brown (10YR 4/4) light clay loam; moderate to fine subangular blocky structure; thin patchy brown (10YR 5/3) clay films on faces of peds; 2 percent pebbles; neutral; clear smooth boundary.

IIB22t—15 to 22 inches; dark yellowish brown (10YR 4/4) heavy clay loam; strong medium subangular blocky structure; firm; thin continuous brown (10YR 5/3 & 10YR 4/3) clay films on faces of peds; 5 percent pebbles; neutral; clear smooth boundary.

IIB23t—22 to 25 inches; dark yellowish brown (10YR 4/4) clay; moderate fine and medium angular and subangular blocky structure; firm; medium continuous dark grayish brown (10YR 4/2) clay films on faces of peds; 5 percent pebbles; neutral; clear smooth boundary.

IIC—25 to 26 inches; light yellowish brown (10YR 6/4) sandy loam; massive; friable; 2 percent pebbles; strong effervescence; moderately alkaline; abrupt wavy boundary.

IIR—26 to 29 inches; light yellowish brown (10YR 6/4) hard limestone bedrock.

The thickness of the solum and depth to bedrock ranges from 20 to 40 inches. Reaction is slightly acid to neutral in the upper part of the solum and neutral to mildly alkaline in the lower part. The solum is 0 to 5 percent coarse fragments.

The Ap horizon is brown (10YR 4/3) or dark grayish brown (10YR 4/2).

The IIBt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is clay loam, silty clay loam, or clay.

The IIC horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is loam or sandy loam that is 2 to 10 percent coarse fragments.

Some pedons do not have a IIC horizon but have a clay enriched IIB3 horizon 2 to 4 inches thick just above the lithic contact.

Montgomery series

The Montgomery series consists of very poorly drained soils formed in moderately fine textured lacustrine material. These soils occupy depressional areas in slack water terraces. A few occur as depressions in uplands. Permeability is slow or very slow. The slope is 0 to 2 percent.

Montgomery soils, commonly adjacent to Algiers and Pewamo soils, are similar to Patton soils. Algiers soils have a buried dark colored A horizon within a depth of 40 inches. Brookston and Pewamo soils formed in till. Patton soils have less clay in the control section than Montgomery soils.

Typical pedon of Montgomery silty clay loam, 300 feet east and 660 feet north of the southwest corner sec. 18, T. 7 S., R. 7 E., in Jackson Township:

Ap—0 to 10 inches; black (10YR 2/1) silty clay loam; weak medium subangular and angular blocky structure; friable; common fine roots; neutral; abrupt smooth boundary.

A12—10 to 13 inches; very dark gray (10YR 3/1) heavy silty clay loam; common medium distinct grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/4) mottles; moderate fine and medium subangular blocky structure; firm; common fine roots; neutral; clear smooth boundary.

B21g—13 to 20 inches; dark gray (10YR 4/1) silty clay; common fine distinct light olive brown (2.5Y 5/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky and angular blocky; firm; few fine roots; neutral; clear wavy boundary.

B22g—20 to 32 inches; grayish brown (2.5Y 5/2) silty clay; common medium distinct light olive brown (2.5Y 5/4) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky and angular blocky; firm; few fine roots; dark gray (10YR 4/1) krotovinas, 1 to 2 inches in diameter; neutral; becoming mildly alkaline in the lower 4 inches; clear wavy boundary.

B3g—32 to 36 inches; grayish brown (2.5Y 5/2) silty clay; common medium distinct light olive brown (2.5Y 5/4 & 5/6) mottles; weak coarse subangular blocky structure; firm; few fine roots; slight effervescence; mildly alkaline; gradual wavy boundary.

C1g—36 to 58 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium distinct light olive brown (2.5Y 5/4) and olive brown (2.5Y 4/4) mottles; massive; firm; few fine roots; dark gray (10YR 4/1) krotovinas, 1 to 2 inches in diameter; strong effervescence; moderately alkaline; gradual wavy boundary.

C2g—58 to 66 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium distinct light olive brown (2.5Y 5/4) mottles; massive; firm; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 40 inches. Reaction is neutral or mildly alkaline in the upper part of the solum and mildly alkaline in the lower part. The thickness of the mollic epipedon ranges from 12 to 16 inches.

The Ap horizon is black (10YR 2/1), very dark gray (10YR 3/1), or very dark brown (10YR 2/2).

The B2g horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 2 or less. The color range in the B3 horizon is the same as in the B2g horizon. The Bg horizon is typically silty clay or clay but may have thin subhorizons of loam or light clay loam 2 to 4 inches thick.

The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. It is stratified silty clay loam, silty clay, and silt loam. Some pedons have thin subhorizons of fine sandy loam and loam 4 to 8 inches thick below a depth of 40 inches.

Morley series

The Morley series consists of well drained soils formed in calcareous moderately fine textured till of the uplands. Permeability is slow. The slope is 18 to 50 percent or more.

Morley soils, commonly adjacent to Blount, Eldean, Glynwood, and Pewamo soils, are similar to Miamian soils. Blount and Glynwood soils have low chroma within 10 inches of the argillic horizon. Eldean soils have sandy or sandy-skeletal material within a depth of 40 inches. Pewamo soils have a mollic epipedon and are in depressions. Miamian soils have less clay in the B and C horizons than Morley soils.

Typical pedon of Morley silt loam, 25 to 50 percent slopes, 2,045 feet north and 1,200 feet west of the southeast corner sec. 30, T. 10 N., R. 4 E., Cynthian Township:

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam; moderate fine and medium granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

A2—4 to 9 inches; brown (10YR 5/3) silt loam; weak fine and medium subangular blocky structure; friable; few fine roots; slightly acid; clear smooth boundary.

IIB2t—9 to 19 inches; dark yellowish brown (10YR 4/4) heavy silty clay loam; weak medium prismatic structure parting to moderate medium angular blocky and subangular blocky; firm; thin patchy brown (10YR 5/3) clay films on faces of peds; few fine roots; 5 percent pebbles; few very dark gray (10YR 3/1) iron and manganese oxide concretions; medium acid; clear smooth boundary.

