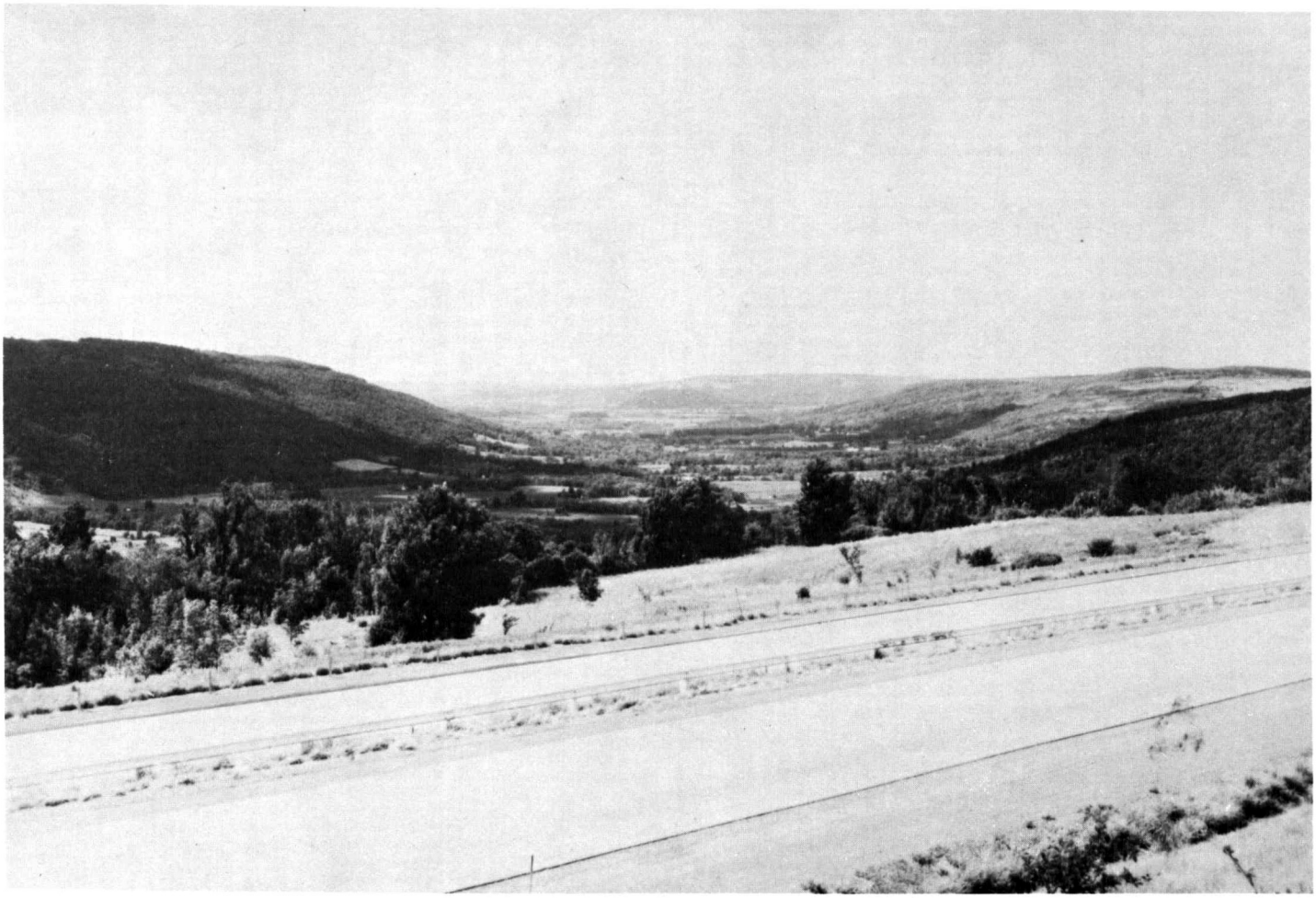
SOIL SURVEY OF

Onondaga County, New York



United States Department of Agriculture
Soil Conservation Service
In cooperation with
Cornell University Agricultural
Experiment Station

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.

Major fieldwork for this soil survey was completed in the period 1945-71. Soil names and descriptions were approved in 1973. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1972. This survey was made cooperatively by the Soil Conservation Service and the Cornell University Agricultural Experiment Station. It is part of the technical assistance furnished to the Onondaga County Soil and Water Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures, and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Onondaga County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the woodland group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and the woodland groups.

Foresters and others can refer to the section "Use of the Soils for Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and recreation areas in the section "Town and Country Planning."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation, Morphology, and Classification of the Soils."

Newcomers in Onondaga County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication and in the section "General Nature of the County."

Cover: Onondaga Valley northwest of Interstate 81. According to a well-publicized hoax, the "Cardiff Giant" was buried in the valley near the center of the picture, in Teel silt loam.

Contents

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SOIL SURVEY OF ONONDAGA COUNTY, NEW YORK

BY FRANK Z. HUTTON, JR., AND C. ERWIN RICE, SOIL CONSERVATION SERVICE[1]

UNITED STATES DEPARTMENT OF AGRICULTURE IN COOPERATION WITH CORNELL UNIVERSITY AGRICULTURAL EXPERIMENT STATION

ONONDAGA COUNTY is near the geographical center of New York State at the eastern edge of the Finger Lakes region (fig. 1). The county is bounded on the north by Oswego County. Oneida

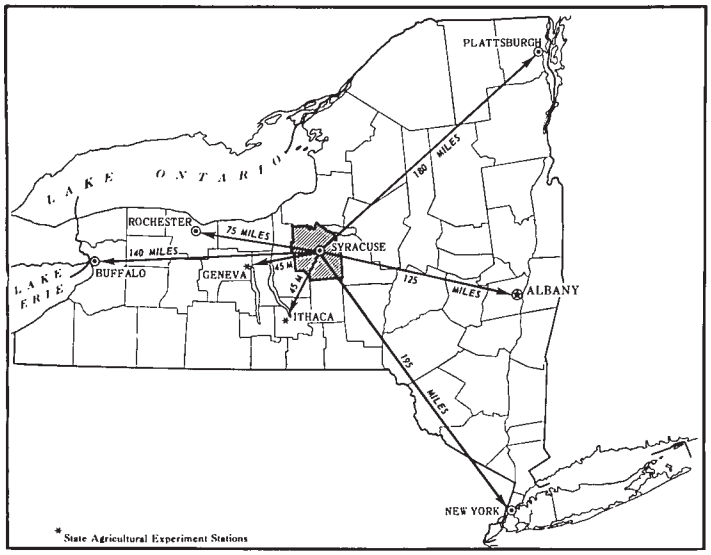

Figure 1.—Location of Onondaga County in New York.

Lake, Oneida River, and Oswego River make up most of this northern boundary. The county is bounded on the south by Cortland County, on the east by Madison County, and on the west by Cayuga County. Onondaga county has a nearly square shape. It is about 34 miles long from north to south and about 30 miles wide from east to west. The total land area is 507,840 acres or 793.5 square miles. The population is 472,835. Syracuse, the county seat, has a population of 197,297 and is centrally located in the county. It is the most important industrial service and transportation center of central New York. Most of the people in the county, as well as many from the surrounding counties, make their living in Syracuse.

The Onondaga Limestone Escarpment divides the county into two physiographic regions—the Erie-Ontario Plain in the northern half and the Allegheny Plateau in the south. Most of the drainage in the county is north into Lake Ontario. Part of the southern quarter of the county drains south into the Susquehanna River.

Onondaga County has a humid, continental climate, somewhat modified by the Great Lakes. Summers are pleasantly warm, but winters are long, cold, and snowy. Syracuse has an average snowfall of 109 inches per year. This is the largest annual snowfall for any metropolitan area of more than 200,000 population in the United States, and results from a strong influence by Lake Ontario on the winter weather.

About 40 percent of the acreage of the county is farmed. Dairying is the principal type of farming, and much of the acreage is in crops used to feed dairy cattle. Grain corn, winter wheat, and other grain crops are also important. Truck crops for local consumption are grown mainly on the sand and gravel or muck soils in the northern part of the county. Most of the 2,000 acres of apple orchards are in the south-central part of the county near Cardiff. The apple crops are sold mainly on the local markets.

About 33 percent of the acreage of the county is the forest (*11*).[2] Although much of this acreage is in small scattered woodlots, several thousand acres in the high hill section near the southern edge of the county are in natural forest and reforested areas, most of which is owned by the county or State. Although 33 percent of the acreage of the county is forested, approximately 31 percent, or 161,700 acres, is commercial forest (*5*). Brushland accounts for 13 percent. The remaining 14 percent includes the city of Syracuse and some villages.

The dominant soils in Onondaga County derived from glacial deposits containing varying amounts of limestone, shale, and sandstone. For the most part these soils are deep, gently sloping to moderately sloping, and medium textured. They are mainly well drained or moderately well drained and are medium to high in content of lime. The dominant soils that formed in glacial till are the well-drained Honeoye and moderately well drained Lima soils, high in content of lime, on the northern lower foothill edge of the Allegheny Plateau; the well-drained Lansing and moderately well drained Conesus soils medium in content of lime; and the moderately well drained Mardin and somewhat poorly drained Volusia soils that are low in content of lime to acid, at the higher elevations on the Allegheny Plateau. On the Erie-Ontario Plain, the dominant soils that formed in glacial till are the well-drained Ontario and moderately well drained Hilton soils high to medium in content of lime; and well-drained Madrid and moderately well drained Bombay soils, medium to low in content of lime, on till plains and drumlins.

Less common soils, but also important, are those that formed in glacial outwash and in lake-laid mate-

[1] Others who participated in the field survey were L. W. KICK, R. A. PARSONS, and P. S. PUGLIA, Soil Conservation Service.

[2] Italic figures in parentheses refer to Literature Cited, p. 232.

rial. The outwash soils are easy to manage. Dominant among these are the Palmyra and Howard soils. The soils that formed in lacustrine deposits erode easily and generally have slow internal drainage. These soils are mainly on the northeastern part of the Erie-Ontario Plain. Dominant among these are the somewhat poorly drained Niagara and the moderately well drained Collamer soils. Large areas of the nearly level Niagara soils mostly are idle or produce only limited amounts of crops. If artificial drainage is properly installed, these soils are productive of most crops. The Ontario and Madrid soils on drumlins are fertile and productive. Because of steep slopes, small field size, and small wet areas, however, these soils are idle and, in places, have reverted to brush. Many of these areas have potential for homesites, especially small estate development. Many of the level, moderately well drained and somewhat poorly drained lacustrine soils in the northern half of the county are used for housing and industrial development. Most areas have severe limitations because of drainage and stability.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Onondaga County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes; the size and speed of streams; 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 that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Honeoye and Niagara, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Ontario loam, 2 to 8 percent slopes, is one of several phases within the Ontario series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, 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 mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Three such kinds of mapping units are shown on the soil map of Onondaga County: soil complexes, soil associations, and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Angola-Darien silt loams, 0 to 6 percent slopes, is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map, but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Benson-Wassaic-Rock outcrop association, sloping, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. Lockport and Brockport silty clay loams, 0 to 6 percent slopes, is an undifferentiated soil group in this county.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Urban land is a land type in this county.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from

field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The General Soil Map at the back of this survey shows soil associations, undifferentiated soil groups, and larger areas of such land types as Urban land in Onondaga County. A soil association is a landscape that has a distinctive proportional pattern of soils. It generally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association can be present in another association, but in a different pattern. The name of an association consists of the names of the dominant soils joined by a hyphen. An undifferentiated group is made up of two or more soils that could be delineated individually, but are shown as one unit because for the purpose of the soil survey there is little value in separating them. An area shown on the map is commonly only one of the dominant soils. The name of the group consists of the dominant soils joined by "and," such as Howard *and* Herkimer soils, gently sloping. In most areas surveyed, there are places where the soil material has been so disturbed or obscured by manmade structures that it has not been classified by soil series. These are called land types and are given such descriptive names as Urban land. Land types large enough to be significant to the use of the General Soil Map are described and shown.

A map showing soil associations, undifferentiated groups, and land types is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning recreational facilities and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other features that affect their management.

The names of the soil associations indicate their dominant slopes. Areas may contain soils that are less sloping or more sloping, however, than the name suggests. The text indicates the range in slope of the soils within the association.

The Onondaga County General Soil Map does not join with the Cortland County and Cayuga County General Soil Maps, as these were published at a much smaller scale. Also, the concepts and names of some series have changed as a result of changes in the classification system since the soil surveys of Cortland and Cayuga Counties were published.

The soil associations, undifferentiated groups, and land types have been grouped into 12 general kinds of landscapes for broad interpretive purposes. Each of the broad groups and their included soil associations, undifferentiated groups, and land types are described in the following pages.

Upland Areas Dominated by Deep Soils Without Fragipans That Formed in Glacial Till and Are Well Drained and Moderately Well Drained

The soils in the eight associations of this group are on uplands throughout the county. They cover a total of about 39.7 percent of the county. Deep, medium-textured soils that are medium and high in lime and well drained or moderately well drained are dominant. Of these soils the ones in the northern half of the county formed largely in sandy loam and loam till derived mainly from sandstone and limestone. Those in the southern half formed largely in silt loam or loam till derived mainly from shale, sandstone, and limestone. Permeability of the till below the subsoil is mostly slow or very slow. In a few places it is moderately slow. The soils range from nearly level to very steep; however, soils that are gently sloping are most extensive in the group. These soils make up about 80 percent of the total group acreage. They are mostly cleared and used for farming. The remaining 20 percent of the acreage is made up of associations of steeper soils that, where cleared, are used mostly for native pasture or are idle. Many of these areas of steeper soils are in forest.

1. Honeoye-Lima association, gently sloping

Deep, well drained and moderately well drained, high-lime soils that have a medium-textured subsoil; on uplands

This association is made up of dominantly gently sloping, but also nearly level, sloping and rolling soils on upland till plains (fig. 2). It is the most extensive association in the county. Areas are mainly in a wide belt in the south-central part of the county, south of Syracuse, on the low northernmost fringe of the

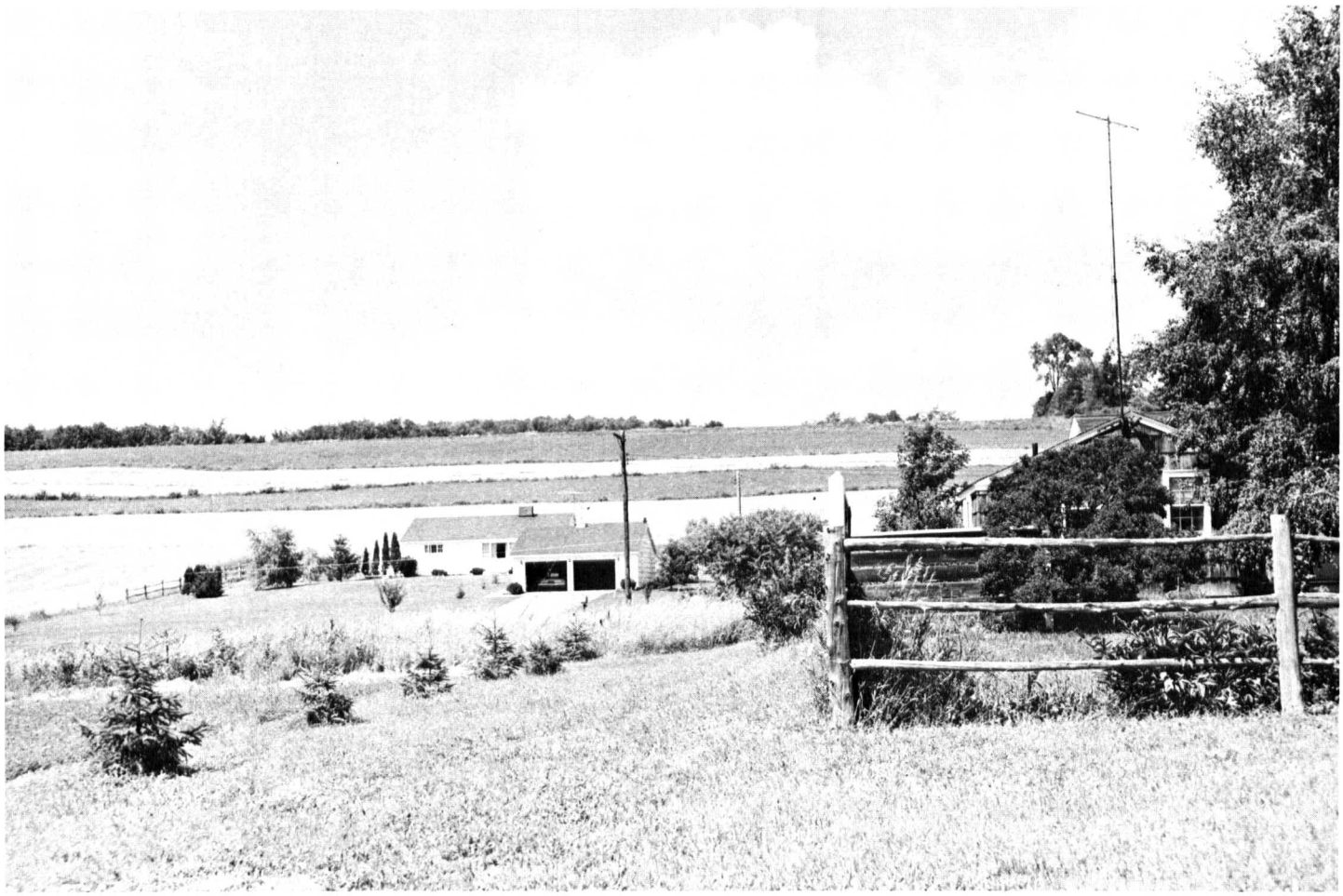

Figure 2.—Area of Honeoye-Lima association, gently sloping. Strip development along roads that encroaches on farmland is a major problem in this association.

Allegheny Plateau and the southern edge of the Erie-Ontario Plain. Elevations are 700 to 1,400 feet.

This association makes up about 14.5 percent of the county. About 70 percent of it is Honeoye soils, and 15 percent is Lima soils. The other 15 percent is minor soils (fig. 3).

Honeoye and Lima soils formed in the same kind of medium-textured glacial till derived mainly from shale, sandstone, and limestone.

Honeoye soils are deep, well drained, medium textured, and high in lime. They are convex, gently sloping, undulating, and rolling. These soils are on hilltops and upper side slopes where runoff water does not accumulate. They have a seasonal high water table at a depth of more than 24 inches.

Lima soils are deep, moderately well drained, medium textured, and high in lime. They are nearly level to gently sloping on broader hilltops from which water drains somewhat slowly, or on smooth foot slopes that receive some runoff from higher areas. They have a seasonal high water table at a depth of 15 to 24 inches.

Minor soils in the association are mainly those of the Aurora, Cazenovia, Kendaia, Lyons, Mohawk, and Palmyra series. Aurora soils are in small areas where shale bedrock is at a depth of 20 to 40 inches. Cazenovia soils also are in small upland areas where till higher in content of clay was deposited. The level or nearly level, somewhat poorly drained Kendaia soils mainly are in depressions and drainageways where runoff water accumulates. The level, poorly drained Lyons soils are mainly in the lowest depressions where water is impounded during wet periods. Similar but darker colored Mohawk soils are in areas where till higher in content of black shale was deposited. Palmyra soils are on small kames or in narrow bands of outwash where glacial streams deposited water-sorted gravel.

Most of the acreage of this association is cleared and farmed. The major soils are fertile and respond well to good management. Those that are sloping and rolling have a moderate hazard of erosion if they are cultivated but not protected. The soils mostly have slight to moderate limitations for many urban uses. They have severe limitations for the disposal of effluent from septic tanks, however, because of slow and very slow permeability in the substratum. These soils are stable and generally have good load-carrying

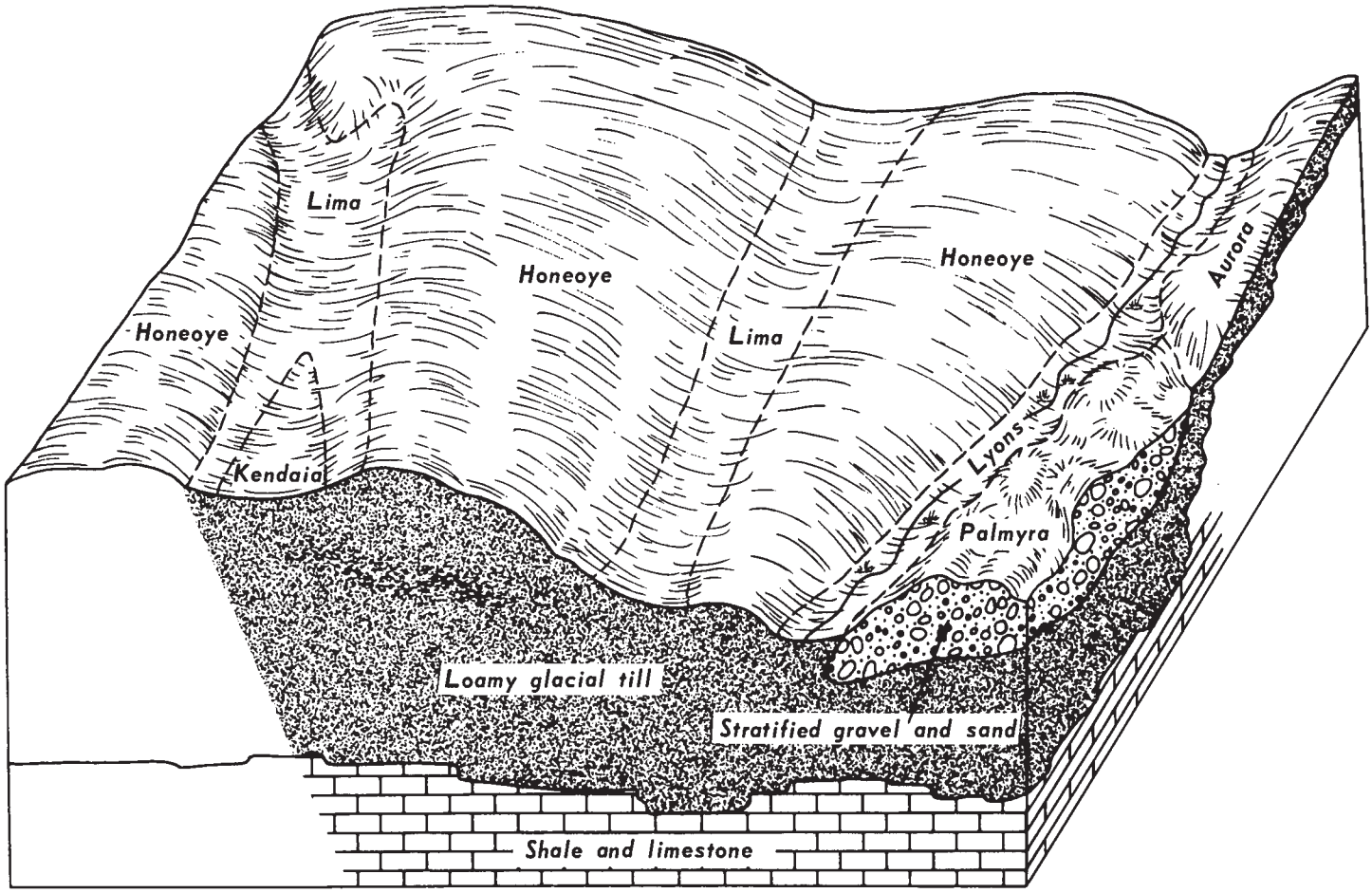

Figure 3.—Typical cross section of Honeoye-Lima association, gently sloping, in the central part of the county.

capacity for building foundations and roads. Topsoil when preserved is generally adequate for lawns and landscaping. Many areas suitable for homesites also have esthetic value.