IIB3t—19 to 28 inches; dark brown (10YR 4/3) silty clay loam; common fine distinct, grayish brown (10YR 5/2) mottles; moderate medium angular and subangular blocky structure; firm; thin very patchy brown (10YR 5/3) clay films on faces of peds; few fine roots; 2 percent pebbles; slight effervescence; mildly alkaline; gradual wavy boundary.

IIC1—28 to 44 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine distinct grayish brown (10YR 5/2) mottles; weak medium and coarse subangular blocky structure; firm; few fine roots; 5 percent pebbles; strong effervescence; moderately alkaline; gradual wavy boundary.

IIC2—44 to 60 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine distinct grayish brown (10YR 5/2) mottles; massive; firm; 5 percent pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 36 inches. The depth to free carbonates ranges from 16 to 30 inches. Reaction is medium acid in the upper part of the solum and mildly or moderately alkaline in the lower part. In most pedons the B3 horizon has free carbonates.

The A1 horizon is very dark brown (10YR 2/2), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2).

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is heavy clay loam, silty clay loam, or clay that is 2 to 10 percent pebbles.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is clay loam or silty clay loam that is 5 to 15 percent pebbles.

Ockley series

The Ockley series consists of well drained soils formed in silty and loamy glacial outwash. These soils occur on stream terraces bordering the major streams. Permeability is moderate in the upper part and very rapid in the underlying material. The slope is 0 to 3 percent.

Ockley soils are commonly adjacent to Eel variant, Eldean, Milton, and Warsaw variant soils. Eel variant soils have a surface layer of recent alluvium 20 to 30 inches thick. Eldean soils have a solum less than 40 inches thick. Milton soils are underlain by limestone bedrock at depths of 20 to 40 inches. Warsaw soils have a mollic epipedon.

Typical pedon of Ockley silt loam, 0 to 3 percent slopes, 1,780 feet west and 660 feet north of the southeast corner sec. 14, R. 13, T. 1, Orange Township:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; weak fine and medium granular structure; friable; medium acid; abrupt smooth boundary.

B1t—9 to 13 inches; dark brown (10YR 4/3) light silty clay loam; moderate medium subangular blocky structure; firm; thin patchy films on faces of peds; medium acid; clear smooth boundary.

B21t—13 to 18 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; thin patchy clay films on faces of peds; medium acid; gradual smooth boundary.

IIB22t—18 to 26 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine and medium subangular blocky structure; firm; thin patchy clay films on faces of peds; 2 percent gravel; medium acid; clear smooth boundary.

IIB23t—26 to 34 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; firm; thin patchy clay films on faces of peds; 5 percent gravel; medium acid; clear wavy boundary.

IIB24t—34 to 42 inches; dark brown (7.5YR 4/2) clay loam; moderate medium subangular blocky structure; firm; thin patchy clay films on faces of peds; 10 percent gravel; medium acid; clear wavy boundary.

IIB3t—42 to 52 inches; dark brown (7.5YR 3/2) gravelly clay loam; weak coarse subangular blocky structure; firm; medium patchy clay films on faces of peds; 25 percent gravel; 5 percent cobbles; slight effervescence; mildly alkaline; clear wavy boundary.

IIC—52 to 62 inches; yellowish brown (10YR 5/4) very gravelly loamy coarse sand; single grained; loose; 60 percent gravel; 5 percent cobbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 40 to 60 inches. The depth to free carbonates ranges from 36 to 54 inches. The thickness of the silty mantle ranges from 12 to 26 inches. Reaction is medium or slightly acid in the upper part of the solum and neutral or mildly alkaline in the lower part. In most pedons the IIB3 horizon has free carbonates.

The Ap horizon is brown (10YR 4/3) or dark grayish brown (10YR 4/2).

The B2t and IIB2t horizons have hue of 10YR to 5YR, value of 4 or 5, and chroma of 3 or 4. They are clay loam or silty clay loam. The IIB2t horizon is 2 to 10 percent coarse fragments. The IIB3t horizon is gravelly clay loam, gravelly loam, or gravelly sandy clay loam that is 15 to 35 percent coarse fragments.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is very gravelly sand or very gravelly loamy coarse sand.

Odell series

The Odell series consists of somewhat poorly drained soils on uplands. These soils formed in calcareous medium textured till. Permeability is moderately slow. The slope ranges from 0 to 6 percent.

The Odell soils in this county differ from the typical Odell soils. They have yellower hue and higher pH in the B horizon. This difference, however, does not alter use and management.

Odell soils, commonly adjacent to Brookston and Crosby soils, are similar to Crane soils. Brookston soils have dominant low chroma just below the Ap horizon. Crosby soils do not have a mollic epipedon. Crane soils are stratified and have sandy and gravelly material at depths of 40 to 60 inches.

Typical pedon of Odell silt loam, 0 to 2 percent slopes, 2,570 feet west and 1,720 feet south of the northeast corner sec. 14, R. 13, T. 2, Green Township:

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam; weak medium subangular blocky structure parting to moderate fine granular; friable; common fine roots; slightly acid; abrupt smooth boundary.

A3—10 to 17 inches; very dark grayish brown (10YR 3/2) silty clay loam; few medium distinct grayish brown (2.5Y 5/2) mottles; moderate fine and medium angular and subangular blocky structure; firm; few fine roots; neutral; clear smooth boundary.

B21t—17 to 24 inches; olive brown (2.5Y 4/4) clay loam; common fine distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to moderate medium angular and subangular blocky; firm; dark gray (10YR 4/1) organic coatings on 60 percent of faces of peds; thin patchy clay films on faces of peds; few fine roots; 5 percent pebbles; neutral; gradual smooth boundary.

B22t—24 to 31 inches; light olive brown (2.5Y 5/4) clay loam; few fine distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to moderate medium and coarse subangular blocky; firm; dark grayish brown (10YR 4/2) organic coatings on 20 percent of faces of peds; thin, very patchy clay films on faces of peds; few fine roots; 5 percent pebbles; neutral; clear smooth boundary.

B3t—31 to 37 inches; light olive brown (2.5Y 5/4) clay loam; common fine distinct yellowish brown (10YR 5/6) and common medium distinct grayish brown (10YR 5/2) mottles; weak fine and medium subangular blocky structure; slightly firm, thin patchy clay films on faces of peds; few very dark gray (10YR 3/1) iron and manganese oxide concretions; 10 percent pebbles; common light gray (10YR 7/2) limestone ghosts; few brownish yellow (10YR 6/6) shale fragments; slight effervescence; mildly alkaline; clear smooth boundary.

C1—37 to 49 inches; yellowish brown (10YR 5/4) loam; common medium distinct grayish brown (10YR 5/2) mottles; massive; friable; common light gray (10YR 7/1) lime streaks; 5 percent pebbles; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—49 to 60 inches; yellowish brown (10YR 5/4) loam; many medium distinct grayish brown (10YR 5/2) mottles; massive; friable; few light gray (10YR 7/1) lime streaks; few very dark gray (10YR 3/1) iron and manganese oxide concretions; 5 percent pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 42 inches. The depth to free carbonates ranges from 20 to 40 inches. The thickness of the mollic epipedon ranges from 12 to 18 inches. Reaction is slightly acid or neutral in the upper part of the solum and neutral or mildly alkaline in the lower part. In most pedons the B2 horizon has free carbonates. The solum typically is 2 to 5 percent coarse fragments in the upper part and 5 to 10 percent in the lower part.

The A horizon is very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2) or very dark brown (10YR 2/2).

The B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 or 4. It is heavy loam or clay loam.

The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 4. It is loam or silt loam that is 5 to 15 percent coarse fragments.

Patton series

The Patton series consists of very poorly drained soils formed in medium textured lacustrine material. These soils are in depressional areas in uplands and slack water terraces. Permeability is moderate. The slope is 0 to 2 percent.

Patton soils, commonly adjacent to Algiers, Pewamo, and Wallkill soils, are similar to Brookston and Montgomery soils. Algiers soils have a buried dark colored A horizon within a depth of 40 inches. Brookston and Pewamo soils formed in till. Wallkill soils are underlain by organic material at depths of 20 to 30 inches. Montgomery soils have more clay in the control section than Patton soils.

Typical pedon of Patton silty clay loam, 1,250 feet west and 1,320 feet south of the northeast corner sec. 32, R. 13, T. 2, Orange Township:

Ap—0 to 10 inches; very dark gray (10YR 3/1) silty clay loam; weak coarse subangular blocky structure parting to moderate medium granular; friable; common fine roots; few worm holes and castings; neutral; abrupt smooth boundary.

B21g—10 to 15 inches; dark gray (5Y 4/1) silty clay loam; common medium distinct yellowish brown (10YR 5/8) mottles; moderate fine and medium angular blocky structure; firm; few fine roots; few very dark gray (10YR 3/1) krotovinas, about 1 inch in diameter; neutral; clear smooth boundary.

B22g—15 to 21 inches; gray (5Y 5/1) silty clay loam; common medium distinct yellowish brown (10YR 5/8) mottles; moderate medium and fine angular blocky structure; firm; few very dark gray (10YR 3/1) krotovinas, about 1 inch in diameter; neutral; gradual wavy boundary.

B23g—21 to 27 inches; gray (5Y 5/1) silty clay loam; common medium distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; neutral; gradual wavy boundary.

B3g—27 to 37 inches; gray (5Y 5/1) light silty clay loam; many medium distinct yellowish brown (10YR 5/8) mottles; weak medium and coarse subangular blocky structure; firm; slight effervescence; mildly alkaline; gradual wavy boundary.

C1g—37 to 46 inches; gray (5Y 5/1) silt loam; many coarse prominent yellowish brown (10YR 5/8) mottles; massive; friable; strong effervescence; moderately alkaline; clear wavy boundary.

C2g—46 to 60 inches; gray (5Y 6/1) stratified silt loam and light silty clay loam; many coarse prominent yellowish brown (10YR 5/6 & 5/8) mottles; massive; friable; laminated very fine sand and silt; 2 mm thick; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 26 to 40 inches. Reaction is neutral or mildly alkaline in the upper part of the solum and neutral to moderately alkaline in the lower part. Most pedons have free carbonates in the lower part.

The Ap horizon is very dark grayish brown (10YR 3/2), very dark gray (10YR 3/1), or very dark brown (10YR 2/2).

The B2g horizon has hue of 5Y or 2.5Y, value of 4 to 6, and chroma of 2 or less. The Bg horizon is commonly silty clay loam but in places has thin subhorizons of silty clay and silt loam.

The C horizon has hue of 2.5Y or 5Y, value of 5 or 6, and chroma of 1 or 2. It is typically stratified silt loam and silty clay loam and in places has subhorizons of fine sand and silt less than 2 inches thick.

Pewamo series

The Pewamo series consists of very poorly drained soils. These soils are in depressions and drainageways of the uplands. Pewamo soils formed in calcareous clay loam or silty clay loam till. Permeability is moderately slow. The slope is 0 to 2 percent.

Pewamo soils, commonly adjacent to Blount, Glynwood, Montgomery, Morley, and Patton soils, are similar to Brookston soils. Blount, Glynwood, and Morley soils do not have a mollic epipedon. Montgomery and Patton soils are stratified and formed in lacustrine sediment. Brookston soils have less clay in the B and C horizons than Pewamo soils.

Typical pedon of Pewamo silty clay loam, 2,575 feet west and 493 feet south of the northeast corner sec. 3, T. 7 S., R. 7 E., Jackson Township:

Ap1—0 to 7 inches; very dark gray (10YR 3/1) silty clay loam; moderate medium subangular blocky and moderate medium granular structure; friable, hard when dry; common fine roots; neutral; clear smooth boundary.