2. *Lansing-Conesus association, sloping*

Deep, well drained and moderately well drained, medium-lime soils that have a medium-textured subsoil; on uplands

This association is made up of dominantly sloping, but also nearly level, gently sloping, undulating, and rolling soils on upland till plains. Areas of this association are on the higher landscapes in the southern quarter of the county, mainly at elevations between 1,000 and 2,000 feet.

This association makes up about 5.1 percent of the county. About 70 percent of it is Lansing soils, and about 20 percent is Conesus soils. Minor soils make up the other 10 percent.

Lansing and Conesus soils formed in the same kind of medium-textured glacial till derived mainly from shale, limestone, and sandstone.

Lansing soils are deep, well drained, and medium textured. They have a medium content of lime. These soils are gently sloping, sloping, or rolling and are on convex positions in the landscape where runoff water does not accumulate. A seasonal high water table generally is below a depth of 3 feet.

Conesus soils are deep, moderately well drained, and medium textured. They have a medium content of lime. These soils are nearly level to gently sloping. They have a seasonal high water table at a depth of 15 to 24 inches. They are mainly on hilltops from which water drains somewhat slowly, or on foot slopes where they receive some runoff from the higher lying, well-drained Lansing soils.

Minor soils in this association are mainly those of the Appleton, Aurora, and Lyons series. The somewhat poorly drained Appleton soils are level or nearly level and are mainly in depressions and drainageways where water accumulates during wet periods. The Aurora soils are in small areas on hilltops and side slopes where shale bedrock is at a depth of 20 to 40 inches. The level, poorly drained Lyons soils are mainly in the lowest depressions where water is impounded during wet periods.

Cleared areas of this association are used mainly for farming. The major soils are moderately fertile, and crops respond well to good management. The high elevations and short growing seasons somewhat limit the choice of crops. Stones on the surface hinder tillage in some places. The major soils have slight to moderate limitations for many urban uses, but the

slowly permeable or very slowly permeable substratum imposes limitation for disposal of effluent from septic tanks. These soils are stable and generally have good load-carrying capacity for foundations and roads. They are only a fair source of topsoil because of a generally high content of stones.

3. *Ontario-Hilton association, gently sloping*

Deep, well drained and moderately well drained, medium- and high-lime soils that have a medium-textured subsoil; on uplands or islandlike areas of lake plains

This association is made up of dominantly gently sloping, but also nearly level, sloping, and rolling soils on upland till plains. Areas of this association are between the drumlins in the northern half of the county. The most extensive areas are in the northwestern quarter of the county, southwest of Baldwinsville. In the northeastern quarter of the county, this association is on scattered till-plain islands on the lake plains extending from Syracuse to Oneida Lake, northeast of Baldwinsville. Elevations are mainly between 400 and 800 feet.

This association makes up about 5 percent of the county. About 60 percent of it is Ontario soils, and about 15 percent is Hilton soils. Minor soils make up the other 25 percent (fig. 4).

Ontario and Hilton soils formed in the same kind of medium-textured to moderately coarse textured glacial till derived mainly from sandstone, limestone, and some shale.

Ontario soils are deep, well drained, and medium textured. They are medium and high in content of lime. These soils are gently sloping, undulating, sloping, or rolling and are on convex hilltops and upper parts of side slopes where they receive little or no runoff from higher lying soils, or soils from which water drains readily. Slopes are generally short to medium. Ontario soils have a seasonal high water table below a depth of 2½ feet.

Hilton soils are deep, moderately well drained, and medium textured. They are medium and high in content of lime. These soils are nearly level to gently sloping. They have a seasonal high water table at a depth of 15 to 24 inches that is perched on the slowly permeable or very slowly permeable substratum. Hilton soils are on hilltops from which water drains somewhat slowly, or in shallow depressions and on concave foot slopes where they receive some runoff or seepage water from the higher lying Ontario soils.

Minor soils in this association are mainly those of the Appleton, Camillus, Cazenovia, Howard, Lairdsville, Lyons, Madrid, and Palmyra series. The wetter Appleton and Lyons soils are in depressions. The well-drained Camillus and Madrid soils, well drained and moderately well drained Cazenovia soils, and moderately well drained and well drained Lairdsville soils are intermingled with Ontario soils. The gravelly Howard or Palmyra soils that are well drained or somewhat excessively drained are in small areas on small kames and narrow outwash plains.

Most of the acreage of this association is cleared

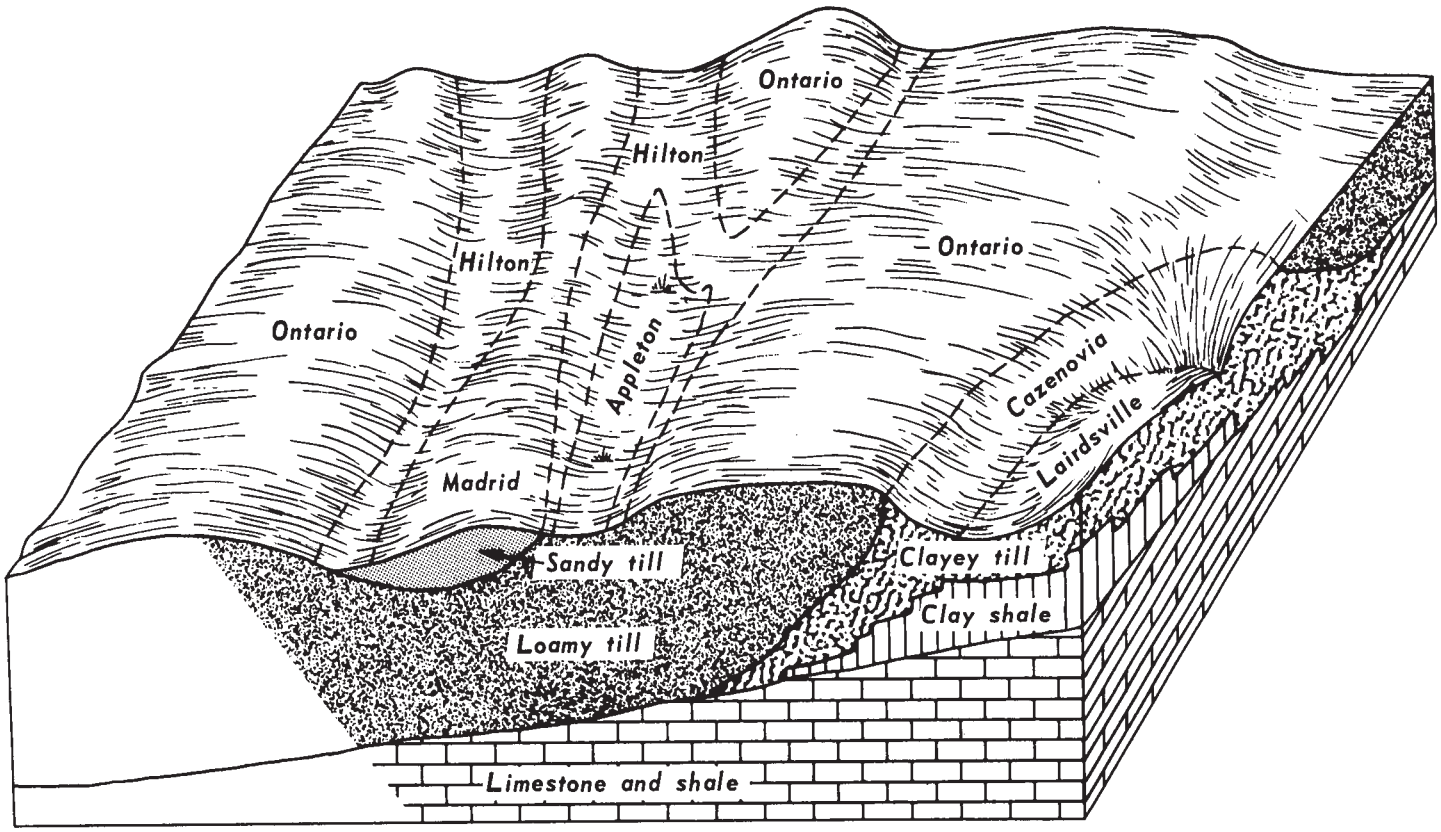

Figure 4.—Typical cross section of Ontario-Hilton association, gently sloping, in the northern part of the county.

and farmed. The major soils respond well to good management. The hazard of erosion is slight to moderate if the surface is left unprotected. These soils are suited to truck crops if adequate water supplies are available for irrigation. The major soils have few limitations for many urban uses, but they do have severe limitations for the disposal of effluent from septic tanks because of the slowly permeable or very slowly permeable till substratum.

4. *Madrid-Hilton association, gently sloping*

Deep, well drained and moderately well drained, low- to high-lime soils that have a moderately coarse textured to medium-textured subsoil; on uplands

This association is made up of dominantly gently sloping, but also undulating to rolling soils on till plains between drumlins in the northern part of the county (fig. 5). Elevations are mainly between 400 and 700 feet.

This association makes up about 3.7 percent of the county. About 70 percent of it is Madrid soils, and about 15 percent is Hilton soils. Minor soils make up the other 15 percent.

Madrid and Hilton soils formed in similar kinds of medium-textured to moderately coarse textured glacial till derived mainly from sandstone, limestone, and some shale.

Madrid soils are deep, well drained, and medium textured to moderately coarse textured. They are low and medium in content of lime. They are gently sloping, sloping, undulating, or rolling. These soils are on convex hilltops or sloping uplands where runoff water does not accumulate.

Hilton soils are deep, moderately well drained, and medium textured. They are intermingled with Madrid soils on hilltops from which runoff is somewhat slow or along foot slopes and in depressions below Madrid soils where some runoff water accumulates. These soils are medium and high in content of lime. Hilton soils are nearly level. They have a seasonal high water table at a depth of 15 to 24 inches that is perched on the dense, slowly permeable or very slowly permeable till substratum.

Figure 5.—Area of Madrid-Hilton association, gently sloping. The well drained Madrid soils are on the convex hilltop, and the moderately well drained Hilton soils are in the slightly concave depression in the right center part of the picture.

Minor soils in this association are mainly those of the Alton, Appleton, Bombay, Howard, Lyons, Ontario, and Palmyra series. The wetter Appleton and Lyons soils are in depressions. The gravelly Alton, Howard, and Palmyra soils that are well drained to excessively drained or somewhat excessively drained are in small areas on small kames or narrow outwash plains. The moderately well drained Bombay soils, similar to Hilton soils, and the well-drained Ontario soils, similar to Madrid soils, are in intermingled areas.

Most of the acreage of this association is cleared and farmed. The major soils respond well to good management. The hazard of erosion is slight to moderate if the soils are cultivated and not protected. These soils are well suited to intensive truck farming if adequate water supplies are available for irrigation. The major soils have few limitations for many urban uses, but they have moderate to severe limitations for sewage disposal by means of septic tanks.

5. *Bombay-Madrid association, gently sloping*

Deep, moderately well drained and well drained, low- and medium-lime soils that have a moderately coarse textured to medium-textured subsoil; on uplands and islandlike areas of lake plains

This association is made up of dominantly gently sloping, but also undulating and rolling soils on till plains between drumlins in the northwestern corner of the county. A few scattered areas are on till islands that project above the lake plains south of Oneida Lake. Elevations are mainly between 400 and 600 feet.

This association makes up about 0.9 percent of the county. About 50 percent of it is Bombay soils, and about 30 percent is Madrid soils. Minor soils make up the other 20 percent.

Bombay and Madrid soils formed in the same kind of medium-textured to moderately coarse textured glacial till derived mainly from sandstone, limestone, and some shale.

Bombay soils are deep, moderately well drained, and medium textured. They are low and medium in content of lime. These soils are nearly level and gently sloping on broad hilltops from which runoff is somewhat slow or on foot slopes below Madrid soils where some runoff water accumulates.

Madrid soils are deep, well drained, and medium textured and moderately coarse textured. They are similar to and closely intermingled with Bombay soils. These soils are nearly level, gently sloping, sloping, or rolling on convex hilltops and on sloping uplands where runoff water does not accumulate.

Minor soils in this association are mainly those of the Alton, Appleton, Collamer, Hilton, Niagara, and Williamson series. The Alton soils are well drained and somewhat excessively drained and gravelly. They are on small beach ridges of glacial lakes or on small narrow outwash plains. The wetter Appleton soils are intermingled with the Bombay and Madrid soils in depressions on uplands. The moderately well drained, silty Collamer and Williamson soils and the somewhat poorly drained Niagara soils are on the fringes of lake

plains. Hilton soils, similar to Bombay soils, are in the same positions as Bombay soils.

Much of the acreage of this association is cleared and used for farming. The major soils are medium to low in natural fertility, but they respond well to applications of lime and fertilizer. Seasonal wetness in places briefly delays planting in spring. These soils are susceptible to erosion if they are cultivated and not protected. The major soils of this association are well suited to truck crops if adequate water supplies are available for irrigation. Seasonal wetness in places is a limitation for some urban uses, especially for septic tank sewage disposal.

6. *Cazenovia association, gently sloping*

Deep, moderately well drained and well drained, high-lime soils that have a moderately fine textured subsoil; on uplands

This association is made up of dominantly gently sloping, but also nearly level, sloping, and rolling soils on upland till plains. Areas of this association are scattered throughout the county at the lower elevation. The most extensive areas are in the central part of the county at elevations of 400 to 1,000 feet. A few areas in the broader valleys in the southern half of the county are at elevations of 1,000 to 1,300 feet.

This association makes up about 2.9 percent of the county. About 75 percent of it is Cazenovia soils. Minor soils make up the other 25 percent.

Cazenovia soils are deep, moderately well drained and well drained, medium-textured soils that have a moderately fine textured reddish subsoil. They are high in content of lime. These soils formed in medium-textured to moderately fine textured glacial till rich in reddish clay shale, limestone, and, in places, reworked lacustrine clay. A seasonal high water table is generally at a depth of 1½ to 2 feet, but in places it is deeper. Cazenovia soils are gently sloping, sloping, undulating, or rolling on hilltops and side slopes where runoff water accumulates in most places.

Minor soils in this association are mainly those of the Ovid, Lyons, Honeoye, Lima, Kendaia, Ontario, Palmyra, Howard, Wassaic, Camillus, and Lairdsville series. The somewhat poorly drained Ovid soils that formed in the same kind of material as Cazenovia soils are the dominant minor soils. They are nearly level to gently sloping in depressions and drainageways and on foot slopes where runoff water from Cazenovia soils accumulates. The poorly drained Lyons soils are in low depressions where water is at or on the surface for extended periods. Small areas of well drained Honeoye and Ontario soils and moderately well drained Lima soils are intermingled with Cazenovia soils. The gravelly, well-drained to excessively drained Palmyra and Howard soils are in small areas on kames, outwash plains, or alluvial fans along narrow channels. The moderately deep, well drained and moderately well drained Wassaic, Camillus, and Lairdsville soils are in small areas where limestone, soft silty shale, or soft clay shale bedrock are at a depth of 20 to 40 inches.

Most of the acreage of this association is cleared and farmed. Cazenovia soils are fertile and respond well to good management. Because of slow infiltration and moderate to rapid runoff, the hazard of erosion is moderate to severe if the soils are cultivated and not protected. The soils tend to clod if they are plowed when too wet or too dry. Severely eroded areas generally are cloddy. Drainage of wetter areas of the minor soils is generally needed. Cazenovia soils have moderate to severe limitations for many urban uses because of slow or very slow permeability and clayey texture in the subsoil and substratum. Stability and load-carrying capacity for building foundations and roads is generally good. Many areas suitable for homesites also have esthetic value.

7. *Honeoye-Lansing association, steep*

Deep, well-drained, high- and medium-lime soils that have a medium-textured subsoil; on uplands

This association is made up of mostly steep, but also moderately steep and very steep soils on the sides of valleys in the southern half of the county. The slopes are generally long and, in places, rough and broken. Elevations are mainly between 1,000 and 2,000 feet.

This association makes up about 5.8 percent of the county. About 50 percent of it is Honeoye soils, and about 35 percent is Lansing soils. Minor soils make up the other 15 percent.

Honeoye and Lansing soils are moderately steep to very steep on valley sides. They are deep, well-drained, medium-textured soils that formed in medium-textured till. These soils have a slowly permeable or very slowly permeable substratum. They are similar, but the Honeoye soils are high in content of lime and are generally less acid in the surface layer and subsoil than the Lansing soils that are medium in content of lime. Also, depth to calcareous material is generally shallower in Honeoye soils than in Lansing soils.

Minor soils in this association are mainly those of the Aurora, Cazenovia, Howard, and Palmyra series. The moderately well drained, moderately deep Aurora soils are intermingled in areas where gray shale is close to the surface along the valley sides. The deep, well drained and moderately well drained Cazenovia soils are along lower valley sides where clayey red shale influences the soil color and texture. The deep, well-drained to excessively drained Palmyra soils and the well-drained and somewhat excessively drained Howard soils are on gravelly glacial outwash deposits along lower valley side fringes.

Cleared areas of this association are used mainly for native pasture or are idle. Much of the acreage is in forest. Slope is the major limitation for both farm and nonfarm uses. Some accessible areas are suitable for homesites, and they also have esthetic value. Also, some places have suitable slope aspect for development as ski areas.

8. *Ontario-Madrid association, steep*

Deep, well-drained, low- to high-lime soils that have a medium-textured to moderately coarse textured subsoil; on uplands

This association is made up of dominantly steep soils on drumlins in the northwestern quarter of the county and, to a lesser extent, in the northeastern

quarter of the county. Also in this association are a few areas of moderately steep, steep, and very steep soils on valley sides along the major streams in the northern half of the county. The drumlins are oval, hogbacked-shaped hills that have a general north-south axis, corresponding to the direction of movement of the glacier. They have steep or very steep north slopes and side slopes that grade to moderately steep south slopes. Some of the larger drumlins have sloping or gently sloping tops that are as large as 10 acres in size in places, but are generally too small to affect major uses.

This association makes up about 1.8 percent of the county. About 55 percent of it is Ontario soils, and about 30 percent is Madrid soils. Minor soils make up the other 15 percent.

Ontario and Madrid soils are on the sides of drumlins and valleys. They are deep and well drained. These soils formed in medium-textured or moderately coarse textured glacial till derived mainly from sandstone and limestone. Madrid soils have a sandier subsoil that contains less silt and clay than that of Ontario soils. Ontario soils are generally shallower over calcareous till than Madrid soils. Also, in places the till under the Madrid soils is more permeable than that under Ontario soils.

Minor soils in this association are mainly those of the Cazenovia, Collamer, Galen, Hilton, Howard, and Palmyra series. The moderately well drained to well drained Cazenovia soils are mainly in small areas intermingled with Ontario and Madrid soils on drumlins. The nearly level to gently sloping, moderately well drained, silty Collamer soils and the sandy Galen soils are in narrow areas between closely spaced drumlins where silt or sand was deposited in glacial lakes. Hilton soils mainly are on narrow foot slopes at the base of moderately steep to very steep slopes where some runoff water accumulates, or they are in small depressions. The well-drained to excessively drained, gravelly Palmyra and Howard soils are on gravelly glacial outwash deposits of lower drumlin sides and lower valley side fringes.

Many of the areas of this association that once were cleared and farmed are idle or are used for native pasture. Some of the moderately steep areas are used for hay. Most of the idle areas are slowly reverting to brush and forest. Slope is the major limitation for both farm and nonfarm uses. Some accessible areas are suitable for homesites, and they also have esthetic value. Also, some areas are suitable for development of parks and upland small-game hunting preserves.

Upland Areas Dominated by Deep Soils Without Fragipans That Formed in Glacial Till and Are Moderately Well Drained and Somewhat Poorly Drained

The soils in the four associations of this group are on uplands throughout the county. They cover a total of about 8.8 percent of the county. About 70 percent of the areas are in the southern half of the county. Deep, medium-textured soils that are medium and high in content of lime and mainly moderately well drained or somewhat poorly drained are dominant. The soils in the northern half of the county formed largely in sandy loam or loam till derived mainly from sandstone and limestone. Those in the southern half formed largely in silt loam or loam till derived mainly from shale, sandstone, and limestone. Permeability of the substratum, regardless of texture, is mainly slow or very slow. The soils range from level to sloping; however, most are level or gently sloping. Areas are mostly cleared and used for farming.

9. Conesus-Appleton association, gently sloping

Deep, moderately well drained and somewhat poorly drained, medium- and high-lime soils that have a medium-textured subsoil; on uplands

This association is made up of dominantly gently sloping but also nearly level soils on upland till plains from which water drains slowly or on which runoff water from higher areas accumulates. Areas of this association are in the southern third of the county at elevations of 1,000 to 2,000 feet.

This association makes up about 0.8 percent of the county. About 50 percent of it is Conesus soils, and about 35 percent is Appleton soils. Minor soils make up the other 15 percent.

Conesus and Appleton soils formed in similar kinds of medium-textured glacial till derived mainly from shale, sandstone, and limestone.

Conesus soils are deep, moderately well drained, and medium textured. They have a medium content of lime. These soils have a seasonal high water table at a depth of 15 to 24 inches. They are nearly level or gently sloping and are in positions where they receive some runoff water from higher areas or from which runoff is somewhat slow.

Appleton soils are deep, somewhat poorly drained, and medium textured. They have a medium and high content of lime. These soils have a somewhat prolonged seasonal high water table at a depth of 6 to 12 inches. They are level or nearly level and are in concave depressions where runoff water accumulates and is slow to drain away.

Minor soils in this association are mainly those of the Lansing and Lyons series. The deep, well-drained Lansing soils are on small convex knolls and hilltops from which water drains readily. The level to gently sloping, deep, poorly drained Lyons soils are in depressions where runoff water is impounded during wet periods, or in areas subject to prolonged seepage.

Cleared areas of this association are used mainly for crops and pasture. The better drained areas are used mainly for crops, and the wetter areas are in pasture or are idle. Areas of Appleton soils that are artificially drained are highly productive, particularly if used for such annual row crops as corn and beans. The major soils of this association have moderate to severe limitations for most urban uses because of wetness and slow and very slow permeability in the substratum. Many areas have satisfactory sites for ponds and small lakes.

10. Hilton-Appleton association, gently sloping

Deep, moderately well drained and somewhat poorly drained, medium- and high-lime soils that have a medium-textured or medium to moderately coarse-

textured subsoil; on uplands or islandlike areas of lake plains

This association is made up of dominantly gently sloping, but also level soils on till plains from which water drains slowly or on which runoff from higher areas accumulates. Most areas are in somewhat depressed parts of till plains between drumlins in the northern half of the county, or in islandlike areas on lake plains south of Oneida Lake. Elevations are mainly between 400 and 600 feet.

This association makes up about 2.4 percent of the county. About 55 percent of it is Hilton soils, and about 30 percent is Appleton soils. Minor soils make up the other 15 percent.

Hilton soils are deep, moderately well drained, and medium textured. They have a medium and high content of lime. These soils formed in till derived mainly from sandstone and limestone. Hilton soils have a seasonal high water table at a depth of 15 to 24 inches that is perched on the slowly or very slowly permeable substratum. They are nearly level to gently sloping, mainly on hilltops from which water drains somewhat slowly or on foot slopes that receive some runoff and seepage from higher lying soils.