Ap2—7 to 10 inches; very dark gray (10YR 3/1) and dark gray (5Y 4/1) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; very weak coarse subangular blocky structure becoming massive in the lower part (plow pan); firm, hard when dry; 1 to 2 percent pebbles; common fine roots; few fine faint very dark gray (10YR 3/1) iron and manganese oxide concretions; neutral; abrupt smooth boundary.

B21tg—10 to 15 inches; dark gray (5Y 4/1) heavy silty clay loam; common fine distinct dark yellowish brown (10YR 4/4) and few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate coarse subangular and angular blocky; firm; common fine roots; thin patchy clay films on faces of peds and coatings around root channels and voids; 2 percent pebbles; common fine very dark gray (10YR 3/1) iron and manganese oxide concretions; neutral; clear smooth boundary.

B22tg—15 to 21 inches; dark gray (5Y 4/1) silty clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; firm; moderate medium prismatic structure parting to weak medium angular and subangular blocky; firm; few fine roots; thin patchy clay films around root channels and voids; some dark gray (5Y 4/1) coatings on faces of peds; 2 percent pebbles; common fine very dark gray (10YR 3/1) iron and manganese oxide concretions; neutral; clear wavy boundary.

B23tg—21 to 26 inches; gray (5Y 5/1) silty clay; many medium dark yellowish brown (10YR 4/4) and few fine prominent yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate fine and medium angular blocky and subangular blocky; firm; thin patchy clay films in voids and some faces of peds; few fine roots; common dark gray (5Y 4/1) krotovinas, 1 inch in diameter; some gray (5Y 5/1) and dark gray (5Y 4/1) coatings on faces of peds; 2 percent pebbles; common fine very dark gray (10YR 3/1) iron and manganese oxide concretions; neutral; gradual smooth boundary.

B24tg—26 to 38 inches; gray (5Y 5/1) silty clay; many medium prominent dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium and coarse subangular blocky; firm; thin patchy clay films in voids and faces of peds; few fine roots; common dark gray (5Y 4/1) krotovinas, 1 inch in diameter; some gray (5Y 5/1) and dark gray (5Y 4/1) coatings on faces of peds; 2 percent pebbles; neutral; gradual smooth boundary.

B3—38 to 44 inches; gray (5Y 5/1) clay loam; many medium prominent dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; few fine roots; common dark gray (10YR 4/1) krotovinas, 1 inch in diameter; some gray (5Y 5/1) coatings on faces of peds; many light gray (10YR 7/2) limestone ghosts; 15 percent limestone pebbles; slight effervescence; mildly alkaline; gradual smooth boundary.

C1—44 to 50 inches; brown (10YR 4/3) clay loam; many medium prominent gray (5Y 5/1) and few fine prominent yellowish brown (10YR 5/6) mottles; very weak coarse subangular blocky structure; firm; few root channels; common dark gray (5Y 4/1) krotovinas, 1 inch in diameter; some gray (5Y 5/1) coatings on faces of peds; 15 percent coarse fragments, mostly limestone; slight effervescence; mildly alkaline; gradual smooth boundary.

C2—50 to 60 inches; brown (10YR 4/3) clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; very weak coarse subangular blocky structure becoming massive in lower part; firm; common dark gray (5Y 4/1) krotovinas, 2 inches in diameter; some gray (5Y 5/1) coatings on faces of peds; few limestone ghosts; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 28 to 70 inches. Reaction is slightly acid or neutral in the upper part of the solum and neutral or mildly alkaline in the lower part. In most pedons the B3 horizon has free carbonates. The solum is 2 to 15 percent coarse fragments.

The A horizon is silt loam or silty clay loam. It is very dark grayish brown (10YR 3/2) or very dark gray (10YR 3/1). Some pedons have an A12 horizon.

The B2 horizon has hue of 5Y, 2.5Y, or 10YR; value of 4 to 6; and chroma of 1 or 2. It is silty clay loam, clay loam, silty clay, or clay. Some pedons do not have a B3 horizon.

The C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 2 to 4. It is silty clay loam or clay loam that is 5 to 15 percent coarse fragments.

Shoals series

The Shoals series consists of somewhat poorly drained soils on flood plains. These soils formed in medium textured alluvial deposits. Shoals soils occur in areas next to the smaller streams. Permeability is moderate. The slope is 0 to 2 percent.

The Shoals soils in this county differ from the typical Shoals soils. They have carbonates throughout the control section and are dominantly mildly alkaline in the surface layer. This difference, however, does not alter use and management.

Shoals soils, commonly adjacent to Algiers, Eel, Genesee, Medway, and Wallkill soils, are similar to Algiers soils. Algiers soils have a buried dark colored A horizon within a depth of 40 inches. Eel soils have dominant high chroma in the upper 20 inches. Genesee soils do not have low chroma in the upper 20 inches. Medway soils have a mollic epipedon. Wallkill soils have organic material at depths of 20 to 30 inches.

Typical pedon of Shoals silt loam, occasionally flooded, 600 feet east and 300 feet north of the center sec. 5, R. 12, T. 1, Orange Township:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; friable; common fine roots; mildly alkaline; abrupt smooth boundary.

C1g—8 to 18 inches; dark grayish brown (2.5Y 4/2) silt loam; many medium distinct brown (10YR 4/3) mottles; weak fine and medium subangular blocky structure; friable; common fine roots; 2 percent pebbles; slight effervescence; moderately alkaline; clear wavy boundary.

C2g—18 to 28 inches; dark grayish brown (2.5Y 4/2) silt loam; many medium distinct brown (10YR 5/3) mottles; weak medium subangular blocky structure; friable; few fine roots; 5 percent pebbles; strong effervescence; moderately alkaline; abrupt wavy boundary.

C3—28 to 45 inches; grayish brown (2.5Y 5/2) loam; common medium prominent yellowish brown (10YR 5/6) mottles; massive; friable; 10 percent pebbles; strong effervescence; moderately alkaline; abrupt wavy boundary.

IIC4—45 to 60 inches; pale brown (10YR 6/3) sandy loam; few fine faint light yellowish brown (10YR 6/4) mottles; single grained; loose; strong effervescence; moderately alkaline.

Reaction is mildly alkaline or moderately alkaline in the upper 40 inches. Most pedons have free carbonates throughout.

The Ap horizon is typically dark grayish brown (10YR 4/2) but in places is grayish brown (10YR 5/2).

The C horizon to a depth of 40 inches has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or 3. It is 2 to 15 percent pebbles. Above 40 inches the C horizon is loam, silt loam, and sandy loam. Below 40 inches it is commonly stratified with medium sand and fine gravel.

Stonelick series

The Stonelick series consists of well drained soils on flood plains. These soils formed in loamy and sandy alluvial deposits in areas next to the larger streams. Permeability is moderately rapid. The slope is 0 to 2 percent.

The Stonelick soils in this county differ from the typical Stonelick soils. They are more than 20 percent coarse fragments in the control section. This difference, however, does not alter the use and management.

Stonelick soils are commonly adjacent to Eel and Genesee soils. Eel and Genesee soils do not have a coarse-loamy texture in the control section.

Typical pedon of Stonelick sandy loam, occasionally flooded, 1,480 feet east and 800 feet south of the northwest corner sec. 34, R. 13, T. 2, Perry Township:

A1—0 to 8 inches; very dark grayish brown (10YR 3/2) sandy loam; weak very fine granular structure; very friable; 5 percent gravel; common fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

C1—8 to 12 inches; brown (10YR 4/3) gravelly loamy coarse sand; single grained; loose; 20 percent gravel; common fine roots; few shell fragments; strong effervescence; moderately alkaline; abrupt smooth boundary.

C2—12 to 26 inches; brown (10YR 4/3) sandy loam; massive; very friable; 5 percent gravel; few fine roots; common shell fragments; strong effervescence; moderately alkaline; abrupt wavy boundary.

C3—26 to 35 inches; brown (10YR 4/3) gravelly coarse sand; single grained; loose; 40 percent gravel; few fine roots; few shell fragments; strong effervescence; moderately alkaline; abrupt wavy boundary.

C4—35 to 66 inches; brown (10YR 4/3) very gravelly coarse sand; single grained; loose; 55 percent gravel; 10 percent cobbles; few boulders; strong effervescence; moderately alkaline.

The thickness of the A horizon ranges from 6 to 9 inches. Reaction is mildly or moderately alkaline in the upper 40 inches. Most pedons have free carbonates throughout. The content of coarse fragments ranges from 2 to 20 percent in the upper horizons and from 35 to 60 percent below depths of 20 to 30 inches.

The A horizon is very dark grayish brown (10YR 3/2) or very dark gray (10YR 3/1).

The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is commonly gravelly sandy loam to very gravelly coarse sand below a depth of 20 inches.

Wallkill series

The Wallkill series consists of very poorly drained soils that have a mineral surface layer underlain by muck. These soils occur in depressional areas in stream terraces and moraines. The muck formed in wet areas as the result of partial decomposition of plants. The overlying mineral material was washed from the nearby uplands. Permeability is moderate in the mineral part of the soil and rapid or moderately rapid in the underlying muck. The slope is 0 to 2 percent.

The Wallkill soils in this county differ from the typical Wallkill soils. They contain more silt and less sand in the B horizon. This difference, however, does not alter use and management.

Wallkill soils, commonly adjacent to Algiers, Carlisle, Patton, and Shoals soils, are similar to Algiers soils. Algiers soils have a dark colored A horizon within a depth of 40 inches. Carlisle soils do not have mineral upper layers. Patton soils have a mollic epipedon. Shoals soils have no organic material within the control section.

Typical pedon of Wallkill silty clay loam, 1,320 feet north and 600 feet east of the southwest corner sec. 36, T. 6 S., R. 7 E., Jackson Township:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate medium granular structure; friable; common fine roots; neutral; clear smooth boundary.

A12—9 to 14 inches; dark grayish brown (10YR 4/2) silty clay loam; weak coarse subangular blocky structure; friable; few fine roots; patchy very dark gray (10YR 3/1) coatings on faces of peds; neutral; clear wavy boundary.

Bg—14 to 22 inches; very dark grayish brown (10YR 3/2) silty clay loam; few fine faint brown (10YR 5/3) mottles; moderate medium subangular blocky structure; firm; common pores; 10 to 15 percent black (N 2/0) mucky silty clay loam intermixed; neutral; abrupt smooth boundary.

IIOa1—22 to 36 inches; black (N 2/0) broken face and rubbed sapric material; 10 percent fiber, less than 1 percent rubbed; weak coarse subangular blocky structure; nonsticky when wet; neutral; clear wavy boundary.

IIOa2—36 to 60 inches; black (N 2/0) broken face; very dark brown (10YR 2/2) rubbed sapric material; 30 percent fiber, less than 5 percent rubbed; massive; nonsticky when wet; neutral.

The thickness of the mineral material ranges from 20 to 30 inches. The thickness of the organic layers ranges from 20 to 40 inches or more. Reaction is neutral or mildly alkaline throughout.

The Ap horizon is very dark grayish brown (10YR 3/2), dark brown (10YR 3/3), or dark grayish brown (10YR 4/2).

The Bg horizon has hue of 10YR or 2.5Y, value or 3 or 4, and chroma of 1 or 2. It is commonly silty clay loam, but in a few areas it is heavy silt loam. The organic material is mostly sapric. In a few areas it is hemic below a depth of 30 inches or more. The organic layer is black (N 2/0, 10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). In some pedons the underlying layers have subhorizons of sedimentary peat 4 to 6 inches thick.