Appleton soils formed in the same materials as Hilton soils. They are deep, somewhat poorly drained, medium textured, and medium and high in content of lime. These soils have a somewhat prolonged seasonal high water table at a depth of 6 to 12 inches. They are level or nearly level and are in concave depressions where runoff water accumulates and is slow to drain away.

Minor soils in this association are mainly those of the Lyons, Madrid, and Ontario series. The well-drained Madrid and Ontario soils are on small convex knolls or hilltops. The poorly drained Lyons soils are mainly in the lowest depressions where runoff water is impounded.

Much of the acreage of this association is cleared and used for crops and pasture. Some areas are idle and are slowly reverting to brush. Appleton soils need drainage if used for crops. If adequately drained they are highly productive, particularly if used for such annual row crops as corn and beans. Because of wetness the major soils of this association have moderate to severe limitations for many urban uses. Many areas have satisfactory sites for ponds and small lakes.

11. Mohawk-Manheim association, gently sloping

Deep, well drained, moderately well drained, and somewhat poorly drained, high-lime soils that have a medium-textured to moderately fine textured subsoil; on uplands

This association is made up of dominantly gently sloping, but also level, sloping, and rolling soils on upland till plains. Areas are mainly scattered in a somewhat irregular, narrow east-west belt in the central part of the county. These areas are south of Syracuse and immediately south of the Onondaga Limestone Escarpment where the black Marcellus Shale Formation is over the Onondaga Limestone Formation. Elevations are mainly between 800 and 1,000 feet.

This association makes up about 2.8 percent of the county. About 65 percent of it is Mohawk soils, and about 20 percent is Manheim soils. Minor soils make up the other 15 percent.

Mohawk soils are deep, moderately well drained and well drained, and medium textured. They have a high content of lime. Characteristically, they are dark colored as a result of the black and very dark gray shale till in which they formed. Mohawk soils have a seasonal high water table at a depth of 15 inches to more than 3 feet. They are gently sloping to sloping and mainly on convex hilltops and hillsides where some runoff water accumulates in places.

Manheim soils formed in the same kind of material as Mohawk soils. They are deep, somewhat poorly drained, and medium textured. These soils have a high content of lime. They have a somewhat prolonged seasonal high water table at a depth of 6 to 12 inches. They are level to gently sloping and are in areas where runoff is slow and on foot slopes where runoff and seepage water from higher areas accumulate.

Minor soils in this association are mainly those of the Honeoye, Kendaia, Lima, Lyons, and Palatine series. The well drained Honeoye soils and the moderately well drained Lima soils are in small areas intermingled with Mohawk soils. The somewhat poorly drained Kendaia soils are in small areas intermingled with Manheim soils. The poorly drained Lyons soils are in lower depressions where runoff water is impounded. The well-drained Palatine soils are on hilltops and hillsides in areas where the black Marcellus Shale bedrock is 20 to 40 inches deep.

Most of the acreage of this association is cleared and farmed. The major soils are fertile and respond to good management. The somewhat poorly drained Manheim soils need drainage for most crops. If adequately drained, they are highly productive, particularly for such annual row crops as corn, beans, and cabbage. The hazard of erosion is slight to moderate on sloping areas if they are cultivated and not protected. Mohawk soils mostly have slight to moderate limitations for many urban uses. They have severe limitations for the disposal of effluent from septic tanks, however, because of slow or very slow permeability in the substratum. Manheim soils have moderate to severe limitations for most urban uses because of wetness. Many areas of Mohawk soils suitable for homesites also have esthetic value.

12. Kendaia-Lima-Lyons association, nearly level

Deep, somewhat poorly drained, moderately well drained, and poorly drained, high-lime soils that have a medium-textured subsoil; on uplands

This association is made up of dominantly nearly level, but also gently sloping and depressional soils on upland till plains where runoff water accumulates. Areas are mainly in the south-central part of the county at elevations of 800 to 1,400 feet. Most areas are on the low north fringe of the Allegheny Plateau and the southern fringe of the Erie-Ontario Plain.

This association makes up about 2.8 percent of the county. About 40 percent of it is Kendaia soils, about 35 percent is Lima soils, and about 15 percent is Lyons soils. Minor soils make up the other 10 percent.

Kendaia, Lima, and Lyons soils in this association all formed in the same kind of medium-textured glacial till derived mainly from shale, sandstone, and limestone.

Kendaia soils are deep, somewhat poorly drained, and medium textured. They have a high content of lime. Kendaia soils have a somewhat prolonged seasonal high water table at a depth of 6 to 12 inches. They are level to gently sloping and are in areas where runoff is slow or on concave foot slopes where runoff water from higher areas accumulates.

Lima soils are deep, moderately well drained, and medium textured. They have a high content of lime. Lima soils have a seasonal high water table at a depth of 15 to 24 inches. They are nearly level to gently sloping and are on hilltops where runoff is somewhat slow or on side slopes that receive runoff from higher areas.

Lyons soils are deep, poorly drained, and medium textured. They have a high content of lime. Lyons soils have a prolonged high water table at a depth of 0 to 6 inches. They are ponded in places. These soils are level or nearly level and are in lower areas where runoff is impounded.

Minor soils in this association are mainly those of the Honeoye and Palms series. The well-drained Honeoye soils are on small convex knolls or hilltops. The very poorly drained Palms soils are shallow muck areas in the lower depressions where runoff water is impounded for the wettest 8 to 10 months of the year.

Cleared areas of this association are used mainly for crops and pasture. The drier Lima soils generally are cropped. The wetter Kendaia and Lyons soils are used for pasture unless they are artificially drained. If adequately drained, the wetter soils are highly productive, particularly if used for such annual row crops as corn and beans. The major soils have moderate to severe limitations for most urban uses because of wetness. Many areas have suitable sites for ponds and small lakes.

Upland Areas Dominated by Deep Soils With Fragipans That Formed in Glacial Till and Are Moderately Well Drained and Somewhat Poorly Drained

Only one soil association is in this category. It covers about 1.8 percent of the county. Areas of it are on uplands in the southern quarter of the county. The soils are deep and medium textured. They have a low content of lime. These soils have a fragipan within 10 to 24 inches of the surface that impedes drainage and restricts rooting. The soils formed in silt loam or loam till derived mainly from sandstone, siltstone, and shale. Permeability of the fragipan and the substratum is very slow or slow. The soils are nearly level to sloping. Cleared areas are largely idle or are reforested.

13. Mardin-Volusia association, sloping

Deep, moderately well drained and somewhat poorly drained, low-lime soils that have a medium-textured fragipan; on uplands

This association is made up of dominantly sloping, but also nearly level and gently sloping soils on till plains on uplands. The areas are at the highest elevations, generally above 1,400 feet, in the southern quarter of the county.

This association makes up about 1.8 percent of the county. About 60 percent of it is Mardin soils, and about 25 percent is Volusia soils. Minor soils make up the other 15 percent.

Mardin soils are deep, moderately well drained, and medium textured. They have a low content of lime. These soils formed in glacial till derived mainly from sandstone, siltstone, and shale. A firm, dense fragipan that impedes drainage and restricts rooting is at a depth of 15 to 24 inches. Mardin soils have a seasonal high water table that is perched on this slowly or very slowly permeable fragipan. The soils are gently sloping and sloping or rolling, and are in slightly convex or smooth landscape positions where runoff is somewhat slow or where some runoff water accumulates.

Volusia soils are somewhat poorly drained. They are similar to and formed in the same kind of materials as Mardin soils. They have a fragipan at a depth of 10 to 16 inches. A seasonal high water table is perched on this pan at a depth of 6 to 12 inches and persists for longer periods. Volusia soils are mainly nearly level and gently sloping and are on broad flat hilltops or foot slopes below Mardin soils.

Minor soils in this association are those of the Appleton, Arnot, Conesus, Lordstown, and Lyons series. Appleton and Conesus soils are in landscape positions similar to those of Mardin and Volusia soils and are generally at the lowest elevations in the association. Arnot and Lordstown soils are intermingled with the Mardin and Volusia soils in areas where the depth to bedrock is less than 40 inches. Lyons soils are in wet depressions throughout areas of the association. In natural drainage these minor soils range from well drained to poorly drained. Also of minor extent in this association are areas of Fluvaquents, frequently flooded. These areas are on the flood plains of high-gradient streams that cross the association.

Most areas of this association that once were cleared are reforested or are idle. The few areas that are farmed are used mainly for hay and pasture. Seasonal wetness, shallow rooting depth, and a short growing season are among the major limitations to farming these soils. A seasonal high water table and a slowly permeable or very slowly permeable fragipan and substratum are limitations for many nonfarm uses. Many areas have good sites for ponds and small lakes. Many areas suitable for homesites also have esthetic value.

Upland Areas Dominated by Moderately Deep and Shallow Soils That Formed in Thin Glacial-Till Deposits Over Bedrock and Are Excessively Drained to Moderately Well Drained

The soils in the nine associations of this group are on uplands where relief is affected by the underlying bedrock. They cover a total of about 9.6 percent of the county. The areas are prominent in an east-west belt that crosses the central part of the county. They

parallel and include the Onondaga Limestone Escarpment, which passes through the southern edge of Syracuse. Other areas are scattered throughout the southern half of the county where shale, sandstone, and siltstone bedrock influence the relief. Moderately deep and shallow, medium-textured soils are dominant in this group of associations. Bedrock is within 10 to 40 inches of the surface over many of the areas, and outcrops of rock are prominent features in places. The soils have profiles that are high, medium, low, and very low in lime. They range from excessively drained to moderately well drained.

These soils formed in thin deposits of silt loam or loam till or residuum derived mainly from the bedrock which underlies them. Permeability is commonly moderate in the soil material above the bedrock, but in places it ranges to slow. The soils range from level to very steep; however, soils that are gently sloping to steep are most extensive in the group. These soils make up about 69 percent of the total acreage. The use pattern is complex in these areas. Where the moderately deep soils are dominant, the areas are commonly farmed. Where the shallow soils dominate, cleared areas generally are idle, but some are used for pasture. Areas of the steeper soils in the group are mostly in forest. Here, cleared areas are mainly idle, a few areas are used for native pasture, and some are being reforested.

14. Benson-Wassaic-Rock outcrop association, gently sloping

Shallow, somewhat excessively drained and excessively drained, and moderately deep, well drained and moderately well drained, high- and medium-lime soils that have a medium-textured subsoil; and Rock outcrop; on uplands

This association is made up of dominantly gently sloping, but also level, sloping, and moderately steep soils on uplands. The relief has been affected by the underlying bedrock, and bedrock outcrops are prominent features of the landscape. Areas of this association are mainly in a narrow east-west belt that crosses the central part of the county. They parallel the Onondaga Limestone Escarpment, which passes through the southern edge of Syracuse. Elevations are mainly between 600 and 900 feet.

This association makes up about 0.7 percent of the county. About 40 percent of it is Benson soils and about 30 percent is Wassaic soils. Rock outcrop makes up another 15 percent, and minor soils make up the other 15 percent.

Benson soils are shallow, somewhat excessively drained and excessively drained, and medium textured. They have a high content of lime. These soils formed in thin deposits of glacial till derived mainly from limestone, sandstone, and shale. Bedrock that is mainly limestone is at a depth of 10 to 20 inches. Although Benson soils in this association are nearly level to moderately steep, they are mainly gently sloping and are in areas where bedrock strongly affects the relief. The many exposures of limestone bedrock in this association are associated mainly with the Benson soils. These exposures make up the Rock outcrop component of the association. Also, bedrock is at a depth of less than 10 inches in many areas.

Wassaic soils formed in the same kind of material as Benson soils. They are intermingled with Benson soils and Rock outcrop in areas where bedrock is at a depth of 20 to 40 inches. Wassaic soils are dominantly well drained, but in places they are moderately well drained and have a seasonal water table at a depth of 20 to 24 inches. They are medium and high in content of lime. These soils are mostly gently sloping, but in places they are moderately steep.

Minor soils in this association are mainly those of the Cazenovia, Honeoye, and Ontario series. These deep soils are intermingled throughout areas of the association where depth to bedrock is more than 40 inches. They are dominantly well drained, but in places the Cazenovia soils are moderately well drained.

Cleared areas of this association are used mainly for native pasture or are idle. The soils are too shallow or too rocky for cultivation in most places. Tree growth in wooded areas is highly variable. The shallow or moderate depth to hard bedrock is the main limitation for many nonfarm uses. Many of the limestone quarries in the county are in this association.

15. Camillus association, gently sloping

Moderately deep, well drained and moderately well drained, medium- and high-lime soils that have a medium-textured subsoil; on uplands

This association is made up of dominantly gently sloping soils on uplands. Relief has been affected by the underlying bedrock and is mainly undulating or rolling. Areas of this association are in a relatively narrow east-west belt in the central part of the county that passes through Syracuse immediately north of the Onondaga Limestone Escarpment. Elevations are mainly between 400 and 600 feet.

This association makes up about 2.3 percent of the county. About 80 percent of it is Camillus soils. Minor soils make up the other 20 percent.

Camillus soils are moderately deep, mainly well drained, and medium textured. They are medium and high in content of lime. In places, they are moderately well drained. Silty shale bedrock is at a depth of 20 to 40 inches. Camillus soils formed in thin deposits of till or partly in residuum derived from the underlying shale. The water table generally is deeper than 3½ feet but in a few places it is seasonally as shallow as 1½ feet. The soil material above the bedrock is moderately permeable, and the shale bedrock generally is moderately permeable to rapidly permeable.

Minor soils in this association are mainly those of the Angola, Cazenovia, Honeoye, Lairdsville, Madrid, Ontario, and Wassaic series. The somewhat poorly drained, moderately deep Angola soils are in the lower, wetter depressions where runoff is very slow during wet periods. The deep, well-drained Honeoye, Madrid, and Ontario soils and the well drained and moderately well drained Cazenovia soils are intermingled in small areas where depth to bedrock is more than 40 inches. The moderately deep Lairdsville soils are in small areas at the lowest elevations where soft clay shale bedrock is at a depth of 20 to 40 inches. The moderately deep Wassaic soils are intermingled

with Camillus soils generally at the higher elevations over harder limestone bedrock.

Cleared areas of this association are mainly used for farming. Camillus soils are considered to be some of the better soils in the county for growing alfalfa and are suited to most crops commonly grown in the county. On rolling areas runoff is rapid, and the hazard of erosion is generally severe. This association is one of the best in the county for urban development. The soft shale bedrock is easy to excavate, yet is stable and has good load-supporting capacity for foundations and roads. Because the bedrock is permeable, effluent from septic tanks can pollute springs, wells, and streams. Many areas suitable for homesites also have high esthetic value.

16. Farmington-Aurora association, sloping

Shallow, well-drained, and moderately deep, moderately well drained, high- to low-lime soils that have a medium-textured to moderately fine textured subsoil; on uplands

This association is made up of dominantly sloping, but also level and gently sloping soils on hilltops and upper parts of side slopes and uplands. Relief has been affected by the underlying bedrock. Areas of this association are scattered throughout the southern half of the county where bedrock consists mainly of alkaline and calcareous gray shale and sandstone. In places these bedrock formations are interbedded with thin strata of limestone. Elevations are mainly between 800 and 1,500 feet.

This association makes up about 0.5 percent of the county. About 50 percent of it is Farmington soils, and about 30 percent is Aurora soils. Minor soils make up the other 20 percent.

Farmington soils are shallow, well drained, and medium textured. They are medium and low in content of lime. Hard, alkaline or calcareous, gray, fine-grained sandstone or impure sandy limestone bedrock is at a depth of 10 to 20 inches. Farmington soils formed in thin deposits of till derived mainly from underlying sandstone and limestone and varying amounts of shale. They are mainly level or nearly level and are on hilltops where the underlying hard bedrock strongly affects the relief. Small areas of Farmington soils are intermingled with Aurora soils and are gently sloping, sloping, and moderately steep in areas where the depth to bedrock is less than 20 inches.

Aurora soils are moderately deep, moderately well drained, medium textured, and have a medium to moderately fine textured subsoil. They are medium and high in content of lime. These soils formed in thin deposits of till derived mainly from the underlying alkaline or calcareous gray shale and fine-grained sandstone bedrock. This bedrock is at a depth of 20 to 40 inches. Aurora soils are mainly gently sloping, sloping, or moderately steep and are on hillsides where some runoff water accumulates. They have a seasonal high water table that is perched on the slowly permeable subsoil at a depth of 18 to 24 inches.

Minor soils are mainly those of the Angola, Conesus, Honeoye, Lansing, Lima, and Varick series. The moderately deep Angola and Varick soils are the wetter associates of Aurora soils and are in landscape positions where runoff is slower or more water accumulates and persists for longer periods. The deep Conesus, Honeoye, Lansing, and Lima soils are intermingled mainly with Aurora soils where the depth to bedrock is more than 40 inches. In natural drainage these minor soils range from well drained to poorly drained.

Most of the acreage of this association has been cleared and is used for crops. The larger areas of shallow Farmington soils are used mainly for native pasture or are idle. The deeper Aurora soils are moderately productive. Erosion is a moderate hazard on the major soils if they are cultivated and not protected. Gullies that may cut to and into the softer, less resistant shale bedrock form readily where water concentrates. Bedrock and seasonal wetness are the main limitations for most urban uses. Some areas suitable for homesites have esthetic value.

17. Wassaic-Benson association, gently sloping

Moderately deep, well drained and moderately well drained, and shallow, somewhat excessively drained and excessively drained, high- and medium-lime soils that have a medium-textured subsoil; on uplands

This association is made up of dominantly gently sloping, but also level and sloping soils on uplands. Relief has been affected by the underlying limestone bedrock. Areas of this association are mainly in an east-west belt that crosses the central part of the county and passes through the southern side of Syracuse near the Onondaga Limestone Escarpment. Small areas are also scattered throughout the northern part of the county where the Lockport Dolomite Formation is the underlying bedrock, and throughout that half of the county where the Tully Limestone Formation is close to the surface.

This association makes up about 2 percent of the county. About 45 percent of it is Wassaic soils, and about 35 percent is Benson soils. Minor soils make up the other 20 percent.

Wassaic soils are moderately deep, well drained and moderately well drained, medium textured, and moderately permeable. They are high and medium in content of lime. Wassaic soils are 20 to 40 inches deep over limestone bedrock. They formed in till derived mainly from limestone, sandstone, and shale. In a few places where the bedrock lacks crevices, Wassaic soils are moderately well drained, and during wet periods they have a seasonal high water table perched on the bedrock at a depth of 20 to 24 inches. These soils are level or nearly level where the nearly horizontal bedrock is uniformly 20 to 40 inches deep. In sloping areas the depth to bedrock is more uneven, and other soils are intermingled with this Wassaic soil.

Benson soils formed in the same material as Wassaic soils. They are shallow, somewhat excessively drained and excessively drained, medium-textured soils that have a high content of lime. These soils are 10 to 20 inches deep over limestone bedrock. They are level to sloping. The larger areas are level or nearly level where the nearly horizontal bedrock is most uniformly at a depth of 10 to 20 inches, and only a few small ledges of rock outcrop are present. Where they are sloping Benson soils are mostly intermingled with the moderately deep Wassaic soils because the bed-

rock ranges from shallow to moderately deep within short distances.

Minor soils in this association are mainly those of the Cazenovia, Honeoye, and Ontario series. These deep soils are level to sloping and are in small areas where the depth to bedrock is more than 40 inches. These soils generally are well drained, but in places the Cazenovia soils are moderately well drained.

Most of the cleared areas of this association are used for crops or pasture. The deeper soils are used mainly for crops and are moderately productive except during extremely dry years. The shallow soils are used mainly for native pasture or are idle. The moderate and shallow depths to bedrock are the main limitations for most urban uses. Many areas near Syracuse are used for homesites, but the cost of digging cellars and ditches for underground utilities is high. The hazard of polluting wells, springs, and streams, especially from domestic sewage disposal systems, is severe. The bedrock generally is a stable foundation for heavy structure. Many limestone quarries are in this association.

18. Lordstown-Arnot association, sloping

Moderately deep, well-drained, and shallow, well drained and moderately well drained, very low lime soils that have a medium-textured subsoil; on uplands

This association is made up of dominantly sloping, but also nearly level and gently sloping soils on hilltops and sloping and moderately steep soils on hillsides of uplands. Relief has been influenced by the underlying bedrock. Areas of this association generally are in the southern third of the county. Elevations are mainly above 1,500 feet.

This association makes up about 1.1 percent of the county. About 60 percent of it is Lordstown soils, and about 25 percent is Arnot soils. Minor soils make up the other 15 percent.

Lordstown soils are moderately deep, well drained, and medium textured. They have a very low content of lime. Sandstone bedrock or hard shale is at a depth of 20 to 40 inches. Lordstown soils formed in thin deposits of till derived mainly from underlying sandstone and shale bedrock. Lordstown soils are gently sloping, sloping, and moderately steep on hilltops and hillsides where runoff is moderate to rapid.

Arnot soils are similar to and formed in the same kind of material as Lordstown soils, but they are shallow and well drained and moderately well drained. Bedrock is at a depth of 10 to 20 inches. In places a seasonal high water table is perched above the bedrock at a depth of 15 to 18 inches. Arnot soils are mostly nearly level and gently sloping and are mainly on hilltops where the nearly horizontal bedrock is at a depth of 10 to 20 inches. In small areas where they are sloping and moderately steep, Arnot soils are intermixed with Lordstown soils.

Minor soils in this association are mainly those of the Mardin and Volusia series. The deep, moderately well drained Mardin soils and the somewhat poorly drained Volusia soils are in small areas where the depth to bedrock is more than 40 inches. They are commonly sloping or in depressions below Lordstown soils where runoff water accumulates.

Cleared areas of this association are idle or are reforested. Only a few areas are used for native pasture or crops. Yields are limited by a short growing season and limited water supply. The moderate and shallow depth to hard bedrock is the main limitation for most nonfarm uses. Some areas suitable for homesites have esthetic value.

19. Aurora-Farmington-Rock outcrop association, steep

Moderately deep and shallow, well drained and moderately well drained, high- to low-lime soils that have a medium-textured to moderately fine textured subsoil; and Rock outcrop; on uplands

This association is made up of dominantly steep, but also very steep soils on valley sides of uplands in the southern half of the county. Elevations are mainly between 1,000 and 1,500 feet.

This association makes up about 1.6 percent of the county. About 40 percent of it is Aurora soils, about 35 percent is Farmington soils, and about 15 percent is Rock outcrop. Minor soils make up the other 10 percent.

Aurora soils are moderately deep, well drained, and medium textured. They are medium and high in content of lime. These soils are 20 to 40 inches deep over alkaline or calcareous gray shale and fine-grained sandstone bedrock. They formed in glacial till derived mainly from shale and sandstone similar to the underlying bedrock.

Farmington soils are shallow, well drained, and medium textured. They are medium and low in content of lime. These soils are 10 to 20 inches deep over alkaline or calcareous, fine-grained sandstone and shale bedrock. The bedrock under Farmington soils generally is harder and more resistant to weathering than that under Aurora soils.

Aurora and Farmington soils have steep and very steep slopes.

The most extensive areas of exposed bedrock that make up the Rock outcrop part of this association are in very steep to nearly vertical gorges of streams where they cross the association. Smaller areas are in narrow bands where the harder sandstone strata crop out on the steep and very steep hillsides.

Minor soils in this association are mainly those of the Angola, Honeoye, Lansing, and Varick series. The deep, well-drained Honeoye and Lansing soils are intermingled in small areas where the depth to bedrock is more than 40 inches. The moderately deep, somewhat poorly drained Angola and poorly drained Varick soils are level to sloping on small narrow benches where seepage water from the bedrock keeps the soils wet for long periods.