Warsaw variant

The Warsaw variant consists of well drained soils formed in loamy glacial outwash material. These soils occur on stream terraces along the major streams. Permeability is moderate or moderately slow in the subsoil and rapid in the underlying material. The slope is 0 to 2 percent.

Warsaw variant soils are commonly adjacent to Casco, Crane, Eldean, and Ockley soils. Casco, Eldean, and Ockley soils do not have a mollic epipedon. Crane soils have a solum more than 40 inches thick.

Typical pedon of Warsaw Variant silt loam, 0 to 2 percent slopes, 2,550 feet east and 1,650 feet north of the southwest corner sec. 16, T. 1 N., R. 7 E., Salem Township:

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine and medium granular structure; friable; many roots; mildly alkaline; clear smooth boundary.

A12—10 to 15 inches; dark brown (10YR 3/3) silt loam; weak fine subangular blocky structure; friable; many roots; mildly alkaline; clear smooth boundary.

B1t—15 to 18 inches; dark yellowish brown (10YR 3/4) silty clay loam; weak and moderate fine and medium subangular blocky structure; slightly firm; common roots; thin patchy very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) coatings on faces of peds; mildly alkaline; clear smooth boundary.

IIB21t—18 to 23 inches; dark brown (7.5YR 4/4) heavy clay loam; moderate fine subangular blocky structure; firm; common roots; thin patchy clay films on faces of peds; 5 percent coarse fragments; mildly alkaline; gradual wavy boundary.

IIB22t—23 to 31 inches; dark brown (7.5YR 4/4) clay; moderate medium subangular blocky structure; firm; thin patchy clay film on faces of peds; 1-inch dark reddish-brown (5YR 3/2) clay at contact with the B3t horizon; 10 percent coarse fragments; mildly alkaline; abrupt wavy boundary.

IIB3t—31 to 39 inches; yellowish brown (10YR 5/4) gravelly clay loam; weak fine and medium subangular blocky structure; friable; thin very patchy clay films on faces of peds and pebbles; 30 percent gravel; 10 percent cobbles; strong effervescence; moderately alkaline; clear wavy boundary.

IIIC—39 to 60 inches; brown (10YR 5/3) and yellowish brown (10YR 5/4) very gravelly loamy coarse sand; single grained; loose; 55 percent gravel; 10 percent cobbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 40 inches. Reaction is neutral or mildly alkaline in the upper part of the solum and mildly alkaline or moderately alkaline in the lower part. In most pedons the IIB3 horizon has free carbonates. The thickness of the mollic epipedon ranges from 12 to 20 inches. The content of coarse fragments increases with increasing depth. It is 2 to 10 percent in the B2t horizon and 10 to 35 percent in the B3t horizon.

The Ap horizon is dark grayish brown (10YR 3/2), very dark brown (10YR 2/2), or very dark gray (10YR 3/1).

The B2t horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 3 or 4. It is heavy clay loam, gravelly clay loam, or clay. In some pedons tongues of the B3t horizon extend 2 to 3 feet into the C horizon.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is very gravelly sand or very gravelly loamy coarse sand.

Formation of the soils

This section describes the factors of soil formation and the processes affecting soil formation as they relate to the formation of soils in Shelby County.

Factors of soil formation

Soil is a complex mixture of weathered rocks, minerals, organic matter, water, and air in varying proportions. The characteristics of the soil at any given point depend on the interrelationships of five factors (*7*) (1) the physical and mineralogical composition of the parent material; (2) the climate under which the parent material has accumulated and formed into soil; (3) the living organisms, or biology, in and on the soil; (4) the topography, or form of the land; and (5) the length of time that the soil has developed by combined activity of soil forming factors. Because different factors are dominant from place to place, many kinds of soil have formed.

Parent material

Parent material is the unconsolidated mass of material from which a soil develops. Most of the soils in Shelby County formed in glacial till of Wisconsin age. The content of calcium carbonate in the till ranges from 25 to 45 percent. In most places the till is thick, but in a few places it is thin over bedrock. The Miamian, Celina, Crosby, and Brookston soils, for example, formed in thick deposits of till and are deep over bedrock. The Milton soils formed in thin deposits of till and are moderately deep over limestone bedrock.

Some soils in this county formed in glacial outwash that contains much sand and gravel. The Eldean and Warsaw variant soils are examples. In most places these soils are good sources of sand and gravel. In some places the coarse textured outwash has been covered with silty and loamy deposits. In these places the Ockley soils formed.

The soils on flood plains formed in material that washed from nearby uplands. These soils have very little profile development. Genesee, Eel, and Shoals soils are examples.

Climate

The climate of Shelby County is of the humid, temperate, continental type. It has been favorable for physical and chemical weathering and for biological activity.

Rainfall supplies adequate percolating water to leach carbonates to moderate depths, for example, in the Miamian, Celina, and Crosby soils. Frequent rains have produced wet and dry cycles that favor translocation of clay minerals and formation of soil structure. Miamian and Eldean soils are examples.

Temperature has favored physical and chemical weathering. Freezing and thawing has aided in the development of soil structure. The warm summers have favored chemical weathering of primary minerals.

Both rainfall and temperature have been favorable for plant growth and the subsequent accumulations of organic matter in the soil.

For additional information on the climate, see "General nature of the county."

Living organisms

At the time of settlement the vegetation in Shelby County was hardwood forest. Beech, maple, oak, hickory, and ash were the most abundant. Grassy clearings identified the better drained sites, and marshy openings the poorly drained swales.

Soils that formed under trees are acid and moderately fertile. They include Miamian, Crosby, and Blount soils. The better drained grassy clearings have dark, less acid, and more fertile soils. Examples are the Odell soils. The marshy swales are very poorly drained, dark, fertile soils, such as Brookston, Pewamo, and Montgomery soils.

Small animals, insects, worms, and roots form channels that make the soil permeable. Animals mix the soil material and contribute organic matter. Worm channels or casts are plentiful in the highly organic surface layer of Warsaw variant and Odell soils. Crawfish channels are common in the more poorly drained soils, such as Brookston, Pewamo, and Montgomery soils.

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Topography

Many of the differences in soils in this county are caused by differences in topography. For example, Miamian, Celina, and Crosby soils formed under similar conditions, except for natural drainage. Natural drainage depends mostly on topography. The well drained Miamian soils occupy areas where surface and internal drainage are good. The moderately well drained Celina soils are in areas of more gentle topography where the water table is seasonally high for brief but significant periods. The somewhat poorly drained Crosby soils are mainly level or nearly level and have slow surface runoff. They have a seasonal high water table for significant periods.

The poorly drained or very poorly drained soils in Shelby County are level to nearly level and occur mainly in depressional areas. In these areas runoff is slow to ponded and silty and clayey material accumulates. Because organic matter decomposes slowly in wet soils, most poorly drained and very poorly drained soils have a thick, dark colored surface layer. Examples are Pewamo, Brookston, and Montgomery soils. The muck soils, such as Carlisle, have accumulated in swampy, depressional areas where the soil material is saturated most of the time.

Of the soils in the same series, those having steeper slopes are generally thinner than those having more gentle slopes, as a result of more rapid runoff and greater erosion on the steeper soils.

Time

Time is needed to produce the effects of the other soil-forming factors. The age of a soil is indicated to some extent by the degree of development of its profile. In many places, however, factors other than time have been responsible for most of the differences in kind and distinctness of horizons in the different soils. If the parent material weathers slowly, the profile develops slowly. If slopes are steep, so that soil is removed almost as fast as it forms, distinct horizons are not developed.

Most soils in the county have well-formed profiles. Examples are the Miamian, Eldean, Celina, and Crosby soils. On the flood plains, however, frequent deposits of fresh sediment periodically interrupt the soil forming process. Eel and Genesee are examples of soils on flood plains in which horizons below the surface layer are not well developed.

Processes of soil formation

The factors of soil formation previously mentioned largely control or influence four soil-forming processes; additions, losses, transfers, and alterations. Some of the processes promote differences within a soil; whereas, others retard or preclude differences.

In this region the most evident addition to the soil is that of organic matter. Soils that have formed under deep-rooted grasses, or where a high water table has restricted decomposition of organic matter, have the deep, dark colored surface horizon of the Brookston or Montgomery soils.

Some organic matter accumulates as a thin surface mat in most of the soils. This dark layer is generally obliterated by cultivation. Severe erosion may remove all evidence of this addition to the soil profile.

The Montgomery, Brookston, and Pewamo soils are seasonally waterlogged and continually accumulate bases through additions brought in by the ground water. In these soils the additions of bases are generally greater than the losses. The Medway, Shoals, Eel, and Genesee soils periodically receive additions of soil material from floodwater. Additions of lime and fertilizer to cultivated areas counteract, or may even exceed, normal losses of plant nutrients.

Leaching of carbonates from calcareous parent material is one of the most significant losses that preceded many other chemical changes in the solum. Most of the glacial till in Shelby County has a high carbonate content—25 to 45 percent.

In most of the soils leaching has removed carbonates to a depth of 2 feet or more. Thus, the upper 2 feet of most soils is acid. Other minerals in the soil are subjected to the same chemical weathering, but their resistance is higher and removal is slower. The alteration of minerals, such as biotite and feldspar, followed the removal of carbonates. This alteration results in changes of color within the profile. Free iron oxides are produced that are segregated by a fluctuating high water table to produce gray colors and mottling, for example in the Brookston and Pewamo soils. If a seasonal high water table does not occur within the profile, brownish colors with stronger chroma or redder hue than those of the C horizon develop.

Seasonal wetting and drying of the soil is largely responsible for the transfer of clay from the A horizon to ped surfaces in the B horizon. The fine clay becomes suspended in percolating water that moves through the surface layer and is carried by the water to the subsoil. The fine clays are deposited on ped surfaces by drying or by precipitation caused by free carbonates. The transfer or fine clay accounts for the clay coating on ped surfaces in the B horizon of such soils as the Eldean, Celina, and Miamian.

Transformations of mineral compounds occur in most soils. The result is most apparent if the development of horizons is not affected by rapid erosion or by accumulation of material at the surface. The primary silicate minerals are weathered chemically to produce secondary minerals, mainly those of the layer-lattice silicate clays. Most of the layer-lattice clays remain in the soil profile but are transferred from upper soil horizons in the profile to deeper horizons.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

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.

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	More than 9

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

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.

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 coat, clay skin.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Complex, soil. A mapping unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

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.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

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 for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Erosion. The wearing away of the land surface by running 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 a bare surface.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Favorable. Favorable soil features for the specified use.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on 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. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the assorted and unassorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by melt water as it flows from glacial ice.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

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.

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.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:
O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.
A horizon.—The mineral horizon, formed or forming 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.
A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.
B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks 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 from which the solum is presumed to have 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.

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.

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.

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.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Moderately fine textured (moderately heavy 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. Types are terminal, lateral, medial, and ground.

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 mixed with mineral soil material. The content of organic matter is more than 20 percent.

Munsell notation. A designation of color by degrees of the three single 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.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by water that originated mainly from the melting of glacial ice. Glacial outwash is commonly in valleys on landforms known as valley trains, outwash terraces, eskers, kame terraces, kames, outwash fans, or deltas.

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.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the 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 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

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 a semisolid to a plastic state.

Poorly graded. Refers to soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets. Surface or subsurface drainage outlets difficult or expensive to install.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree 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

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

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.

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.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

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.

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.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature 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 other plant and animal life characteristics of the soil are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use or management.

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, silt loam, 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."

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Well graded. Refers to a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

ILLUSTRATIONS

Figure 1.—Blount soils are well suited to general farming. They support all crops commonly grown in the county.

Figure 2.—Eel soils are subject to flooding.

Figure 3.—Farm pond in an area of Glynwood soils. These soils provide a good site.