Cleared areas of this association are used mainly for native pasture or are idle. Much of the association is in forest. Slope and depth to bedrock are the major limitations for both farm and nonfarm uses. Some accessible areas, suitable for homesites, also have esthetic value. Some places have suitable slope aspect for ski-area development.

20. Benson-Wassaic-Rock outcrop association, steep

Shallow, somewhat excessively drained or excessively drained, and moderately deep, well drained and

moderately well drained, high- and medium-lime soils that have a medium-textured subsoil; and Rock outcrop; on uplands

This association is made up of dominantly steep, but also very steep soils in areas adjacent to and including limestone escarpments. Relief has been strongly affected by the underlying bedrock, and bedrock exposures on the escarpments are prominent features of the landscape. Areas of this association are mainly in a narrow east-west belt that crosses the central part of the county. They parallel and include areas of the Onondaga Limestone Escarpment, which passes through the southern edge of Syracuse. Elevations are mainly between 700 and 1,000 feet.

This association makes up about 0.3 percent of the county. About 35 percent of it is Benson soils, and about 25 percent is Wassaic soils. Rock outcrop makes up another 15 percent, and minor soils make up the other 25 percent.

Benson soils are shallow, somewhat excessively drained or excessively drained, and medium textured. They have a high content of lime. These soils formed in thin deposits of glacial till derived mainly from limestone, sandstone, and shale. Bedrock, which is mainly limestone, is at a depth of 10 to 20 inches.

Wassaic soils are moderately deep, well drained and moderately well drained, and medium textured. They are medium and high in content of lime. These soils formed in thin deposits of glacial till derived mainly from limestone, sandstone, and shale. Wassaic soils are in areas where the bedrock is at a depth of 20 to 40 inches.

The Rock outcrop part of this association consists mainly of exposures of bedrock on nearly vertical cliffs and in gorges of streams that cross areas of the association. In addition to the exposures of bedrock, there are many very shallow areas where bedrock is at a depth of less than 10 inches.

Minor soils in this association are mainly those of the Cazenovia, Honeoye, and Ontario series. These deep, well-drained soils are generally on less steeply sloping areas where the depth to bedrock is more than 40 inches. Also of minor extent are small areas of Fluvaquents, frequently flooded. They are on narrow flood plain areas in the bottoms of gorges.

Cleared areas of this association are used mainly for native pasture or are idle. Much of the acreage of this association is in forest where tree growth is highly variable. Slope and the depth to bedrock are major limitations for both farm and nonfarm uses. Some accessible areas are desirable as homesites and also have esthetic value.

21. Camillus association, steep

Moderately deep, well drained and moderately well drained, medium- and high-lime soils that have a medium-textured subsoil; on uplands

This association is made up of dominantly steep, but also very steep soils on valley sides and in gorges in the northern part of the county. Relief has been affected by the shale bedrock. Elevations are mainly between 400 and 700 feet.

This association makes up about 0.2 percent of the county. About 75 percent of it is Camillus soils. Minor soils make up the other 25 percent.

Camillus soils are moderately deep, dominantly well drained, and medium textured. They are medium and high in content of lime. These soils are 20 to 40 inches deep over soft, silty, alkaline or calcareous shale. They formed in thin deposits of till or partly in residuum derived from this underlying shale.

Minor soils in this association are those of the Benson, Lairdsville, Ontario, and Wassaic series. The deep Ontario soils are intermingled in small areas where the depth to bedrock is greater than 40 inches. The shallow and moderately deep Benson and Wassaic soils are commonly at higher elevations in areas where limestone bedrock is close to the surface. The moderately deep Lairdsville soils are at lower elevations where clay shale bedrock is within 20 to 40 inches of the surface. Natural drainage of these minor soils ranges from moderate to excessive. Also of minor extent in the association are small areas of Fluvaquents, frequently flooded. They are on narrow flood plains of high-gradient streams that cross areas of the association.

Cleared areas of this association are idle or in native pasture. Most areas are in forest. Slope and depth to bedrock are the main limitations for most farm and nonfarm uses. Also, Camillus soils are highly erodible if not protected.

22. Arnot-Lordstown-Mardin association, steep

Shallow, moderately deep, and deep, well drained and moderately well drained, very low and low lime soils that have a medium textured subsoil; on uplands

This association is made up of dominantly steep and very steep soils on valley sides at higher elevations in the southern third of the county. Elevations are mainly more than 1,400 feet.

This association makes up about 0.9 percent of the county. About 40 percent of it is Arnot soils, about 30 percent is Lordstown soils, and 20 percent is Mardin soils. Minor soils make up the other 10 percent.

The Arnot, Lordstown, and Mardin soils formed in deposits of glacial till derived mainly from sandstone and shale.

Arnot soils are shallow, dominantly well drained, and medium textured. The deposits in which these soils formed are thin, and hard sandstone or shale bedrock is at a depth of 10 to 20 inches. In places Arnot soils are moderately well drained and have a seasonal high water table perched above the bedrock at a depth of 15 to 18 inches.

The moderately deep, well-drained, medium-textured Lordstown soils are similar to Arnot soils, but they have bedrock at a depth of 20 to 40 inches.

The deep, moderately well drained, medium-textured Mardin soils have bedrock at a depth of more than 40 inches. Mardin soils have a dense, slowly permeable fragipan at a depth of 15 to 24 inches that restricts rooting depth and water movement.

Minor soils in this association are mainly those of the Howard, Lansing, and Volusia series. These are all deep soils where bedrock is at a depth of more than 40 inches. Howard soils are along glacial outwash channels that cross areas of the association. Lansing soils are along steep and very steep foot

slopes, and Volusia soils are around seeps. Natural drainage of these minor soils ranges from somewhat excessive to somewhat poor. Also of minor extent in this association are small areas of rock outcrop where bedrock is exposed along gorges and narrow ledges.

Most areas of this association are in forest. The few cleared areas are used mainly for native pasture or are idle, but some are reforested. Slope and depth to bedrock are the main limitations for most farm and nonfarm uses. Some accessible areas are suitable for homesites and also have esthetic value. Some places have favorable slope aspect for ski-area development.

Upland Areas Dominated by Moderately Deep Soils That Formed in Thin Glacial-Till Deposits Over Shale Bedrock and Are Moderately Well Drained and Somewhat Poorly Drained

The soils in the two associations of this group are on uplands where relief is affected by the underlying shale bedrock. They cover a total of about 5.5 percent of the county. Areas are in two general locations. One is in the northern third of the county where the underlying bedrock is reddish-colored clay shale. The other is in the southern half of the county where much of the underlying bedrock is relatively soft, gray shale. Bedrock is within 20 to 40 inches of the surface in many of the areas. Moderately deep, medium textured to moderately fine textured soils that have medium- and high-lime profiles are dominant in this group of associations. The soils are mainly moderately well drained and somewhat poorly drained. They formed in thin deposits of till or residuum derived mainly from the underlying shale bedrock. Permeability of the subsoil is slow or very slow. The soils range from level to sloping. Most of the cleared areas in the northern third of the country are idle. Those in the southern half of the county are used mainly for crops and pasture, but some are idle.

23. Aurora-Angola-Darien association, gently sloping

Moderately deep and deep, moderately well drained and somewhat poorly drained, medium- and high-lime soils that have a medium-textured to moderately fine textured subsoil; on uplands

This association is made up of dominantly gently sloping but also level and sloping soils on uplands. Relief has been affected by the underlying shale bedrock. Areas of this association are scattered throughout the southern half of the county. Elevations are mainly between 1,000 and 1,500 feet.

This association makes up about 3.7 percent of the county. About 70 percent of it is Aurora soils, and about 20 percent is a complex of Angola and Darien soils. Minor soils make up the other 10 percent.

Aurora soils are moderately deep, moderately well drained, and medium textured. They are medium and high in content of lime. These soils are underlain by bedrock at a depth of 20 to 40 inches. The bedrock is dominantly dark-gray, relatively soft shale that is alkaline or calcareous. In places the shale is interbedded with thin strata of harder, fine-grained sandstone. Aurora soils formed in thin deposits of till derived mainly from this underlying shale and lesser amounts of limestone. They are gently sloping to sloping and are on convex hilltops and hillsides where runoff is somewhat slow or where some runoff water accumulates. These soils have a seasonal high water table at a depth of 18 to 24 inches that is perched on the slowly permeable subsoil.

The moderately deep Angola and deep Darien soils are similar to and formed in the same kind of material as Aurora soils. They are somewhat poorly drained and have a seasonal high water table at a depth of 6 to 12 inches that persists for longer periods than in Aurora soils. They occur in intricate patterns on flats above Aurora soils where runoff is slow or on foot slopes and in depressions below Aurora soils where water accumulates. Depth to bedrock ranges from 20 inches to more than 40 inches over very short horizontal distances.

Minor soils in this association are mainly those of the Farmington, Kendaia, Lima, Lyons, and Varick series. The shallow Farmington soils are in small areas scattered throughout the association where hard bedrock is at a depth of less than 20 inches. The deep Kendaia, Lima, and Lyons soils are in small areas where bedrock is at a depth of more than 40 inches. The moderately well drained Lima soils are intermingled with Aurora soils, and the somewhat poorly drained Kendaia and poorly drained Lyons soils are intermingled with Darien soils. Varick soils are similar to but are the wetter drainage associates of Aurora and Angola soils. They are intermingled with Aurora and Angola soils in wetter areas.

Cleared areas of this association are used mainly for crops and pasture, but some areas are idle. The somewhat poorly drained Angola-Darien complex needs drainage for best crop growth. Wetness, depth to bedrock, and slow or very slow permeability are the main limitations for many nonfarm uses. Some of the better drained areas are suitable for homesites and also have esthetic value.

24. Lairdsville-Brockport-Lockport association, gently sloping

Moderately deep, well drained, moderately well drained, and somewhat poorly drained, medium- and high-lime soils that have a fine textured to moderately fine textured subsoil; on uplands

This association is made up of dominantly gently sloping, but also level and sloping soils on uplands. Relief has been affected by the underlying shale bedrock. Areas of this association are scattered throughout the northern third of the county where soft clay shale of the Vernon Formation is close to the surface. They are mainly on lower fringes of uplands adjacent to the lake plains, or they are in islandlike areas that protrude above the lake plains. Elevations are generally between 400 and 500 feet.

This association makes up about 1.8 percent of the county. About 45 percent of it is Lairdsville soils, about 20 percent is Lockport soils, and about 20 percent is Brockport soils. Minor soils make up the other 15 percent.

Lairdsville soils are moderately deep, moderately

well drained and well drained, and medium textured. They have a moderately fine textured or fine textured subsoil. Reddish clay shale bedrock is at a depth of 20 to 40 inches. These soils are medium and high in content of lime. They formed in residuum or mixed glacial till and residuum derived mainly from the underlying shale. These soils are dominantly moderately well drained. They have a seasonal high water table at a depth of 15 to 24 inches that is perched on the slowly permeable or very slowly permeable subsoil. Lairdsville soils are gently sloping to sloping and are on convex hilltops where runoff is somewhat slow or on hillsides where some runoff water accumulates.

Brockport and Lockport soils have profiles similar to those of Lairdsville soils. They are also moderately deep over clay shale and formed in the same kind of material. These soils differ mainly in that they are somewhat poorly drained and have a seasonal high water table at a depth of 6 to 12 inches that persists for longer periods than in Lairdsville soils. Brockport soils have brown and olive colors in contrast to the reddish colors of Lairdsville and Lockport soils. Brockport and Lockport soils are on flat hilltop areas above Lairdsville soils where runoff is slow or they are on foot slopes and in depressions below Lairdsville soils where water accumulates.

Minor soils in this association are mainly those of the Cazenovia, Lakemont, Ontario, and Wampsville series. These are all deep soils. Bedrock is at a depth of more than 40 inches. The Cazenovia and Ontario soils are intermingled with the major soils of the association on uplands. The Lakemont soils are in low wet depressions where clay sediment was deposited in small glacial lakes. The Wampsville soils are in small areas of glacial outwash where glacial streams deposited gravel, shale, and sand. These minor soils range from well drained to very poorly drained.

Cleared areas of this association are mostly idle. A few areas are used for crops and pasture, and some are in urban use. The major soils are slow to dry out and clod if plowed when too wet or too dry because of the high clay content of the surface layer. Drainage is needed on the wetter soils for best crop growth, but it is difficult to establish because of the slowly permeable or very slowly permeable, clayey subsoil. The hazard of erosion is severe on the gently sloping and sloping areas if these soils are not protected. Seasonal wetness, slow permeability or very slow permeability, and depth to bedrock are limitations for many nonfarm uses. Also, the clayey soil material is very sticky when wet. In places the shale bedrock underlying the major soils is a source of clay for industrial uses.

Lake-Plain Areas Dominated by Deep Soils That Formed in Sandy Deltaic and Glacio-Lacustrine Sediment and Are Excessively Drained to Very Poorly Drained

The soils in the three associations of this group are scattered across the lake plains in the northern half of the county. They cover a total of about 3.9 percent of the county. Areas are mainly on deltas and in glacial water dissection channels. The soils are deep and formed mainly in water-sorted sandy deposits. They have a medium-textured to moderately coarse textured and coarse-textured surface layer. The content of lime ranges from high to very low. The soils are nearly level to rolling. Drainage ranges from excessive on the more rolling areas to very poor in the lower depressions. Permeability is mainly moderate to rapid, but in places slowly permeable layers are in the substratum. The use pattern is complex. About half of the cleared areas are farmed, and about half are idle.

25. Arkport-Colonie association, gently sloping

Deep, well-drained, medium- and low-lime soils that have a banded, medium-textured to moderately coarse textured and coarse textured subsoil; and deep, well-drained to excessively drained, low and very low lime soils that have a coarse-textured subsoil; on deltas, beaches, and bars of lake plains

This association is made up of dominantly gently sloping, but also nearly level, undulating, or rolling soils on sandy deltas and beach and bar areas of the lake plains. Areas of this association are mostly in the northern half of the county. Elevations are 400 to 500 feet.

This association makes up about 1.7 percent of the county. About 40 percent of it is Arkport soils, and about 35 percent is Colonie soils. Minor soils make up the other 25 percent.

Arkport soils are deep, well drained, and medium textured. They are medium and low in content of lime. These soils formed in deltaic or bar and beach deposits consisting mainly of sand but also containing some silt and clay. Arkport soils typically have a subsoil of thin bands of brown or reddish-brown very fine sandy loam in a lighter colored and lighter textured matrix below a depth of about 15 to 30 inches. They are mainly nearly level or gently sloping on the tops of deltas and undulating or rolling on dissection landforms.

The deep, well-drained to excessively drained Colonie soils are similar to and are closely intermingled with Arkport soils throughout areas of the association. They differ mainly in that they are generally coarser textured throughout. Also, they lack the textural bands above a depth of 30 inches that are characteristic of Arkport soils.

Minor soils in this association are mainly those of the Alton, Collamer, Galen, Lamson, Minoa, Otisville, and Williamson series. The Alton and Otisville soils are on gravelly parts of deltas, bars, and beaches. The other soils are in lower areas of the lake plains where the water table is closer to the surface than it is in Arkport and Colonie soils. Natural drainage of these minor soils ranges from excessive to very poor.

Cleared areas of this association are used mainly for crops or are idle. Many areas near Syracuse are in urban use. The major soils are low in natural fertility, and, in places, are droughty. These soils can be tilled early in spring, however, and are easy to till. They respond well if adequately fertilized and irrigated. The soils are also suitable for land smoothing and are very well suited to truck crops. They are subject to soil blowing, and water erosion is a hazard on the sloping areas if the soils are cultivated and not protected. The soils are fairly well suited to many

nonfarm uses that require good drainage. Banks in shallow excavations are subject to caving, and trafficability is poor on noncohesive, sandy areas. Establishment and maintenance of vegetation is difficult because of lower fertility and, in places, droughtiness.

26. Croghan-Naumburg association, nearly level

Deep, moderately well drained to poorly drained, very low and low-lime soils that have a coarse-textured subsoil; on deltaic areas of lake plains

This association is made up of dominantly nearly level, but also level, sandy soils in deltaic areas on the lake plains. Areas of this association are mostly in the northwestern corner of the county, but a few areas are scattered across the rest of the northern quarter. Elevations are below 450 feet.

This association makes up about 0.5 percent of the county. About 40 percent of it is Croghan soils, and about 30 percent is Naumburg soils. Minor soils make up the other 30 percent.

Croghan and Naumburg soils are deep and coarse textured. They are very low and low in content of lime. These soils formed in the same kind of sandy deltaic deposits on the lake plains. Croghan soils are moderately well drained and have a seasonal high water table that fluctuates to within 18 to 24 inches of the surface through rapidly permeable sandy material. Naumberg soils are poorly drained and somewhat poorly drained, and the water table is at a depth of 6 to 12 inches and persists for longer periods. Croghan soils are level and nearly level generally in slightly higher deltaic positions above Naumburg soils.

Minor soils in this association are those of the Alton, Colonie, Lamson, Minoa, Otisville, and Wareham series. The wetter Lamson and Wareham soils are in depressions. The Minoa soils are in landscape positions similar to those of Naumburg soils. The sandy Colonie soils are on knolls. Alton and Otisville soils are mainly on beach and bar areas where gravel was deposited. Drainage of these minor soils ranges from very poor to excessive.

Cleared areas of this association are mostly idle or in native pasture. Only a few small areas are cropped. Under adequate management that includes drainage and, in places, irrigation, the major soils are suited to such truck crops as potatoes, blueberries, and strawberries. Seasonal wetness is a major limitation for many nonfarm uses. Also, the soils are subject to caving in shallow excavations, and trafficability is poor in noncohesive sandy areas if they are dry.

27. Minoa-Lamson-Galen association, nearly level

Deep, moderately well drained to very poorly drained, medium- and high-lime soils that have a moderately coarse textured to medium-textured subsoil; on sandy deposits of lake plains

This association is made up of dominantly nearly level, but also level and gently sloping soils on delta fringes and glacial stream channel areas on the lake plains. Areas of this association are scattered mainly across the northern third of the county. Elevations are below 450 feet.

This association makes up about 1.7 percent of the county. About 45 percent of it is Minoa soils, about 30 percent is Lamson soils, and about 15 percent is Galen soils. Minor soils make up the other 10 percent.

All of these soils formed in the same kind of deltaic or glacial stream channel deposits of fine sand and very fine sand on the lake plains. They are deep and medium textured or moderately coarse textured. They are medium and high in content of lime.

Minoa soils are somewhat poorly drained and moderately coarse textured. They have a seasonal high water table at a depth of 6 to 12 inches that persists for relatively long periods. The soils are nearly level and gently sloping in areas above or below Galen soils where runoff is slow or water accumulates.

Lamson soils are poorly drained and very poorly drained and medium textured. They have a prolonged high water table at or near the surface for long periods. Water ponds in places. Lamson soils are intermingled with Minoa and Galen soils in depressions where water accumulates and remains for long periods.

Galen soils have a medium-textured surface layer. They are moderately well drained and have a seasonal high water table at a depth of 15 to 24 inches. These soils are nearly level and gently sloping and are intermingled with Minoa and Lamson soils in landscape positions where runoff is somewhat slow or where some water accumulates.

Minor soils in this association are mainly those of the Appleton, Alton, Arkport, Bombay, Collamer, Colonie, Hilton, Madrid, Niagara, and Palms series. The sandy Arkport and Colonie soils, the silty Collamer and Niagara soils, and the gravelly Alton soils and Palms muck are all intermingled with Minoa, Lamson, and Galen soils on the lake plains. Appleton, Bombay, Hilton, and Madrid soils that formed in till are in small islandlike areas that protrude above the lake plains. Drainage of these minor soils ranges from very poor to somewhat excessive.

Cleared areas are used mainly for farming or are idle. If adequately drained the major soils are well suited to many crops, particularly annual row crops and vegetables. Wetness and poor stability are the main limitations for many nonfarm uses.

Lake-Plain and Valley Areas Dominated by Deep Soils That Formed in Silty or Clayey Glacio-Lacustrine Sediment and Are Moderately Well Drained and Somewhat Poorly Drained

The soils in the five associations of this group are scattered across the lake plains in the northern half of the county and, to a lesser extent, in the larger north-south valleys in the central part of the county. They cover about 10.2 percent of the county. Associations of soils that formed in silty lacustrine sediments on the lake plains in the northern half of the county are the most extensive, and make up about 90 percent of the area covered by this group. These soils are deep, medium textured, and are medium and high in content of lime. They have a moderately slowly permeable or slowly permeable subsoil and substratum. Associations of soils that make up the other 10 percent of the group are mainly in the larger north-south valleys. These soils are deep, medium textured to moderately fine

textured, and are high in content of lime. They formed in clayey lacustrine sediment and they have a very slowly permeable subsoil and substratum. The soils range from level or nearly level to rolling. They are dominantly moderately well drained and somewhat poorly drained, but in places those on the more sloping and rolling areas are well drained. Cleared areas are used mostly for farming or are idle. Some areas in the vicinity of Syracuse are in urban use.

28. Collamer-Dunkirk association, gently sloping

Deep, moderately well drained and well drained medium- and high-lime soils that have a medium-textured to moderately fine textured subsoil; on lake plains

This association is made up of dominantly gently sloping, but also nearly level, undulating, and rolling soils on some of the higher parts of the lake plains. Areas of this association are mainly in the northern half of the county. Elevations are mainly between 400 and 500 feet.

This association makes up about 1.1 percent of the county. About 60 percent of it is Collamer soils, and about 25 percent is Dunkirk soils. Minor soils make up the other 15 percent.

Collamer soils are deep, moderately well drained, and medium textured. They are medium and high in content of lime. These soils formed in lake-laid deposits of silt, very fine sand, and moderate amounts of clay. Collamer soils have a seasonal high water table at a depth of 12 to 18 inches that is perched on the slowly permeable substratum. They are nearly level and gently sloping and are in landscape positions where runoff is somewhat slow or some water accumulates.

Dunkirk soils formed in the same kind of material as Collamer soils. They differ in that they are well drained and the depth to the seasonal high water table is greater. Dunkirk soils lack the mottles above a depth of 20 inches that are characteristic of Collamer soils. They are commonly in rolling areas above Collamer soils where runoff is fairly rapid and water does not accumulate.

Minor soils in this association are mainly those of the Arkport, Canandaigua, Madrid, Niagara, and Ontario series. The Canandaigua and Niagara soils are the wetter drainage associates of Collamer and Dunkirk soils and are in small flats where runoff is slow or in small depressions where water remains for long periods. The well-drained, sandy Arkport soils are in small areas, and the moderately well drained, silty Williamson soils are in small areas where fragipans formed in the soil. The well-drained Madrid and Ontario soils are in scattered, small till islands that protrude above the lake plains.

Cleared areas of this association are used mainly for farming. Most crops commonly grown in the county are well suited to these soils, and they respond well to good management. The hazard of erosion is one of the major limitations to farming these soils. Undulating and rolling areas are common, so adequate erosion-control measures are difficult to establish in places. Many areas of this association in the vicinity of Syracuse are in, or are being developed for urban use. Erodibility, slowly permeable substrata, and seasonal wetness over the more extensive areas are major limitations for urban uses. Also, load-carrying capacity is variable over short distances and needs careful consideration.

29. Collamer-Niagara association, gently sloping

Deep, moderately well drained and somewhat poorly drained, medium- and high-lime soils that have a medium-textured to moderately fine textured subsoil; on lake plains

This association is made up of dominantly gently sloping, but also level and undulating soils on the lake plains where runoff is moderate or slow, or in areas that receive runoff from higher lying areas. Areas of this association are mainly in the northern half of the county. Elevations are mainly between 360 and 450 feet.

This association makes up about 3 percent of the county. About 55 percent of it is Collamer soils, and about 25 percent is Niagara soils. Minor soils make up the other 20 percent (fig. 6).

Collamer and Niagara soils formed in the same kind of lacustrine deposits of silt, very fine sand, and moderate amounts of clay. They are similar soils that are deep, medium textured, and are medium and high in content of lime.

Collamer soils are moderately well drained and have a seasonal high water table at a depth of 12 to 18 inches. They are nearly level, gently sloping, or undulating and are in areas where runoff is somewhat slow or where some water accumulates.

Niagara soils are somewhat poorly drained and have a seasonal high water table at a depth of 6 to 12 inches. They are nearly level to very gently sloping and are in areas above Collamer soils where runoff is slower, or they are below Collamer soils in areas where water accumulates and remains for longer periods.

Minor soils in this association are mainly those of the Appleton, Canandaigua, Dunkirk, Hilton, Madrid, and Williamson series. The Canandaigua, Dunkirk, and Williamson soils formed in the same kind of lacustrine materials as Collamer and Niagara soils, and they are in small scattered areas intermingled with those soils on the lake plains. The Appleton, Hilton, Madrid, and Ontario soils formed in till and are in small, scattered, islandlike areas that protrude above the lake plains. In natural drainage these minor soils range from well drained to very poorly drained.

Cleared areas of this association are used mainly for farming, or are idle. The wetter areas that are cropped generally are drained. These soils are productive, and crops respond well to good management. The gently sloping and undulating areas are subject to erosion if they are cultivated and not protected. Some of the better drained areas in the vicinity of Syracuse are used for urban development. Wetness, moderately slow permeability or slow permeability, and erodibility are major limitations for urban uses. Also, the load-carrying capacity of these soils is extremely variable over short distances and needs careful consideration.

30. Niagara-Collamer association, nearly level

Deep, somewhat poorly drained and moderately well

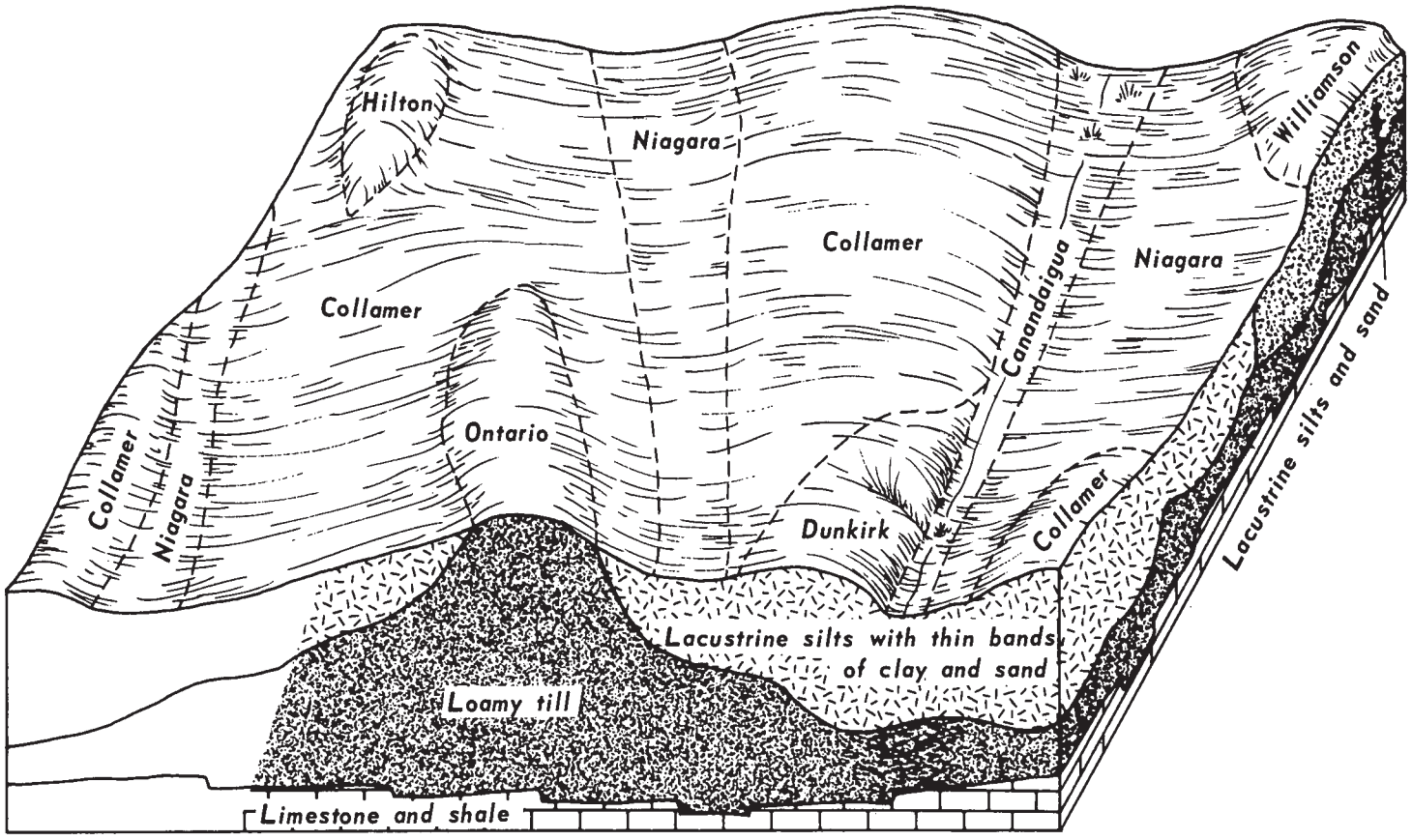

Figure 6.—Typical cross section of Collamer-Niagara association, gently sloping, on lake plains in the northern part of the county.

drained, medium- and high-lime soils that have a medium-textured to moderately fine textured subsoil; on lake plains

This association is made up of dominantly nearly level soils in areas of lake plains from which runoff is slow or moderately slow. Areas of this association are mainly in the northern half of the county. Elevations are mainly below 450 feet.

This association makes up about 3.3 percent of the county. About 70 percent of it is Niagara soils, and about 20 percent is Collamer soils. Minor soils make up the other 10 percent.

Niagara and Collamer soils formed in the same kind of lacustrine deposits of silt, very fine sand, and moderate amounts of clay. They are deep, medium textured, and medium and high in content of lime.

Niagara soils are somewhat poorly drained and have a seasonal high water table at a depth of 6 to 12 inches. The water table persists for longer periods in the Niagara soils than it does in Collamer soils. Niagara soils are on broad flats above Collamer soils where runoff is slow, or they are below Collamer soils in areas where water accumulates and remains for longer periods.

Collamer soils are moderately well drained and have a seasonal high water table at a depth of 12 to 18 inches.

Minor soils in this association are mainly those of the Canandaigua, Fonda, Lamson, Minoa, Palms, and Rhinebeck series. The wetter Canandaigua, Fonda, and Lamson soils and Palms muck are in small depressions. Minoa and Rhinebeck soils are intermingled with the major soils and occur as small sandy areas or clayey areas, respectively. Natural drainage of these minor soils ranges from somewhat poor to very poor.

Cleared areas of this association are used mainly for farming or are idle. Large acreages are in native pasture. Cropped areas generally are artificially drained. If adequately drained, the soils are well suited to such annual row crops as corn and beans. Wetness, moderately slow permeability or slow permeability, and poor stability are major limitations for many nonfarm uses.

31. Williamson-Niagara association, gently sloping

Deep, moderately well drained, low and very low lime soils that have a medium-textured fragipan; and deep, somewhat poorly drained, medium- and high-lime soils that have a medium-textured to moderately fine textured subsoil; on lake plains

This association is made up of dominantly gently sloping, but also level and undulating soils on lake plains. Areas of this association are mainly in the extreme northwestern part of the county, but few areas are scattered throughout the rest of the northern quarter. Most elevations are less than 450 feet.

This association makes up about 1.7 percent of the county. About 65 percent of it is Williamson soils, and about 20 percent is Niagara soils. Minor soils make up the other 15 percent.

Williamson soils are deep, moderately well drained, and medium textured. They are low and very low in content of lime. These soils formed in lacustrine deposits of silt, very fine sand, and small amounts of clay. Williamson soils have a well-expressed, slowly permeable or moderately slowly permeable fragipan at a depth of 15 to 24 inches that restricts rooting and movement of water. They have a seasonal high water table that is perched above the pan. These soils are mainly nearly level, gently sloping, or undulating on the higher parts of the lake plains where runoff is somewhat slow or where some runoff water accumulates.

Intermingled in depressions and along drainageways on the lake plains are areas of wetter Niagara soils that receive runoff from the higher lying Williamson soils. Niagara soils are deep, medium textured, and are medium to high in content of lime. They formed in lacustrine materials similar to those in which Williamson soils formed, but they have a higher content of lime. Niagara soils are somewhat poorly drained and have a seasonal high water table at a depth of 6 to 12 inches that persists for longer periods than it does in Williamson soils.

Minor soils in this association are mainly those of the Alton, Arkport, Bombay, Canandaigua, Colonie, Lamson, Minoa, and Wyland series. The gravelly Alton soils and the sandy Arkport and Colonie soils are on small deltas or in beach and bar areas of the lake plains. The Canandaigua, Lamson, and Minoa soils are intermingled as small scattered areas in low depressions on the lake plains. Bombay soils that formed in till are on small, scattered, islandlike areas that protrude above the lake plains. Wayland soils and also Fluvaquents, frequently flooded, are on narrow flood plains of streams that cross the association. Natural drainage of these minor soils ranges from excessive to very poor.

Cleared areas of this association are used mainly for farming or are idle. The major soils are relatively low in natural fertility, but crops respond well to adequate applications of lime and fertilizer. The hazard of erosion is severe on more sloping soils of the association if they are cultivated and not protected. Also, the wetter areas need drainage for best crop response. Seasonal wetness and slow permeability are major limitations for many nonfarm uses.

32. *Schoharie-Odessa association, rolling*

Deep, well drained and somewhat poorly drained, high-lime soils that have a fine textured to moderately fine textured subsoil; on lake plains

This association is made up of dominantly rolling, but also level, gently sloping, and undulating soils on the lake plain. Areas of this association are most extensive in the larger north-south valleys in the central part of the county. The areas are mainly on valley floors above flood plains and along lower valley walls. Elevations are mainly between 400 and 1,000 feet.

This association makes up about 1.1 percent of the county. About 50 percent of it is Schoharie soils, and about 25 percent is Odessa soils. Minor soils make up the other 25 percent.

Schoharie soils are deep, moderately well drained and well drained, and medium textured and moderately fine textured. They have a high content of lime. These soils formed in lake-laid deposits of reddish-colored silt and clay that are calcareous. Schoharie soils have a seasonal high water table at a depth of 18 to 36 inches that is perched on the very slowly permeable, clayey subsoil and substratum. These soils are rolling, undulating, gently sloping and are in landscape positions where runoff is somewhat slow to rapid. Some runoff generally accumulates on foot slopes.

The deep, somewhat poorly drained, moderately fine textured Odessa soils are similar to and formed in the same kind of material as Schoharie soils. They have a seasonal high water table at a depth of 6 to 12 inches that persists for longer periods than it does in Schoharie soils. Odessa soils are nearly level to gently sloping and are in areas above Schoharie soils where runoff is slow, or they are along foot slopes in dissections and in depressions below Schoharie soils where runoff accumulates.

Minor soils in this association are mainly those of the Cazenovia, Collamer, Dunkirk, Fonda, Lakemont, and Palmyra series. The Lakemont and Fonda soils are the wetter drainage associates of Schoharie and Odessa soils and are in small depressions on the lake plains. Collamer and Dunkirk soils are in small scattered areas where silt and very fine sand were deposited, generally in the higher landscape positions. Palmyra soils are on small kames or narrow outwash plains where glacial streams deposited gravel and sand. Cazenovia soils, which formed in till, are on small islandlike areas that protrude above the lake plains, or they are along valley walls.

Cleared areas of this association are used mostly for farming or are idle. These soils are difficult to till because of the high content of clay, so hay is the main crop. The hazard of erosion is severe if these soils are cultivated and not protected. Seasonal wetness, very slow permeability, and poor stability are major limitations for many nonfarm uses. Also, the sticky, plastic clay provides poor trafficability when wet and is subject to mass slippage on steeper slopes. Some areas are suitable for homesites and also have esthetic value.

Lake-Plain and Valley Areas Dominated by Deep Soils That Formed in Silty or Clayey Glacio-Lacustrine Sediment and Are Somewhat Poorly Drained to Very Poorly Drained

The soils in the three associations of this group are mostly on the lake plains in the northern half of the county. They cover about 3.2 percent of the county. The areas are made up of either deep, medium-textured, medium- and high-lime soils that formed in silty lacustrine sediment, or deep, medium-textured to moderately fine textured, high-lime soils that formed in

clayey sediment. Drainage of these soils ranges from somewhat poor to very poor. Permeability is moderately slow or slow in those soils that formed in silty material, and it is slow or very slow in those soils that formed in clayey sediment. The soils are level, nearly level, or depressional. Cleared areas are used mainly for pasture or are idle. Many areas are in water-tolerant trees.

33. Niagara-Canandaigua association, nearly level

Deep, somewhat poorly drained to very poorly drained, medium- and high-lime soils that have a medium-textured to moderately fine textured subsoil; on lake plains

This association is made up of dominantly nearly level or depressional soils on the lake plains where runoff is slow or very slow, or where water accumulates and remains for relatively long periods. Areas of this association are mainly in the northern half of the county. Elevations are less than 450 feet.

This association makes up about 0.9 percent of the county. About 55 percent of it is Niagara soils, and about 30 percent is Canandaigua soils. Minor soils make up the other 15 percent.

Niagara and Canandaigua soils formed in the same kind of lacustrine deposits of silt, very fine sand, and moderate amounts of clay. They are deep, medium textured, and are medium and high in content of lime. They differ in that Niagara soils are somewhat poorly drained and have a seasonal high water table at a depth of 6 to 12 inches, whereas Canandaigua soils are poorly drained and very poorly drained, the water table is at or near the surface for long periods, and water ponds in places. The Canandaigua soils are commonly below Niagara soils in depressions where water accumulates and remains for longer periods.

Minor soils in this association are mainly those of the Collamer, Fonda, Lamson, Minoa, Palms, and Rhinebeck series. The Collamer soils are on small knolls at the highest elevations. The very poorly drained Fonda soils are in small depressions where clay was deposited. The poorly drained and very poorly drained Lamson soils are in small depressions where sand was deposited. Palms muck is in the small, lowest depressions where plant remains are deposited. The Minoa and Rhinebeck soils are intermingled on similar landscape positions with Niagara soils. The Minoa soils are in small sandy areas, and the Rhinebeck soils are in small clayey areas. In natural drainage these minor soils range from very poorly drained to moderately well drained.

Cleared areas of this association are used mainly for native pasture or are idle. If cropped, those soils generally are artificially drained. If adequately drained, they are particularly productive of such annual row crops as corn. Wetness, moderately slow permeability or slow permeability, and poor stability are the main limitations for many nonfarm uses.

34. Fonda-Lakemont association, level

Deep, very poorly drained and poorly drained, high-lime soils that have a fine textured to moderately fine textured subsoil; on lake plains

This association is made up of dominantly level, but also nearly level or depressional soils on the lake plains where runoff is very slow or water accumulates and remains for long periods. Areas of this association are mainly in the northern half of the county. Elevations are mainly less than 500 feet.

This association makes up about 0.5 percent of the county. About 40 percent of it is Fonda soils, and about 30 percent is Lakemont soils. Minor soils make up the other 30 percent.

Fonda and Lakemont soils formed in similar kinds of lacustrine deposits of silt and clay. They are deep, moderately fine textured soils that have a high content of lime. These soils differ mainly in that Fonda soils are very poorly drained and have a mucky surface layer that the poorly drained Lakemont soils do not have. Fonda and Lakemont soils have a seasonal high water table at or near the surface, and water ponds in many places. Fonda soils are commonly below Lakemont soils in depressions where water remains for slightly longer periods than it does on Lakemont soils.

Minor soils in this association are mainly those of the Brockport, Collamer, Lockport, Niagara, Odessa, Palms, and Schoharie series. The Brockport and Lockport soils are on small islandlike areas of till where soft shale bedrock is at a depth of 20 to 40 inches. Odessa and Schoharie soils are better drained associates of Fonda and Lakemont soils and are in small, scattered higher areas in the association. The silty Collamer and Niagara soils are on small scattered knolls where silt has been deposited. Areas of very poorly drained Palms muck are in the lowest depressions where plant remains accumulate. In natural drainage these minor soils range from very poorly drained to moderately well drained.

Cleared areas of this association are used mainly for wetland pasture or are idle. Many areas are in forests of water-tolerant trees. Wetness, very slow permeability, moderately fine texture or fine texture, and poor stability are the main limitations for most nonfarm uses. In places there are suitable sites for ponds and shallow-water impoundments.

35. Rhinebeck-Fonda association, nearly level

Deep, somewhat poorly drained and very poorly drained, high-lime soils that have a moderately fine textured to fine textured subsoil; on lake plains

This association is made up of dominantly nearly level, but also level soils on lake plains that are dotted with depressions. Areas of this association are mainly in the northeastern part of the county. Elevations are mainly less than 400 feet.

This association makes up about 1.8 percent of the county. About 70 percent of it is Rhinebeck soils, and about 15 percent is Fonda soils. Minor soils make up the other 15 percent.

Rhinebeck soils are deep, somewhat poorly drained, and medium textured. They have a high content of lime. These soils formed in lacustrine deposits of silt and clay. They are level and nearly level and are mainly on lake plains where runoff is slow. They have a seasonal high water table at a depth of 6 to 12 inches that is perched on the slowly permeable subsoil and substratum.

Closely intermingled with Rhinebeck soils in depressions on the lake plains where water accumulates are areas of wet, mucky Fonda soils. Fonda soils formed in the same kind of lacustrine silt and clay deposits as Rhinebeck soils. They are also deep soils that have a high content of lime. These soils differ from Rhinebeck soils in that they are very poorly drained, have a moderately fine textured surface layer, and are high in content of organic matter. Fonda soils have a seasonal high water table at or near the surface much of the time. Water ponds in many places.

Minor soils in this association are mainly those of the Appleton, Canandaigua, Collamer, Hilton, Ontario, Palms, and Schoharie series. The Collamer and Schoharie soils are on small knolls on the lake plains. Canandaigua soils are in low depressions where silt has been deposited. Palms muck is in the lowest depressions where plant remains accumulate. The Appleton, Hilton, and Ontario soils formed in till and are on small islandlike uplands that protrude above the lake plains. These minor soils range from very poorly drained to well drained.

Cleared areas of this association are used mainly for pasture or are idle. A few areas are cropped, mainly for hay. If adequately drained, the soils are suited to such row crops as corn. Many areas of the association are forested. Wetness, slow permeability or very slow permeability, a moderately fine textured or fine textured subsoil, and poor stability are the main limitations for most nonfarm uses. Many areas have suitable sites for ponds or shallow-water developments.

Valley Areas Dominated by Deep Soils That Formed in Gravelly and Sandy Glacial Outwash on Old Alluvial Fans, Terraces, Deltas, and Kames and Are Excessively Drained to Moderately Well Drained

The soils in the four associations and two undifferentiated groups of soils in this major grouping are scattered throughout the county. They cover about 8.2 percent of the county. The areas are most extensive on glacial outwash terraces and fan deposits along the larger valleys in the southern two-thirds of the county. The soils are deep. They formed in water-sorted deposits of gravel and sand on old alluvial fans, terraces, deltas, and kames. The more extensive soils have a medium-textured to moderately coarse textured surface layer and high- and medium-lime profiles. In natural drainage the major soils are well drained to somewhat excessively drained or excessively drained. About 75 percent of the soils are level, gently sloping, or undulating. The remaining 25 percent are rolling or hilly to very steep. Permeability ranges from moderate to very rapid in the surface layer and subsoil, but it is rapid or very rapid in the gravelly substratum. Most areas where the soils are level, gently sloping, or undulating are used mainly for farming. The rolling to very steep areas are mostly idle, but a few are used for pasture.

36. Howard and Herkimer soils, gently sloping

Deep, well-drained and somewhat excessively drained, medium- and high-lime soils that have a medium-textured subsoil; on old alluvial fans

This undifferentiated group is made up of dominantly gently sloping, but also nearly level soils on old alluvial fans. Areas are mainly in the southern part of the county where high-gradient tributary streams enter the larger valleys. Elevations are mainly between 400 and 1,300 feet.

This undifferentiated group makes up about 0.9 percent of the county. About 55 percent of it is Howard soils, and about 25 percent is Herkimer soils. Minor soils make up the other 20 percent.

Howard soils are deep, well drained and somewhat excessively drained, and medium textured. They have a medium content of lime. These soils formed in outwash-fan material derived mainly from sandstone, limestone, and shale. They are nearly level and gently sloping. They are on fans of high-gradient streams that flow through areas of glacial till rich in sandstone, limestone, and shale.

Herkimer soils are deep, dominantly well drained, and medium textured. They are medium and high in content of lime. These soils formed in outwash-fan material that is mainly black and gray shale and limestone. They are nearly level to gently sloping. Herkimer soils are on alluvial fans of streams that cut gorges through shale bedrock or flow through areas of upland till rich in shale. In places Herkimer soils are moderately well drained and have a seasonal high water table at a depth of 24 inches.

Minor soils in this group are mainly those of the Aurora, Collamer, Dunkirk, Hamlin, Honeoye, Palmyra, Schoharie, and Teel series. The Hamlin and Teel soils are along the lower fringes of fans on flood plains. The Collamer, Dunkirk, and Schoharie soils are on dissections of the lake plains above the fans. The Palmyra soils are commonly intermingled with Howard soils on fans or are on kamy areas adjacent to them. The shaly Aurora soils are commonly on uplands adjacent to Herkimer soils on fans, and the Honeoye soils are on adjacent uplands near Howard soils on fans. Natural drainage of these minor soils ranges from somewhat poor to excessive.

Cleared areas are used mainly for crops. The major soils can be tilled fairly early in the season, and crops respond well to good management. Infrequent flash floods are a major limitation to farming and many nonfarm uses of these soils. Erosion is a hazard on the more sloping soils if they are not protected.

37. Palmyra-Howard association, gently sloping

Deep, well-drained to excessively drained, high- and medium-lime soils that have a medium-textured to moderately coarse textured subsoil; on glacial outwash terraces

This association is made up of dominantly gently sloping, but also level and undulating soils on glacial outwash terraces. These terraces are mainly along the larger valleys in the southern two-thirds of the county. Elevations are mainly between 600 and 1,300 feet.