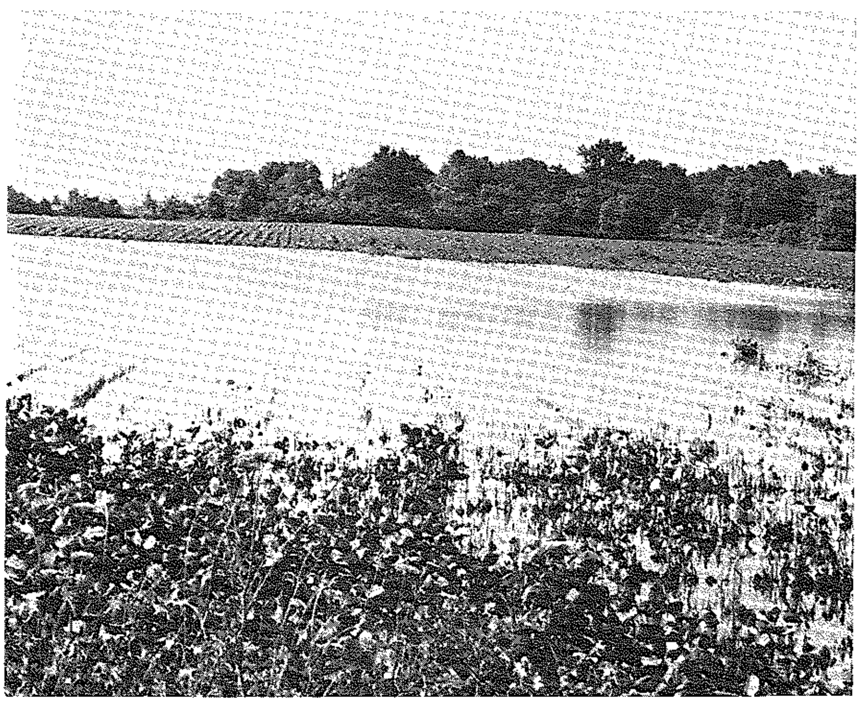

Figure 4.—Areas of Patton soils are subject to ponding.

Figure 5.—Shoals soils are subject to stream flooding.

Figure 6.—This drainage ditch, constructed in an area of Pewamo soil, provides outlets for subsurface drains. A well managed plant cover protects the ditch from erosion.

Figure 7.—Glynwood soils are suitable for foundations. When not protected by vegetation, these soils erode easily.

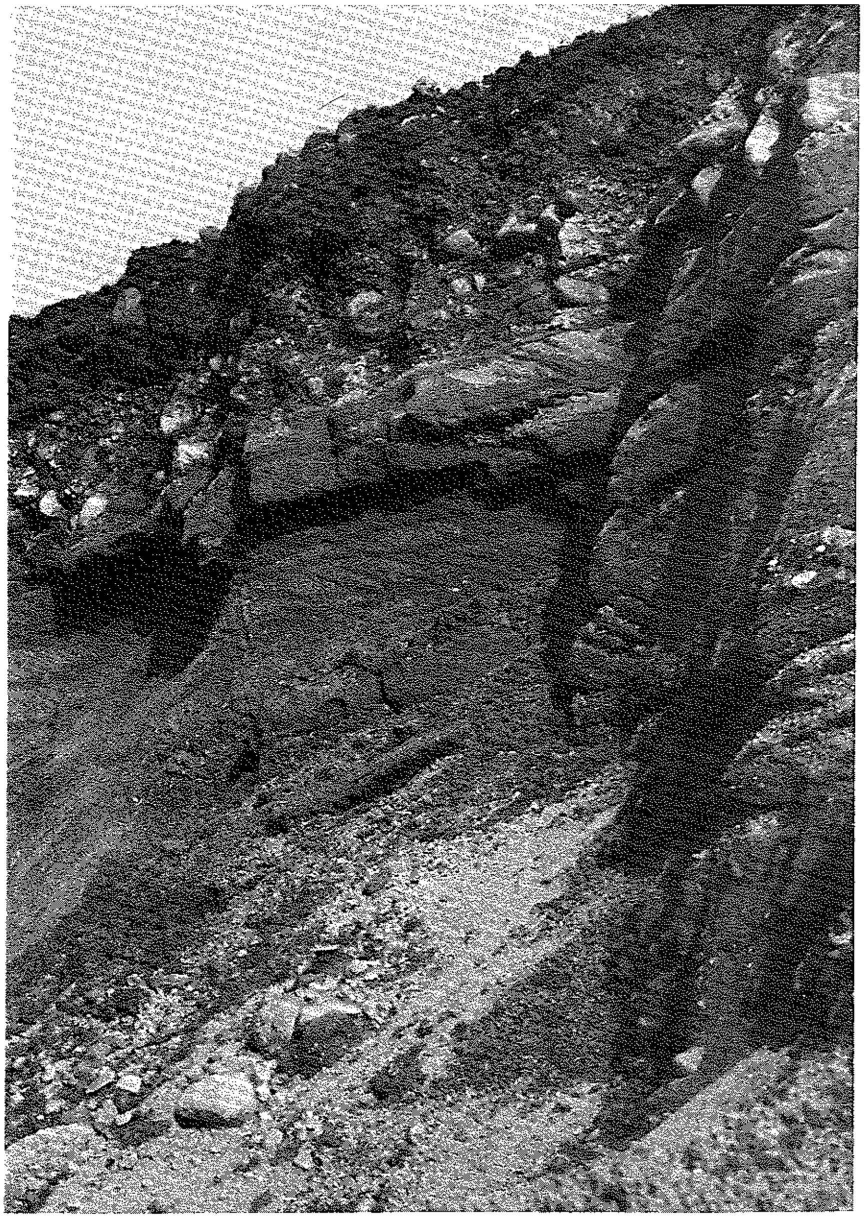

Figure 8.—The Casco soils are underlain by stratified sandy and gravelly material.