This association covers about 3.4 percent of the county. About 60 percent of it is Palmyra soils, and 15

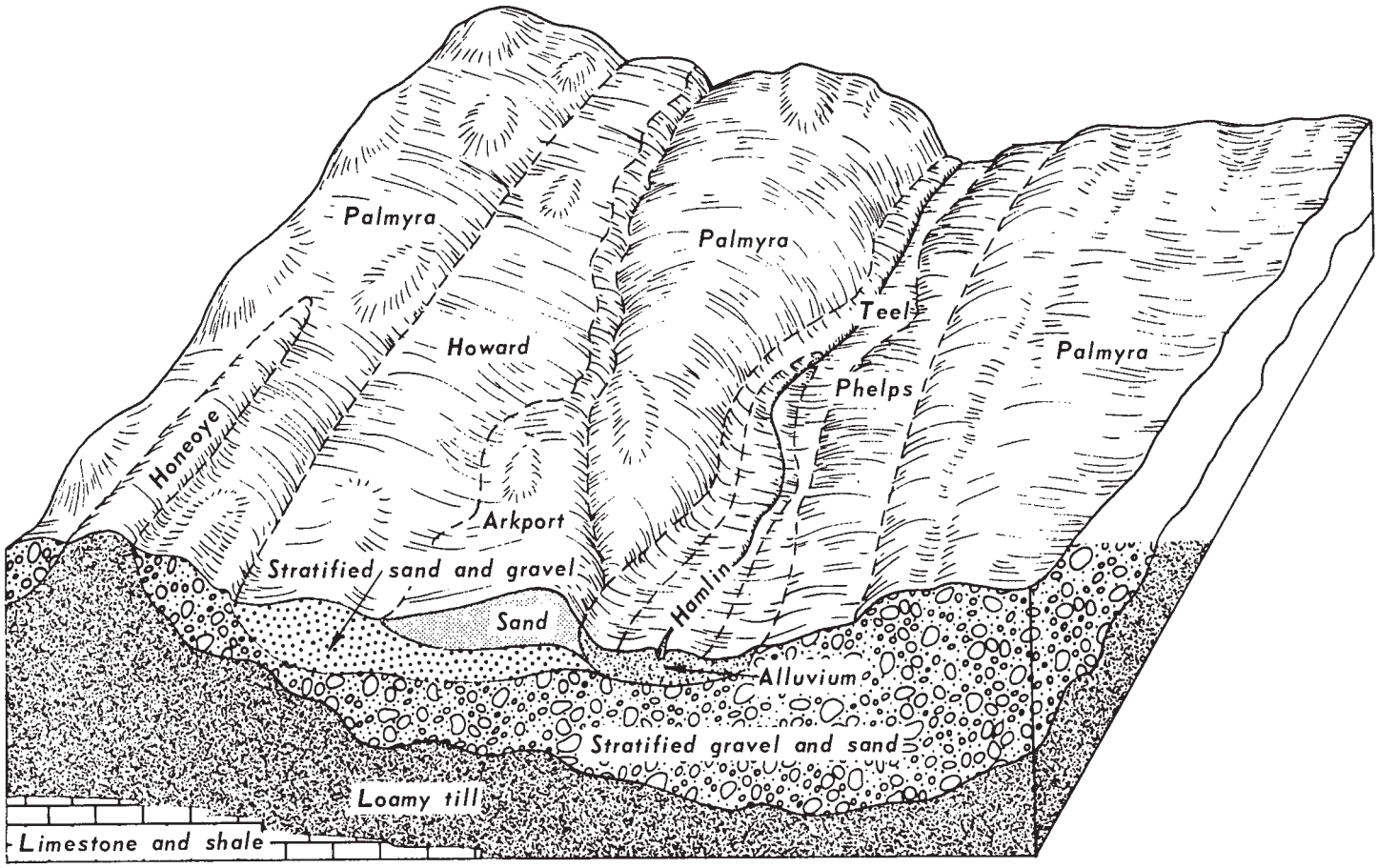

Figure 7.—Typical cross section of Palmyra-Howard association, gently sloping, on outwash deposits in valleys in the central and southern parts of the county.

percent is Howard soils. Minor soils make up the other 25 percent (fig. 7).

Palmyra and Howard soils formed in similar kinds of stratified gravelly and sandy glacial outwash material that derived mainly from sandstone, shale, and limestone. Aside from reaction and permeability, Palmyra and Howard soils differ mainly in that Palmyra soils contain less gravel in the subsoil than Howard soils. Also, Palmyra soils have free lime in the substratum immediately below the subsoil, whereas Howard soils do not in places.

Palmyra soils are deep, well drained to excessively drained, and medium textured. They have a high content of lime. Permeability is moderate to moderately rapid in the surface layer and subsoil and rapid to very rapid in the substratum.

Howard soils are deep, well drained and somewhat excessively drained, and medium textured and moderately coarse textured. They have a medium content of lime. Permeability is moderate to rapid in the surface layer and subsoil and very rapid in the substratum.

Minor soils in this association are mainly those of the Arkport, Dunkirk, Fredon, Halsey, Hamlin, Honeoye, Madrid, Ontario, Phelps, Schoharie, and Teel series. Fredon, Halsey, and Phelps soils are the wetter drainage associates of Palmyra and Howard soils, and are intermingled with Palmyra and Howard soils on lower parts of outwash terraces. Areas of sandy Arkport, silty Dunkirk, and clayey Schoharie soils are intermingled on the lake plains with, or adjacent to, areas of Palmyra and Howard soils. Hamlin and Teel soils are on narrow flood plains of streams flowing through the association. Small areas of Honeoye, Madrid, or Ontario soils are on adjacent uplands. In natural drainage these minor soils range from well drained to very poorly drained.

Most cleared areas of this association are used for farming. They can be tilled early in the season and are well suited to many crops, including fruits and vegetables. The high content of gravel and cobbles in the surface layer limits the choice of crops. Suitable crops respond well to good management. Many areas of this association are also in urban use, for which they have few limitations. The major soils are good potential sources of sand and gravel. In many places the glacial outwash materials in which the major soils formed are good aquifers and provide ample supplies of water for domestic use.

38. Wampsville-Palmyra-Phelps association, gently sloping

Deep, moderately well drained to excessively drained, medium- and high-lime soils that have a medium-

textured to moderately fine textured subsoil; on glacial outwash terraces

This association is made up of dominantly gently sloping, but also level and undulating soils on glacial outwash terraces in the northern part of the county. Areas of this association are confined to a relatively narrow east-west belt that extends from the vicinity of Plainville and Jordan in the western part of the county to near Mycenae and North Manlius in the eastern part. Elevations are mainly between 400 and 600 feet.

This association makes up about 1.1 percent of the county. About 40 percent of it is Wampsville soils, about 25 percent is Palmyra soils, and about 15 percent is Phelps soils. Minor soils make up the other 20 percent.

Wampsville soils are deep, well-drained, medium-lime soils that have a medium-textured surface layer and a moderately fine textured subsoil. They formed in deposits of glacial outwash that are rich in red and olive-gray clay shale. Permeability is moderate in the surface layer and subsoil and rapid in the substratum. Wampsville soils are commonly in positions intermediate to those occupied by Palmyra and Phelps soils.

Palmyra soils are deep, well drained to excessively drained, and medium textured. They have a high content of lime. These soils formed in glacial outwash material that contains less shale and more limestone and sandstone than that in which Wampsville soils formed. Palmyra soils have a coarser textured subsoil than Wampsville soils. Permeability is moderate to moderately rapid in the surface layer and subsoil of Palmyra soils and rapid to very rapid in the substratum. Palmyra soils are commonly above Wampsville soils in areas of the association.

Phelps soils are deep, moderately well drained, and medium textured. They formed in similar glacial outwash material and are closely intermingled with both Wampsville and Palmyra soils in areas of the association. They are in low areas or depressions where the water table is at a depth of 15 to 24 inches for brief intervals in spring and during wet periods.

Minor soils in this association are mainly those of the Brockport, Cazenovia, Fredon, Halsey, Lairdsville, Lakemont, Lockport, and Ontario series. The Fredon and Halsey soils are the wetter drainage associates of Wampsville, Palmyra, and Phelps soils and are intermingled in depressions on outwash terraces. Lakemont soils are in small depressions where clay was deposited in ponded areas. Brockport, Lairdsville, and Lockport soils are on either higher or lower positions where shale bedrock is at a depth of 20 to 40 inches. Cazenovia and Ontario soils that formed in till are on small uplands that protrude above the outwash terraces. In natural drainage these minor soils range from well drained to very poorly drained.

Cleared areas of this association are used mainly for crops. The major soils are productive, and crops respond well to good management. Many areas near Syracuse are developed for homesites. Seasonal wetness in places is one of the few limitations to urban uses.

39. *Alton and Otisville soils, gently sloping*

Deep, well-drained to excessively drained, medium- to very low lime soils that have a moderately coarse textured to coarse textured subsoil; on glacial outwash terraces and deltas or gravel beaches and bars of postglacial lakes

This undifferentiated group is made up of dominantly gently sloping, but also level or undulating soils on glacial outwash terraces and deltas or postglacial lake beaches and bars. The areas are mainly in the northern quarter of the county. Elevations are mainly between 400 and 600 feet.

This group makes up about 0.7 percent of the county. About 60 percent of it is Alton soils and about 20 percent is Otisville soils, and in a few areas they are intermingled. Minor soils make up the other 20 percent.

Alton and Otisville soils formed in similar kinds of stratified gravelly and sandy glacial outwash or postglacial lake beach and bar deposits. This material derived mainly from red and gray sandstone and, in the case of Alton soils, from limestone in places. Aside from reaction and permeability, Alton and Otisville soils differ mainly in that Alton soils have a lower content of sand in the surface layer and upper part of the subsoil than Otisville soils. Both soils have a high content of gravel. Areas of Alton soils are scattered across the entire northern quarter of the county, and Otisville soils are mainly in two areas in the northwestern part. The most extensive of these is north of Beaver Lake near Jacksonville and Little Utica; the other is north of Baldwinsville in the Three Rivers Game Management Area.

Alton soils are deep, well drained and somewhat excessively drained, and moderately coarse textured. They are medium and low in content of lime. Permeability is rapid throughout.

Otisville soils are deep, excessively drained, and coarse textured. They are very low and low in content of lime. Permeability is very rapid throughout.

Minor soils in this undifferentiated group are mainly those of the Arkport, Bombay, Colonie, Lamson, Madrid, Minoa, Phelps, and Williamson series. Areas of sandy Arkport, Colonie, Minoa, and Lamson soils and silty Williamson soils are on deltaic or lake plains that are scattered within and along the fringes of areas that are dominated by Alton and Otisville soils. Wetter Phelps soils that formed in similar materials on outwash deposits are in low positions. Bombay and Madrid soils that formed in till are on small upland knolls that protrude above the general elevation of areas of this undifferentiated group of soils. Natural drainage of these minor soils ranges from excessive to very poor.

Cleared areas are used mainly for truck farming or pasture, or are idle. The major soils are droughty, and applied fertilizer is readily leached from them. If irrigation is applied as needed and fertilization is timely, these soils are suited to intensive truck cropping. The soils are easy to work and can be tilled early in the season, but the content of gravel and cobbles in the surface layer limits the choice of crops. Droughtiness, low fertility, and content of gravel are the main limitations for many nonfarm uses. The major soils generally are good potential sources of sand and gravel.

40. Palmyra-Howard association, rolling

Deep, well-drained to excessively drained, high- and medium-lime soils that have a medium-textured to moderately coarse textured subsoil; on glacial outwash terraces and kames

This association is made up of dominantly rolling areas of soils on glacial outwash kames and terraces. Areas of this association are scattered throughout the larger valleys and lowlands of the county. Elevations are mainly between 400 and 1,300 feet.

This association makes up about 1.1 percent of the county. About 50 percent of it is Palmyra soils, and about 20 percent is Howard soils. Minor soils make up the other 30 percent.

Palmyra and Howard soils formed in similar kinds of stratified gravelly and sandy glacial outwash material that derived mainly from sandstone, shale, and limestone. Aside from reaction and permeability, Palmyra and Howard soils differ mainly in that Palmyra soils contain less gravel in the subsoil than Howard soils. Also, Palmyra soils have free lime in the substratum immediately below the subsoil, whereas Howard soils do not in places.

Palmyra soils are deep, well drained to excessively drained, and medium textured. They have a high content of lime. Permeability is moderate to moderately rapid in the surface layer and subsoil and rapid to very rapid in the substratum.

Howard soils are deep, well drained and somewhat excessively drained, and medium textured to moderately coarse textured. They have a medium content of lime. Permeability is moderate to rapid in the surface layer and subsoil and very rapid in the substratum.

Minor soils in this association are mainly those of the Alton, Arkport, Fredon, Halsey, Phelps, and Wampsville series. Fredon, Halsey, and Phelps soils are the wetter drainage associates of Palmyra and Howard soils. They are intermingled with Palmyra and Howard soils in depressions or in low kamy areas. Areas of sandy Arkport, coarser Alton, and more shaly Wampsville soils are intermingled in similar landscape positions with Palmyra and Howard soils.

Cleared areas of this association are used mainly for farming or are idle. Complex slopes restrict the use of cultivated crops because of the hazard of erosion. Slope is the main limitation for many nonfarm uses, but there are some good homesites. Many areas of this association are good potential sources of sand and gravel.

41. Palmyra-Howard association, hilly

Deep, well-drained to excessively drained, high- and medium-lime soils that have a medium-textured to moderately coarse textured subsoil; on glacial outwash terraces and kames

The association is made up of dominantly hilly soils in kame and kettle areas and moderately steep to very steep soils on glacial outwash terrace escarpments. Areas of this association are mainly along the larger valleys in the southern two-thirds of the county. Elevations are mainly between 600 and 1,300 feet.

This association makes up about 1 percent of the county. About 60 percent of it is Palmyra soils, and about 20 percent is Howard soils. Minor soils make up the other 20 percent.

Palmyra and Howard soils formed in similar kinds of stratified gravelly and sandy glacial outwash that derived mainly from sandstone, shale, and limestone. Aside from reaction and permeability, Palmyra and Howard soils differ mainly in that Palmyra soils contain less gravel in the subsoil than Howard soils. Palmyra soils have free lime in the substratum immediately below the subsoil, whereas Howard soils do not in places.

Palmyra soils are deep, well drained to excessively drained, and medium textured. They have a high content of lime. Permeability is moderate to moderately rapid in the surface layer and subsoil and rapid to very rapid in the substratum.

Howard soils are deep, well drained and somewhat excessively drained, and medium textured to moderately coarse textured. They have a medium content of lime. Permeability is moderate to rapid in the surface layer and subsoil and very rapid in the substratum.

Minor soils in this association are mainly those of the Arkport, Carlisle, Cazenovia, Dunkirk, Fredon, Halsey, Ontario, Palms, Phelps, and Schoharie series. Fredon, Halsey, and Phelps soils are the wetter drainage associates of Palmyra and Howard soils. Together with Carlisle soils and Palms muck, they are intermingled with Palmyra and Howard soils mainly in the bottoms of kettle holes and around seeps. Areas of sandy Arkport, silty Dunkirk, and clayey Schoharie soils are intermingled on lake plains with or adjacent to areas of Palmyra and Howard soils. Small areas of Cazenovia and Ontario soils are on adjacent uplands. Natural drainage of these minor soils ranges from somewhat excessive to very poor.

Cleared areas of this association are used mainly for pasture or are idle. Pastures are generally of poor quality because of droughtiness. Runoff is very rapid on these hilly to very steep soils, and the hazard of erosion is severe if they are left without protective cover. Slope is the main limitation for many nonfarm uses. In places they are potential sources of sand and gravel.

Valley Areas Dominated by Deep Soils That Formed in Recent Alluvial Deposits on Flood Plains and Are Well Drained to Very Poorly Drained

The soils in the two associations of this group are on flood plains of streams throughout the county. They cover about 2.9 percent of the county. The soils are deep and medium textured. They formed in recent alluvium rich in silt and very fine sand. They have medium- and high-lime profiles. The soils are level or nearly level and are well drained to very poorly drained. Permeability is generally moderate throughout, but in places the wetter soils have slowly permeable layers. The dryer soils are used mostly for crops, and the wetter soils are used mainly for pasture or are idle.

42. Teel-Hamlin-Wayland association, level

Deep, well-drained to somewhat poorly drained, me-

dium- and high-lime soils that have a medium-textured to moderately coarse textured subsoil; and deep, poorly drained and very poorly drained, medium- and high-lime soils that have a medium-textured to moderately fine textured subsoil; on flood plains

This association is made up of dominantly level soils on flood plains along the major streams in the county. Most areas are in the wider north-south valleys in the central part of the county. Elevations are mainly between 400 and 1,300 feet.

This association makes up about 1.1 percent of the county. About 60 percent of it is Teel soils, about 15 percent is Hamlin soils, and about 15 percent is Wayland soils. Minor soils make up the other 10 percent.

Teel, Hamlin, and Wayland soils all formed in similar kinds of recent alluvial deposits on flood plains. This alluvial material is mainly silt and very fine sand. In places the deposits in which Wayland soils formed contain more clay. The soils are all deep and medium textured. They are medium and high in content of lime. They differ mainly in that Teel soils are moderately well drained and somewhat poorly drained, Hamlin soils are well drained, and Wayland soils are poorly drained and very poorly drained. A seasonal high water table is at a depth of 12 to 24 inches in Teel soils. It is below a depth of 24 inches in Hamlin soils and is at or near the surface for long periods in Wayland soils. Permeability is moderate throughout the profile of Teel and Hamlin soils and is slow in some part of the profile of Wayland soils. Hamlin soils are in the higher positions, Teel soils are at the intermediate levels, and Wayland soils are in the lowest positions. Hamlin soils are commonly adjacent to stream channels where the alluvial deposits are relatively thicker. All of these soils are subject to flooding. Floods occur mainly in spring, but can happen any time during periods of excessive precipitation and runoff. Frequency of flooding ranges from annually on the lower parts of flood plains to as seldom as once in 10 to 20 years on some of the higher positions that are commonly occupied by Hamlin soils.

Minor soils in this association are mainly those of the Carlisle, Herkimer, Howard, Palms, and Palmyra series, and areas of Fluvaquents, frequently flooded. Carlisle soils and Palms mucks are in small, low slackwater areas away from the main stream channels where little or no deposition takes place during flooding. Herkimer and Howard soils are on small, old alluvial fans where tributary streams flow into the larger valleys. Small areas of Palmyra soils are on glacial outwash terraces that are adjacent to or protrude above the flood plains. Natural drainage of these minor soils ranges from excessive to very poor.

Cleared areas of the Teel and Hamlin soils in this association are used mainly for crops, and the wetter Wayland soils are commonly used for pasture or are idle. Crop response is generally excellent on the Teel and Hamlin soils under good management. Flooding is a hazard, but it rarely occurs in the growing season in most areas. Flooding and wetness are the main limitations for most nonfarm uses.

43. Wayland-Teel association, level

Deep, poorly drained and very poorly drained, medium- and high-lime soils that have a medium-textured to moderately fine textured subsoil; and deep, moderately well drained and somewhat poorly drained, medium- and high-lime soils that have a medium-textured to moderately coarse textured subsoil; on flood plains

This association is made up of dominantly level soils on low areas of flood plains that are subject to frequent flooding. Areas of this association are mainly along the larger streams in the county. Elevations are mainly between 400 and 1,300 feet.

This association makes up about 1.8 percent of the county. About 60 percent of it is Wayland soils, and about 20 percent is Teel soils. Minor soils make up the other 20 percent.

Wayland and Teel soils formed in similar kinds of alluvial deposits on flood plains. These alluvial deposits are mainly silt and very fine sand, but in places the deposits in which Wayland soils formed contain more clay. Wayland and Teel soils are medium-textured soils that are medium and high in content of lime. They differ mainly in that Wayland soils are poorly drained and very poorly drained, whereas Teel soils are moderately well drained and somewhat poorly drained. The water table is at or near the surface for long periods in Wayland soils. It is seasonally at a depth of 12 to 24 inches in Teel soils. Permeability is slow in some parts of the Wayland soils, and it is moderate in Teel soils. Wayland soils are in lower flood-plain positions below Teel soils where flooding is more frequent. Flooding occurs mainly in spring, but it can happen anytime during periods of excessive precipitation and runoff.

Minor soils in this association are mainly those of the Carlisle, Fonda, Hamlin, Herkimer, Howard, Lakemont, and Palms series, and areas of Fluvaquents, frequently flooded. Carlisle soils and Palms muck are in the small, low slackwater areas away from the main stream channels where little or no deposition takes place during flooding. Fonda and Lakemont soils are in the slackwater areas where clayey material was deposited. Hamlin soils are on higher flood-plain positions above Wayland and Teel soils. Herkimer and Howard soils are on small, old alluvial fans where tributary streams flow into the larger valleys. Natural drainage of these minor soils ranges from very poor to somewhat excessive.

Cleared areas of this association are mainly in pasture or are idle. Frequent flooding and wetness are the main limitations for farming and most nonfarm uses.

Lake-Plain, Valley, and Upland Areas Dominated by Deep Soils That Formed in Organic Deposits and are Very Poorly Drained

Only one soil association is in this category. It covers about 3.2 percent of the county. Areas of it are scattered throughout the county in swampy depressions on lake plains, outwash plains, flood plains, and uplands. The soils are deep. They formed in deposits of well-decomposed and partly decomposed plant and animal remains that accumulated in depressions. The soils are mostly level and very wet. Most areas are

covered with swamp, forest, or marsh vegetation. A few drained areas are in specialty crops.

44. Carlisle-Palms association, level

Deep, very poorly drained, medium- and high-lime, organic soils in waterlogged bogs on lake plains, outwash plains, flood plains, and glaciated uplands

This association is made up of dominantly level soils in swampy depressions on lake plains, outwash plains, flood plains, and uplands. Areas of this association are scattered throughout the county, but are most extensive in the northern quarter of the county at elevations of less than 600 feet. In other parts of the county, elevations range to as much as 1,300 feet.

This association makes up about 3.2 percent of the county. About 50 percent of it is Carlisle soils, and about 30 percent is Palms soils. Minor soils make up the other 20 percent.

Carlisle and Palms soils are deep, very poorly drained, organic soils. They formed in deposits of well-decomposed to partly decomposed organic matter that has accumulated in boggy depressions. This material is mainly the remains of reeds, sedges, and water-tolerant trees. In Carlisle soils the organic deposits are more than 51 inches thick over mineral soil layers. In Palms soils the deposits are 16 to 50 inches thick over mineral layers. Except for a few areas that have been drained, the water table is at or near the surface most of the year. Water ponds in places. Permeability in the organic material is moderately rapid, and in the underlying mineral material it is variable.

Minor soils in this association are mainly those of the Edwards and Martisco series and Saprists and Fluvaquents, ponded, in bogs; those of the Canandaigua, Fonda, and Lamson series on lake plains; those of the Halsey series on outwash plains; those of the Warners and Wayland series on flood plains; and those of the Lyons series on uplands. Drainage of these minor soils ranges from poor to very poor.

Areas of this association are mainly in swamp woods, or, where too wet for trees, in cattail marshes. Cleared and drained areas are in specialty crops. Wetness, high compressibility, and very poor stability are the main limitations for most nonfarm uses. Some areas have potential for wetland wildlife habitat.

Land-Type Areas Where the Soil Material Has Been So Disturbed or Obscured by Manmade Structures That It Has Not Been Classified by Soil Series

The areas in this category cover about 3 percent of the county. These are areas of large Quarries, Gravel pits, Urban land, and Made land, chemical waste. Generally, each area requires onsite investigation to determine its potential use.

45. Quarries

These are limestone bedrock Quarries, 100 acres or more in size, and operative or inoperative. They make up about 0.2 percent of the county. Onsite investigation is needed to determine potential use.

46. Gravel pits

These are large Gravel pits, 100 acres or more in size, and operative or inoperative. They make up about 0.2 percent of the county. Onsite investigation is needed to determine potential use.

47. Urban land

Urban land consists of large built-up areas that have been so altered or obscured by urban works and structures that identification of the soils is not feasible. Buildings or pavements cover more than 50 percent of such areas, which include the downtown business district of the city of Syracuse and the large industrial complexes and shopping centers of the city and its suburbs. Urban land makes up about 2.3 percent of the county.

48. Made land, chemical waste

This material is in large waste-bed areas that were developed to dispose of solid chemical waste made up largely of calcium derivatives. Some of the waste beds are being built up and some have been built up to the maximum height allowed by law and are being stabilized. These areas make up about 0.3 percent of the county. Onsite investigation is needed to determine potential use.

Descriptions of the Soils

This section describes the soil series and mapping units in Onondaga County. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for moist soil unless otherwise stated.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Urban land, for example, does not belong to a soil series, but nevertheless, is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of the description of each mapping unit are the capability unit and woodland group in which the map-

ping unit has been placed. The page for the description of each capability unit and woodland group can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*9*).

Alton Series

The Alton series consists of deep, well-drained and somewhat excessively drained, moderately coarse textured, gravelly soils. These soils formed in glacial outwash material or in beach deposits of postglacial lakes. The gravel beach deposits consist mostly of material derived from red and gray sandstone. The soils are nearly level to hilly and are on terraces along the outer edges of lake plains.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent
Alton gravelly fine sandy loam, 0 to 3 percent slopes	990	0.2
Alton gravelly fine sandy loam, 3 to 8 percent slopes	1,570	.3
Alton gravelly fine sandy loam, rolling	590	.1
Angola-Darien silt loams, 0 to 6 percent slopes	2,490	.5
Angola-Darien silt loams, 6 to 12 percent slopes	410	.1
Appleton loam, 0 to 3 percent slopes	3,990	.8
Appleton channery silt loam, 0 to 3 percent slopes	360	.1
Appleton channery silt loam, 3 to 8 percent slopes	1,220	.2
Arkport very fine sandy loam, 2 to 6 percent slopes	2,690	.5
Arkport very fine sandy loam, rolling	1,020	.2
Arkport very fine sandy loam, hilly	440	.1
Arnot channery silt loam, gently sloping	930	.2
Arnot-Lordstown association, very steep	3,190	.6
Aurora silt loam, 0 to 6 percent slopes	4,920	1.0
Aurora silt loam, 6 to 12 percent slopes	4,710	.9
Aurora silt loam, 12 to 18 percent slopes	2,910	.6
Aurora silt loam, 12 to 18 percent slopes, eroded	860	.2
Aurora-Farmington-Rock outcrop association, steep	6,880	1.4
Benson silt loam, undulating	4,010	.8
Benson silt loam, rolling	640	.1
Benson-Wassaic-Rock outcrop association, sloping	3,440	.7
Benson-Wassaic-Rock outcrop association, very steep	1,600	.3
Bombay gravelly loam, 2 to 8 percent slopes	2,320	.5
Camillus silt loam, 2 to 6 percent slopes	5,170	1.0
Camillus silt loam, 6 to 12 percent slopes	3,120	.6
Camillus silt loam, 6 to 12 percent slopes, eroded	1,110	.2
Camillus silt loam, 12 to 18 percent slopes, eroded	1,540	.3
Camillus and Lairdsville shaly soils, steep	1,510	.3
Canandaigua mucky silt loam	3,700	.7
Carlisle muck	9,960	2.0
Cazenovia silt loam, 2 to 8 percent slopes	7,700	1.5
Cazenovia silt loam, 8 to 15 percent slopes	3,480	.7
Cazenovia silt loam, 8 to 15 percent slopes, eroded	1,450	.3
Cazenovia soils, 15 to 25 percent slopes	2,020	.4
Collamer silt loam, 0 to 2 percent slopes	4,900	1.0
Collamer silt loam, 2 to 6 percent slopes	13,800	2.7
Colonie loamy fine sand, 0 to 6 percent slopes	2,950	.6
Colonie loamy fine sand, rolling	820	.2
Conesus gravelly silt loam, 0 to 3 percent slopes	170	(1)
Conesus gravelly silt loam, 3 to 8 percent slopes	7,200	1.4
Croghan loamy fine sand, 0 to 6 percent slopes	1,270	.3
Darien silt loam	280	.1
Dunkirk silt loam, rolling	3,030	.6
Edwards muck	520	.1
Farmington-Aurora association, sloping	2,180	0.4
Fluvaquents, frequently flooded	3,730	.7
Fonda mucky silty clay loam	2,590	.5
Fredon loam	1,600	.3
Galen very fine sandy loam, 0 to 2 percent slopes	710	.1
Galen very fine sandy loam, 2 to 6 percent slopes	1,020	.2
Halsey mucky loam	760	.2
Hamlin silt loam	770	.2
Hamlin silt loam, high bottom	1,090	.2
Herkimer silt loam	1,270	.3
Hilton loam, 0 to 3 percent slopes	2,960	.6
Hilton loam, 3 to 8 percent slopes	8,280	1.6
Honeoye silt loam, 2 to 8 percent slopes	31,830	6.3
Honeoye silt loam, 8 to 15 percent slopes	20,220	4.0
Honeoye silt loam, rolling	3,090	.6
Honeoye and Lansing gravelly silt loams, 15 to 25 percent slopes	15,890	3.1
Honeoye very stony soils, sloping	1,420	.3
Honeoye, Lansing and Ontario soils, steep	9,770	1.9
Honeoye, Lansing and Ontario soils, very steep	4,860	1.0
Howard gravelly fine sandy loam, 0 to 3 percent slopes	300	.1
Howard gravelly fine sandy loam, 3 to 8 percent slopes	1,860	.4
Howard gravelly fine sandy loam, rolling	860	.2
Howard gravelly loam, 0 to 3 percent slopes	520	.1
Howard gravelly loam, 3 to 8 percent slopes	930	.2
Howard gravelly loam, rolling	320	.1
Howard gravelly silt loam, 0 to 3 percent slopes	1,490	.3
Howard gravelly silt loam, 3 to 8 percent slopes	2,690	.5
Kendaia silt loam, 0 to 3 percent slopes	3,480	.7
Kendaia silt loam, 3 to 8 percent slopes	2,840	.6
Lairdsville silt loam, 2 to 6 percent slopes	2,860	.6
Lairdsville silty clay loam, 6 to 12 percent slopes, eroded	1,430	.3
Lakemont silty clay loam	960	.2
Lamson very fine sandy loam	2,640	.5
Lansing gravelly silt loam, 2 to 8 percent slopes	6,420	1.3
Lansing gravelly silt loam, 8 to 15 percent slopes	10,410	2.0
Lansing gravelly silt loam, rolling	1,960	.4
Lima silt loam, 0 to 3 percent slopes	2,560	.5
Lima silt loam, 3 to 8 percent slopes	12,500	2.5
Lockport and Brockport silty clay loams, 0 to 6 percent slopes	3,970	.8
Lordstown channery silt loam, sloping	2,550	.5
Lordstown-Arnot channery silt loams, moderately steep	940	.2
Lyons silt loam	2,390	.5
Made land, chemical waste	1,400	.3
Madrid fine sandy loam, 2 to 8 percent slopes	8,780	1.7
Madrid fine sandy loam, 8 to 15 percent slopes	1,400	.3
Madrid fine sandy loam, 8 to 15 percent slopes, eroded	1,680	.3

TABLE 1.—*Approximate acreage and proportionate extent of the soils—Continued*

Soil	Acres	Percent
Madrid fine sandy loam, rolling	1,150	0.2
Madrid gravelly loam, 2 to 8 percent slopes	1,480	.3
Madrid gravelly loam, 8 to 15 percent slopes	450	.1
Manheim silt loam, 0 to 3 percent slopes	520	.1
Manheim silt loam, 3 to 8 percent slopes	2,280	.5
Manlius shaly silt loam, 2 to 6 percent slopes	260	.1
Manlius shaly silt loam, 6 to 12 percent slopes	730	.1
Manlius shaly silt loam, 12 to 18 percent slopes	510	.1
Mardin channery silt loam, 2 to 8 percent slopes	2,590	.5
Mardin channery silt loam, 8 to 15 percent slopes	2,950	.6
Mardin channery silt loam, 15 to 25 percent slopes	1,830	.4
Mardin soils, steep	720	.1
Mardin channery silt loam, moderately shallow variant, 2 to 6 percent slopes	400	.1
Mardin channery silt loam, moderately shallow variant, 6 to 18 percent slopes	220	(1)
Martisco and Warners soils	1,850	.4
Minoa fine sandy loam, 0 to 2 percent slopes	3,290	.7
Minoa fine sandy loam, 2 to 6 percent slopes	1,220	.2
Mohawk silt loam, 2 to 8 percent slopes	5,470	1.1
Mohawk silt loam, 8 to 15 percent slopes	3,000	.6
Mohawk silt loam, 15 to 25 percent slopes	1,290	.3
Naumburg loamy fine sand	980	.2
Niagara silt loam, 0 to 4 percent slopes	21,360	4.2
Odessa silty clay loam, 0 to 2 percent slopes	700	.1
Odessa silty clay loam, 2 to 6 percent slopes	910	.2
Ontario loam, 2 to 8 percent slopes	11,470	2.3
Ontario gravelly loam, 8 to 15 percent slopes	2,910	.6
Ontario gravelly loam, 8 to 15 percent slopes, eroded	1,760	.4
Ontario gravelly loam, rolling	1,040	.2
Ontario and Madrid soils, 15 to 25 percent slopes	4,390	.9
Otisville gravelly loamy fine sand, 0 to 8 percent slopes	640	.1
Otisville gravelly loamy fine sand, rolling	110	(1)
Ovid silt loam, 0 to 3 percent slopes	330	.1
Ovid silt loam, 3 to 8 percent slopes	1,170	.2
Palatine shaly silt loam, 2 to 6 percent slopes	750	.1
Palatine shaly silt loam, 6 to 12 percent slopes	620	.1
Palms muck	5,430	1.1
Palmyra gravelly loam, 0 to 3 percent slopes	5,330	1.1
Palmyra gravelly loam, 3 to 8 percent slopes	9,580	1.9
Palmyra gravelly loam, rolling	3,400	.7
Palmyra and Howard soils, hilly	3,220	.6
Palmyra and Howard soils, steep	1,650	.3
Palmyra and Howard soils, very steep	1,280	.3
Phelps gravelly loam, 0 to 3 percent slopes	1,790	.4
Phelps gravelly loam, 3 to 8 percent slopes	1,350	.3
Rhinebeck silt loam	7,820	1.5
Saprists and Fluvaquents, ponded	720	.1
Schoharie silt loam, 2 to 6 percent slopes	850	.2
Schoharie silt loam, rolling	1,420	.3
Schoharie silty clay loam, hilly	870	.2
Schoharie soils, steep	780	.2
Teel silt loam	5,250	1.0
Urban land	8,300	1.6
Varick silt loam	540	.1
Volusia channery silt loam, 0 to 8 percent slopes	1,270	.3
Volusia channery silt loam, 8 to 15 percent slopes	520	.1
Volusia channery silt loam, moderately shallow variant, 0 to 6 percent slopes	540	.1
Wampsville gravelly silt loam, 0 to 3 percent slopes	950	.2
Wampsville gravelly silt loam, 3 to 8 percent slopes	1,900	.4
Wampsville gravelly silt loam, rolling	200	(1)
Wareham loamy fine sand	370	.1
Wassaic silt loam, 0 to 8 percent slopes	3,880	.8
Wassaic silt loam, 8 to 15 percent slopes	760	.2
Wassaic-Benson silt loams, moderately steep	220	(1)
Wayland silt loam	7,950	1.6
Weaver silt loam	790	.2
Williamson silt loam, 0 to 2 percent slopes	1,570	.3
Williamson silt loam, 2 to 6 percent slopes	4,680	.9
Williamson silt loam, rolling	720	.1
Williamson silt loam, rolling, eroded	330	.1
Miscellaneous		
Borrow pits	420	.1
Cut and fill land	5,430	1.1
Made land	2,000	.4
Gravel pits	1,270	.3
Quarries	1,400	.3
Water (areas less than 40 acres in size)	1,600	.3
Total acres in areas mapped	[2]501,760	100.0

[1] Less than 0.05 percent.
[2] Does not include 6,080 acres of Onondaga Indian Reservation, which was not mapped.

In a representative profile in a hayfield, the surface layer is dark-brown gravelly fine sandy loam 8 inches thick. This layer is underlain by a rapidly permeable subsoil that extends to a depth of 46 inches. Between depths of 8 and 17 inches, the upper part of the subsoil is very friable, reddish-brown gravelly sandy loam. Between depths of 17 and 36 inches, the middle part of the subsoil is reddish-brown very gravelly sandy loam. Between depths of 36 and 46 inches, the lower part of the subsoil is loose, dark-brown very gravelly loamy sand. The substratum, between depths of 46 and 144 inches, is stratified gravelly and sandy material that is loose in the upper part and cemented with secondary lime at a depth of 96 inches.

Alton soils have a rapidly permeable gravelly subsoil and substratum that are readily penetrated by roots of deep-rooted crops and trees. The upper 30 to 40 inches, however, has low to moderate available water capacity, and most rooting takes place in this zone. Alton soils respond very well to management and are quick to warm up in spring. They have a high infiltration rate. The capacity of these soils to supply nitrogen, phosphorus, and potassium is low. Unlimed areas are strongly acid. Large amounts of fertilizer and lime are needed. The high content of gravel and cobbles in the soils limits the growth and quality of some crops, especially root and tuber crops. They also hinder tillage and harvesting. Alton soils are suited to deep-rooted general crops. They are good to excellent as sources of sand and gravel.

Representative profile of Alton gravelly fine sandy loam, 3 to 8 percent slopes, in a hayfield in the town

of Lysander, 250 feet southwest of Emerick Road, 5,400 feet north of State Route 370, and 500 feet north of the powerline at the south edge of the gravel pit:

Ap—0 to 8 inches, dark-brown (7.5YR 3/2) gravelly fine sandy loam; moderate, fine, granular structure; very friable; many roots; 20 percent gravel; neutral; abrupt, smooth boundary.

B21—8 to 17 inches, reddish-brown (5YR 4/4) gravelly sandy loam; weak, very fine, subangular blocky structure; very friable; many roots; common fine, medium, and coarse pores; 30 percent gravel; strongly acid; clear, wavy boundary.

IIB22—17 to 36 inches, reddish-brown (5YR 4/3) very gravelly sandy loam; very weak, fine, subangular blocky structure; very friable; common roots; common medium and coarse pores; 40 percent gravel; few fine silt coats and patches of clay coats on upper faces of gravel; medium acid; clear, wavy boundary.

IIB3—36 to 46 inches, dark-brown (7.5YR 4/2) very gravelly loamy sand; single grained; loose; few roots; few medium and coarse pores or crude voids between sand grains; few thin silt patches; occasional thin clay films on surfaces of pebbles; slightly acid; clear, wavy boundary.

IIC—46 to 144 inches, dark-brown (7.5YR 3/2) to pinkish-gray (7.5YR 6/2) stratified sand and gravel; single grained; loose in upper part, becoming cemented with secondary lime at a depth of 96 inches; few fine roots; moderately alkaline (calcareous).

The solum ranges from 40 to 60 inches in thickness. Depth to carbonate ranges from 40 to 80 inches. In the A horizon, coarse fragments range from 15 to 35 percent.

The Ap and A1 horizons range from dark reddish brown (5YR 3/2) to dark brown (10YR 3/3) in color.

The B horizon ranges from dark brown (10YR 3/3) to reddish brown (2.5YR 5/4), but is dominantly reddish brown and brown. This horizon ranges from loam to sandy loam and has an occasional subhorizon of loamy sand that is 20 to 45 percent coarse fragments by volume in the upper 10 to 30 inches and 40 to 75 percent below. This horizon ranges from very friable to loose in consistence. In unlimed areas reaction in the solum ranges from strongly acid to neutral.

Alton soils are closely associated with the moderately well drained Phelps soils and formed in similar material. Alton soils are also near Arkport and Colonie soils, which contain little or no gravel.

Alton gravelly fine sandy loam, 0 to 3 percent slopes (AlA).—This nearly level soil is in flat areas of glacial outwash terraces. Areas are generally more than 10 acres in size. Included in mapping are small areas of Arkport and Colonie soils that make up as much as 10 percent of the mapped acreage. They have little effect on use and management.

This soil, especially when irrigated, is well suited to some truck crops. Gravel and cobbles interfere with tillage and limit the kind of crops that can be grown. Capability unit IIs–1; woodland suitability group 3o1.

Alton gravelly fine sandy loam, 3 to 8 percent slopes (AlB).—This soil is on outwash plains. Slopes are short and complex. In areas larger than 10 acres, slopes are undulating. In a few areas slopes are smooth and uniform. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of moderately well drained Phelps soils in depressions and small areas of Arkport or Colonie soils that are more sandy. These inclusions make up less than 10 percent of the mapped acreage and have little or no effect on use and management.

If irrigated, this soil is suited to truck crops. The hazard of erosion is generally only slight, but is moderate in places where slopes are steeper and longer. Gravel and cobbles interfere with tillage and harvesting and limit the kinds of crops that can be grown. Capability unit IIs–1; woodland suitability group 3o1.

Alton gravelly fine sandy loam, rolling (AlC).—This soil has short, complex slopes on outwash deposits. Slopes range mainly from 8 to 15 percent. A few small areas have smooth, even slopes. Most areas are less than 20 acres in size, and many are smaller than 10 acres.

This soil has a profile similar to the one described as representative of the series, but it is more variable in depth to the stratified sand and gravel.

Included with this soil in mapping are small areas of sandy Colonie and Arkport soils. Also included are areas of moderately well drained Phelps soils in the lowest depressions. Other inclusions are areas of steeper Alton soils. These inclusions have little or no effect on use and management.

This soil is suited to such deep-rooted hay crops as alfalfa. The soil is somewhat droughty. Runoff is moderate, and the hazard of erosion is moderate to severe. The short, complex slopes make the use of contour measures for erosion control impractical in most places. Capability unit IVe–10; woodland suitability group 3o1.

Angola Series

The Angola series consists of moderately deep, somewhat poorly drained, medium-textured soils. These soils formed in neutral to moderately alkaline till high in content of dark-gray shale similar to the underlying bedrock. They are level to sloping and are on bedrock-controlled landforms.

In a representative profile in a cultivated area, the surface layer is very dark gray silt loam 8 inches thick. Between depths of 8 and 22 inches, the subsoil is firm, slightly sticky, olive-brown, shaly heavy loam that contains many yellowish-brown, dark yellowish-brown, and grayish-brown mottles. The underlying bedrock, at a depth of 22 inches, is calcareous, massive, dark-gray shale and fine-grained sandstone.

Angola soils have a slowly permeable or very slowly permeable subsoil and are too wet to be tilled early in spring. Root growth is mainly limited to the upper 20 to 24 inches of soil above the bedrock. These soils have moderate to high available water capacity. Runoff and seepage from adjacent higher lying soils collect in some areas, so that crops continue to grow even when crops on better drained soils are damaged by lack of moisture.

Angola soils need drainage for most crops. In most places the soft shale bedrock can be readily excavated in the upper 1 to 2 feet. In some places hard layers of rock hinder excavation.

Lime needs of Angola soils are variable. The content of organic matter and nitrogen is medium to high. Wetness, however, slows the decomposition of the organic matter and the release of nitrogen is slow. Plants therefore need additional nitrogen, especially early in spring and in wet summers. In drained areas large amounts of nitrogen are released in warm weather and cause lodging of small grains in

places. The capacity of these soils to supply phosphorus and potassium is medium.

Wetness and bedrock at a depth of 20 to 40 inches are the main limitations to the use of these soils for farm and nonfarm purposes.

Representative profile of Angola silt loam from an area of Angola-Darien silt loams, 0 to 6 percent slopes, in a cultivated field in the town of Pompey, 450 feet south of U.S. Highway 20, 1,900 feet east of Oran Road:

Ap—0 to 8 inches, very dark gray (10YR 3/1) silt loam, very dark grayish brown (10YR 3/2) crushed, gray (10YR 6/1) dry; moderate, medium and coarse, granular structure; friable, slightly sticky; many roots; 10 percent angular stone and shale fragments; neutral; abrupt, wavy boundary.

B2—8 to 22 inches, olive-brown (2.5Y 4/4), shaly heavy loam; many (40 percent), medium, distinct yellowish-brown (10YR 5/4), dark yellowish-brown (10YR 4/4), and grayish-brown (2.5Y 5/2) mottles; moderate, coarse, prismatic structure parting to moderate, coarse, subangular blocky; firm, slightly sticky; common fine roots; many fine and medium and few large pores; distinct grayish-brown (2.5Y 5/2) clay films on prism faces, thin patchy clay films on blocky faces; clay linings in large and medium pores; 20 percent shale and angular stone fragments; neutral; abrupt, wavy boundary.

R—22 inches, dark-gray (5Y 4/1), thin, bedded, calcareous, fine-grained sandstone and shale bedrock. Beds range from 1/2 inch to 2 inches thick with vertical joints 6 to 18 inches apart in upper 2 feet.

The solum ranges from 20 to 30 inches in thickness. Depth to bedrock ranges from 20 to 40 inches. Bedrock is brittle, dark-gray, slightly acid to calcareous shale, hard limestone, or thin strata of fine-grained, slightly acid to calcareous sandstone.

The A horizon ranges from very dark gray (N 3/0) to dark grayish-brown (10YR 4/2). This horizon ranges from 5 to 30 percent coarse fragments, mainly shale and sandstone. Reaction of the A horizon in unlimed areas ranges from medium acid to neutral.

The B horizon has hues of 10YR to 5Y, values of 3 to 5, and chromas of 2 to 4, with common to many yellowish-brown, dark yellowish-brown, and grayish-brown mottles. The B horizon is heavy loam to light silty clay loam that is 18 to 35 percent clay and 5 to 35 percent coarse fragments. Reaction in the B horizon ranges from medium acid to mildly alkaline.

A C horizon is generally present where bedrock is at a depth of 24 to 40 inches. It ranges in color from dark grayish brown (10YR 4/2) to olive gray (5Y 5/2) and in texture from silt loam to silty clay loam that is 20 to 60 percent shale and stone fragments. Reaction in the C horizon ranges from neutral to moderately alkaline (calcareous).

Angola soils are mapped only in a complex with Darien soils in Onondaga County. Angola and Darien soils are similar in color, drainage, texture, and types of landforms. They differ mainly in that Angola soils are 20 to 40 inches deep over bedrock and Darien soils are more than 40 inches deep over bedrock. Angola soils form a drainage sequence with the moderately well drained to well drained Aurora soils and the poorly drained Varick soils, which formed in similar material. Angola soils are also near Lyons soils, but they have a surface layer that is lower in organic-matter content than that of the deeper and wetter Lyons soils.

Angola-Darien silt loams, 0 to 6 percent slopes (AnB).—Angola and Darien soils each make up about 40 to 50 percent of this complex. In a few areas, however, one of these soils is dominant, and the other is a minor constituent. These soils have the profiles described as representative of their respective series. Areas of these soils are generally larger than 10 acres. The level or nearly level areas are on flat hilltops that are slow to drain. The gently sloping areas that have smooth to slightly concave slopes are mostly on valley sides that receive a large amount of runoff or seepage from adjacent higher areas.

Included with these soils in mapping are small areas of wetter Varick and Lyons soils in depressions and shallow drainageways. These wetter soils generally make up less than 10 percent of most areas, but they delay tillage unless drained.

The soils of this mapping unit need drainage for the satisfactory production of most crops. Hard layers of bedrock at a depth of 20 to 40 inches hinder ditching in many areas. Erosion is a hazard on the steeper and longer slopes. Capability unit IIIw–2; woodland suitability group 3w1.

Angola-Darien silt loams, 6 to 12 percent slopes (AnC).—Angola and Darien soils are of about equal extent in most areas of this complex. In a few areas one of these soils is dominant, and the other is a minor constituent. These soils have profiles similar to those described as representative of their respective series, but they generally are slightly better drained and, where eroded, the surface layer is lower in organic-matter content. Areas of these soils generally are smaller than 10 acres. These soils generally are on lower, slightly concave valley sides that receive a large amount of runoff and seepage from adjacent higher soils.

Included with these soils in mapping are small areas of Aurora soils on convex-shaped knolls. These better drained Aurora soils make up as much as 15 percent of some areas, but they have little significance in use and management. Also included are small areas of poorly drained Varick soils in the narrow drainageways, and a few small, steeper areas of bedrock ledges and rock outcrops that hinder tillage and mowing.

These soils need drainage or water diversion for the satisfactory production of most crops. They also need erosion-control measures if they are used for row crops. Capability unit IIIe–7; woodland suitability group 3w1.

Appleton Series

The Appleton series consists of deep, somewhat poorly drained, medium-textured soils. These soils formed in glacial till high in content of limestone and sandstone with minor amounts of shale. Appleton soils are level to gently sloping on uplands that receive runoff from adjacent higher soils or from which water drains slowly.

In a representative profile in a hayfield, the surface layer is very dark brown loam 9 inches thick. Between depths of 9 and 22 inches the subsoil is friable to firm, mottled, dark yellowish-brown heavy fine sandy loam. Between depths of 22 and 30 inches, the lower part of the subsoil is strongly mottled, dark yellowish-brown sandy clay loam that is firm and slightly sticky. Between depths of 30 and 60 inches, the substratum is firm, grayish-brown, calcareous gravelly loam.

In Appleton soils permeability of the subsoil is moderate in the upper part and slow in the lower part. Permeability is slow in the substratum. These soils, unless artificially drained, are too wet to be

tilled early in spring. At this time the water table is within 6 to 12 inches of the surface. The water table recedes in drier periods. Because of wetness, root growth generally is confined to the uppermost 24 to 30 inches of these soils unless they are drained. This zone has moderate to high available water capacity, but normally there is more than enough water for plant growth. Runoff from adjacent higher areas collects on these soils. Crops, therefore, continue to grow in dry summers when crops on better drained soils are damaged by lack of water.

Some areas of Appleton soils are slightly acid and need lime, but other areas are neutral and do not need lime. The content of organic matter and nitrogen is high. The capacity of these soils to supply potassium and phosphorus is medium. Wetness is a limitation, but if corrected, the soils are well suited to a wide variety of crops.

Representative profile of Appleton loam, 0 to 3 percent slopes, in a hayfield in the town of Clay, 100 feet south of Ver Plank Road, 2,700 feet east of the intersection of Bennett Road:

Ap—0 to 9 inches, very dark brown (10YR 2/2) loam, grayish brown (10YR 5/2) dry; weak, coarse, subangular blocky structure parting to weak, fine, granular; friable; many roots; 5 percent coarse fragments consisting mainly of gravel and cobbles; medium acid; abrupt, smooth boundary.

B&A—9 to 22 inches, dark yellowish-brown (10YR 4/4) heavy fine sandy loam; common, fine and medium, distinct yellowish-brown (10YR 5/6) and few, fine and medium, distinct light brownish-gray (10YR 6/2) mottles; moderate, medium, subangular blocky structure; friable to firm, slightly sticky; few fine roots; many fine and few large pores; 5 percent coarse fragments, mainly gravel and cobbles; 1- to 4-millimeters-thick, light olive-brown (2.5Y 5/4) fine sand coats on ped faces; interior of peds has very dark brown clay linings in larger pores; slightly acid; clear, smooth boundary.

B2t—22 to 30 inches, dark yellowish-brown (10YR 4/4) light sandy clay loam; many (35 percent), medium and coarse, distinct yellowish-brown mottles; moderate, coarse, subangular blocky structure; firm, slightly sticky; dark grayish-brown (10YR 4/2) ped faces; few roots; many fine and medium pores that have clay linings; thin patchy clay films on ped faces; 12 percent coarse fragments, mainly gravel and cobbles; neutral; clear, wavy boundary.

C—30 to 60 inches, grayish-brown (10YR 5/2) gravelly loam; few, medium, distinct yellowish-brown mottles in upper part; moderate, thick, platy structure; firm; 20 percent gravel and cobbles; moderately alkaline (calcareous).

The solum ranges from 20 to 36 inches in thickness. Depth to carbonates ranges from 20 to 32 inches. Content of coarse fragments ranges from 5 to 35 percent in the solum and generally increases with increasing depth. Depth to bedrock is more than 40 inches and in places is many feet.

The A horizon ranges from very dark brown (10YR 2/2) to dark grayish brown (10YR 4/2). The A1 horizon, where present, ranges from black (N 2/0) to very dark grayish brown (10YR 3/2). The A2 horizon and the A part of the A&B or B&A horizon, where present, have hues of 5YR to 2.5Y, values of 5 to 7, and chromas of 1 to 3 with few to many mottles. The A horizon ranges from fine sandy loam to silt loam. Reaction in the A horizon ranges from medium acid to neutral.

The B&A horizon ranges from 0 to 13 inches in thickness. The B horizon has hues of 5YR to 2.5Y, values of 3 to 6, and chromas of 3 to 5. Mottles range from few to many. The Bt horizon ranges from loam to light sandy clay loam and is 18 to 28 percent clay. Reaction in the B horizon ranges from medium acid to mildly alkaline.

The C horizon ranges from 5YR to 2.5Y in hue. It is fine sandy loam to very gravelly loam that is 5 to 50 percent coarse fragments, by volume. Consistence generally is firm or very firm.

Appleton soils are closely associated with the moderately well drained Conesus and Hilton soils and the poorly drained Lyons soils. All formed in similar material.

Appleton loam, 0 to 3 percent slopes (AoA).—Most of the larger areas of this level or nearly level soil are on hilltops from which water drains slowly. Many areas are long and narrow. Smaller areas are generally in depressions or along drainageways in the till plain. They have concave slopes that receive a large amount of runoff from adjacent higher soils. Most areas are smaller than 10 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of poorly drained Lyons soils in the lowest depressions. These small wet spots make up as much as 20 percent of some areas, and they delay tillage in spring unless they are drained. Also included are small areas of Hilton and Bombay soils on slight rises and knolls, but these better drained soils have little effect on use and management. Because of limited acreage, areas of Appleton loam, 3 to 5 percent slopes, are also included. In places gravel or cobbles on the surface hinder tillage.

If drained, this soil is well suited to many crops, but crop choice is limited if the soil is undrained. Capability unit IIIw–3; woodland suitability group 3w1.

Appleton channery silt loam, 0 to 3 percent slopes (ApA).—This level or nearly level soil is on uplands at elevations of more than 1,200 feet. Many nearly level areas of this soil are in slightly concave depressions in the landscape where they receive a large amount of runoff from adjacent higher areas of Lansing and Conesus soils. Other level areas are on broad hilltops from which water drains slowly. Many areas of this soil are larger than 10 acres.

This soil has a profile similar to the one described as representative of the series, but it contains many flat angular stone fragments and is generally more acid.

Included with this soil in mapping are small areas of poorly drained Lyons soils in depressions or drainageways. These wetter soils make up as much as 15 percent of some areas, and they delay tillage. Also included are small areas of better drained Conesus and Lansing soils on small convex shaped knolls. These better drained soils have little or no effect on use and management.

If drained, this soil is well suited to many crops. This soil contains stone fragments in places that hinder tillage or harvesting. Capability unit IIIw–3; woodland suitability group 3w1.

Appleton channery silt loam, 3 to 8 percent slopes (ApB).—This gently sloping soil is at elevations above 1,200 feet. Most areas have smooth to slightly concave slopes and are situated where they receive a large amount of runoff or seepage from adjacent higher areas. Most areas of this soil are smaller than 10 acres.

This soil has a profile similar to the one described as representative of the series, but it contains more flat angular stone fragments, is slightly better drained, and is generally more acid.

Included with this soil in mapping are small areas of better drained Conesus and Lansing soils on slight

convex knolls. Also included are some small areas of wetter Lyons soils in seep spots and depressions.

This soil is suited to cultivated crops, pasture, and trees. If the soil is undrained, crop choice is limited; but if drained, it is suited to a wide variety of crops. If the soil is drained and used intensively for row crops, measures to control both runoff and erosion are needed, especially on the longer slopes. Angular stones hinder tillage in places. Capability unit IIIw–3; woodland suitability group 3w1.

Arkport Series

The Arkport series consists of deep, well-drained soils that formed in sandy lake deposits. These soils are on deltas that formed where sand was dropped as streams entered glacial lakes. They are mainly level to gently undulating on lake plains and deltas, but a few areas are rolling or hilly.

In a representative profile in a formerly cultivated area, the surface layer is dark-brown very fine sandy loam about 10 inches thick. Between depths of 10 and 18 inches, the subsurface layer is yellowish-brown to light yellowish-brown, very friable very fine sandy loam. The upper part of the subsoil, between depths of 18 and 30 inches, is friable, dark yellowish-brown to brown very fine sandy loam that has horizontal, 1/16- to 1/2-inch-thick bands of dark-brown, slightly heavy very fine sandy loam totaling about 3 inches in thickness. Between depths of 30 and 42 inches, the subsoil is friable, dark yellowish-brown very fine sandy loam. Between depths of 42 and 60 inches, the subsoil is loose, pale-brown loamy very fine sand that has 1/16- to 1/2-inch-thick layers of dark-brown very fine sandy loam totaling 4 inches in thickness. The substratum, between depths of 60 and 70 inches, is pale-brown very fine sand. Reaction throughout the profile is slightly acid.

Arkport soils are moderately permeable to rapidly permeable. Depth to a seasonal high water table is more than 36 inches in most places. Roots of deep-rooted crops and trees penetrate readily into the sandy layer, but most rooting is in the upper 30 to 40 inches of soil, which has moderate to high available water capacity. Arkport soils have bands of very fine sandy loam in the subsoil and substratum that retard movement of water and thus hold it available to plants.

Most areas of Arkport soils need lime, but some do not. The supply of nitrogen is low. The capacity of the soils to supply phosphorus and potassium is low. Crops on Arkport soils, however, are highly responsive to fertilization and management. These soils can be tilled fairly early in spring and are easy to work. They are subject to soil blowing if left exposed, and sloping areas are subject to a severe hazard of water erosion.

Representative profile of Arkport very fine sandy loam, 2 to 6 percent slopes, in an idle area in the town of Salina, 1,600 feet northeast of the State Route 370 overpass over the State Thruway, 1,700 feet west of State Route 57, 3,100 feet south of Long Branch Road, 1,900 feet northwest of the overpass of Interchange No. 38 over the State Thruway:

Ap—0 to 10 inches, dark-brown (10YR 4/3) very fine sandy loam; weak, fine, granular structure; friable; many roots; slightly acid; abrupt, smooth boundary.

A2—10 to 18 inches, yellowish-brown (10YR 5/4) light very fine sandy loam, fading with increasing depth to light yellowish brown (10YR 6/4); weak, medium, platy structure; very friable; few roots; few medium pores; slightly acid; abrupt, smooth boundary.

B21t—18 to 20 inches, dark yellowish-brown (10YR 4/4) very fine sandy loam lamellae; weak, thin and medium, platy structure; friable; few roots; common fine pores; distinct clay bridges between sand grains; slightly acid; abrupt, smooth boundary.

B22—20 to 30 inches, brown (10YR 5/3), light very fine sandy loam; weak, medium, platy structure; friable; network of dark-brown (10YR 4/3), crudely horizontal, fine sandy loam lamellae 1/16 to 1/2 inch thick, and rounded granules 1/4 to 1/2 inch in diameter that total 3 inches in thickness; few roots; common fine and medium pores; distinct clay bridging between sand grains in lamellae and granules; slightly acid; clear, wavy boundary.

B23t—30 to 42 inches, dark yellowish-brown (10YR 4/4) very fine sandy loam; very weak, medium, platy structure; friable, slightly sticky; very few roots; few fine pores; patches as large as 1 inch in diameter have clay bridges between sand grains; slightly acid; clear, wavy boundary.

B24—42 to 60 inches, pale-brown (10YR 6/3) loamy very fine sand; single grained; loose; intricate pattern of dark-brown (10YR 4/3), very fine sandy loam lamellae, 1/16 to 1/2 inch thick, totaling 4 inches in thickness; lamellae are massive; friable; very few roots; common fine pores; patchy clay bridging between sand grains in lamellae; slightly acid; gradual, wavy boundary.

C—60 to 70 inches, pale-brown (10YR 6/3) very fine sand; single grained; loose; slightly acid.

The solum ranges from 40 inches to 8 feet in thickness. Depth to carbonate ranges from 4 feet to more than 10 feet.

The A horizon above the lamellae ranges from 15 to 30 inches in thickness. The Ap horizon ranges from grayish brown to dark brown. The A2 horizon ranges from very fine sandy loam to loamy fine sand in texture. This ranges from 5 to 22 inches in thickness. It has hues of 5YR to 10YR, values of 5 to 6, chromas of 3 to 6, and generally fades in color with increasing depth. Reaction in the A horizon ranges from strongly acid to neutral.

That part of the B horizon containing lamellae that have a distinct increase in clay ranges from 2 to 9 inches in thickness. Lamellae that have an increase in clay have a total thickness of more than 6 inches. No lamellae above a 30-inch depth are more than 5 inches thick. The matrix of the B horizon is fine sand to very fine sandy loam. It has hues of 5YR to 10YR, values of 5 to 7, and chromas of 2 to 4. The lamellae range from very fine sandy loam to fine sandy loam that is 1 to 5 percent more clay than the matrix. They have hues of 5YR to 10YR, values of 3 to 5, and chromas of 2 to 4. Reaction of the B horizon ranges from strongly acid to neutral.

The C horizon is mainly stratified fine sand or very fine sand that has thin bands of silt or silty clay. In places it is stratified sand and gravel below a depth of 40 inches. In other places it is silt and silty clay below a depth of 40 inches. Reaction of the C horizon ranges from slightly acid to moderately alkaline, and the horizon is calcareous in some places. Depth to bedrock generally is more than 5 feet and commonly is many feet.

Arkport soils are closely associated with the moderately well drained Galen soils and the somewhat poorly drained Minoa soils and formed in similar material. They are finer textured than Colonie soils and have a total thickness of lamellae greater than that of Colonie soils.

Arkport very fine sandy loam, 2 to 6 percent slopes (ArB).—This gently sloping or undulating soil is on lake plains and deltas. Its gentle slopes are mainly convex in shape. A few areas have smooth uniform slopes. Most areas of this soil are irregular in shape and range in size from less than 10 acres to more

than 100 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of nearly level Arkport soils and areas of wetter Galen soils in depressions and along intermittent drainageways. Also included are small areas of gravelly Alton and Howard soils, and in a few places Colonie soils are included as very sandy spots.

This soil is well suited to crops, early pasture, and trees. It is especially well suited to truck crops, as it is very responsive to fertilization, irrigation, and intensive management. This soil is one of the best in the county for land smoothing in order to establish uniform slopes. The hazard of water erosion is generally not severe except where water concentrates. Soil blowing is a hazard on exposed fields. Capability unit IIe–3; woodland suitability group 2o1.

Arkport very fine sandy loam, rolling (ArC).—This soil is on the tops of sandy lake plain deposits, on the sides of moderately deep drainageways that have short, complex slopes, or on the short sloping sides of dunelike mounds. Slopes are dominantly between 6 and 12 percent. Most areas of this soil are smaller than 10 acres.

Included with this soil in mapping are areas of Colonie soils and small narrow areas of wetter Galen soils along the bottoms of the drainageways. Also included are areas of Alton or Howard soils in small gravelly spots.

This soil is suited to crops, pasture, and trees. The hazard of water erosion is severe if it is cropped intensively. The soil is also subject to soil blowing in exposed areas. Such erosion-control measures as contour stripcropping and terracing are extremely difficult to establish because the slopes are short and irregular. Land smoothing to establish uniform slopes is feasible in some areas. Spots of unstable sand are hazardous to heavy equipment. Capability unit IIIe–4; woodland suitability group 2o1.

Arkport very fine sandy loam, hilly (ArD).—This soil is on short, moderately steep sides of sandy lake plains, deltas, or in incised drainageways of lake plains. Most areas are long and narrow and have short, irregular slopes. Slopes range from 12 to 25 percent.

This soil has a profile similar to the one described as representative of the series, but it generally is thinner to the stratified sandy substratum.

Included with this soil in mapping are very sandy areas of Colonie soils and gravelly spots of Alton or Howard soils. Also included are a few areas of moderately steep dunelike mounds.

This soil is better suited to deep-rooted hay crops or trees than to most other uses. It is generally too droughty for pasture. This soil is not well suited to row crops because it is subject to a severe hazard of water erosion and soil blowing. Such erosion-control measures as contour stripcropping are extremely difficult to establish because the slopes are short and irregular. Unstable sand spots and moderately steep slopes are limitations to the use of heavy machinery. Capability unit IVe–10; woodland suitability group 2o1.

Arnot Series

The Arnot series consists of shallow, well drained and moderately well drained, medium-textured soils on uplands. These soils formed in thin deposits of glacial till high in content of gray sandstone, siltstone, and shale. The till is underlain by sandstone, siltstone, or shale bedrock at a depth of 10 to 20 inches. These soils are nearly level to very steep and are mainly at high elevations on bedrock-controlled landforms.

In a representative profile in a formerly cultivated area, the surface layer is very dark grayish-brown channery silt loam about 8 inches thick. Between depths of 8 and 18 inches, the subsoil is very channery silt loam that is friable and brown to a depth of 14 inches and is faintly mottled below this depth. Bedrock is at a depth of 18 inches.

In Arnot soils the root zone is mainly in the 10 to 20 inches of moderately permeable to rapidly permeable soil above bedrock. Because of the shallowness to the bedrock and the high content of stones, the available water capacity is low or very low. Plants in the shallower soils are the first to wilt during dry periods. Short periods of wetness are common in spring when water is perched above the bedrock. The capacity of these soils to supply nitrogen, phosphorus, and potassium is generally medium. They are strongly acid or very strongly acid, and they need lime.

Representative profile of Arnot channery silt loam, gently sloping, in an old apple orchard in the town of Fabius, 400 feet west of Shackham Road, 3,300 feet north of the Cortland County line in the northwestern corner of a small abandoned quarry on the northern side of the truck trail:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) channery silt loam, dark brown (10YR 3/3) crushed; moderate, medium and coarse, granular structure; friable; many fine and medium roots; 25 percent angular sandstone fragments; strongly acid; clear, wavy boundary.

B21—8 to 14 inches, brown (10YR 4/3) very channery silt loam; weak, fine and medium, subangular blocky structure; friable, nonsticky; common roots; many fine and common medium pores; 40 percent angular sandstone fragments; strongly acid; gradual, wavy boundary.

B22—14 to 18 inches, dark yellowish-brown (10YR 4/4) very channery silt loam, few, fine, faint yellowish-brown and light olive-brown mottles; weak, thin, platy structure; friable, nonsticky; common fine and medium roots; many fine and common medium pores; 50 percent angular sandstone fragments; strongly acid; abrupt, wavy boundary.

R—18 inches, gray sandstone bedrock, upper 12 to 18 inches fractured and coated with silty soil material seeped from the B horizons. Quarry adjacent to profile site shows 6 to 10 feet of massive gray sandstone bedrock underlain by softer thin layer of gray and dark-gray shale bedrock.

Thickness of the solum and depth to bedrock range from 10 to 20 inches. Content of coarse fragments ranges from 15 to 35 percent in the Ap horizon and from 35 to 60 percent in the B horizon. These are dominantly gray sandstone and hard shale rock and range in size from small fragments to large flagstones.

The Ap horizon is grayish brown (2.5Y 5/2) to dark brown (10YR 3/3). The A1 horizon, where present, is dark gray (N/0) to very dark brown (10YR 2/2). A thin, grayish-brown (10YR or 2.5Y 5/2) A2 horizon is present in some unplowed areas.

The B horizon has hues of 7.5YR to 2.5Y, values of 3 to 5,

and chromas of 3 to 6. Reaction in the B horizon ranges from very strongly acid to strongly acid.

Arnot soils are associated with slightly deeper Lordstown soils that are 20 to 40 inches deep over bedrock. Arnot soils are also associated with the deeper Mardin and Volusia soils, which have a fragipan.

Arnot channery silt loam, gently sloping (ATB).—This soil is on hilltops and valley sides. In many places it is in narrow, treadlike positions on step-shaped hillsides where the risers consist of outcrops of sandstone and hard shale bedrock. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Lordstown soils where the bedrock is 20 to 40 inches deep. Also included are small areas of a moderately deep, poorly drained soil in small shallow depressions.

This soil is suited to crops, pasture, and trees. Because of shallowness to bedrock, the soil is droughty. It is generally better suited to early maturing grain and to shallow-rooted crops that can tolerate dryness than it is to most other uses. Measures that conserve water and control erosion are needed on sloping areas. In some places bedrock outcrops make the use of machinery hazardous. Capability unit IVe–5; woodland suitability group 4d1.

Arnot-Lordstown association, very steep (AVF).—The soils in this association are in steep and very steep landscape positions at high elevations. Areas are mainly steep and very steep hillsides and valley sides where slopes range from 25 to 45 percent. Also included are very steep gorges where slopes range from 35 to 65 percent. Ledges of bedrock outcrops are prominent features of the landscape. Varying amounts of flagstones and large flat boulders are scattered on the surface. Most of the areas are long and narrow and range in size from 30 to more than 500 acres. Some of the larger areas are more than 1,000 feet wide.

About 50 percent of the association is Arnot soils, and 30 percent is Lordstown soils. The rest is about 10 percent rock outcrops and 10 percent minor soils.

Arnot and Lordstown soils in this association have profiles similar to those described as representative of their respective series, but large flat flagstones and boulders are scattered on the surface and throughout the profile. Depth to bedrock is variable over short distances, and rock outcrops of hard sandstone are common. In places, the bedrock escarpments are nearly vertical, especially in the gorges.

Minor soils in the association consist of deep, moderately well drained Mardin soils, and somewhat poorly drained Volusia soils where the depth to bedrock is more than 40 inches. Other minor soils are Volusia soils, moderately shallow variant, where the depth to bedrock is 20 to 40 inches. These Volusia soils are in seep spots.

Most of the acreage of this association is in trees. A few of the areas that have slopes of less than 35 percent are in low-quality pasture. Both soils in capability unit VIIs–1; Arnot soils in woodland suitability group 4x1 and Lordstown soils in woodland suitability group 3r4.

Aurora Series

The Aurora series consists of moderately deep, moderately well drained, medium-textured soils. These soils formed in neutral to moderately alkaline till high in content of dark-gray shale and lesser amounts of limestone. They are underlain by dark-gray shale bedrock at a depth of 20 to 40 inches. These soils are nearly level to very steep on bedrock-controlled landforms that are mainly on uplands and valley sides.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam 9 inches thick. Between depths of 9 and 12 inches is a leached subsurface layer of brown, friable silt loam. Between depths of 12 and 18 inches, the upper part of the subsoil is firm, mottled, dark-brown heavy silt loam. Between depths of 18 and 29 inches, the subsoil is mottled, dark grayish-brown, heavy shaly silt loam. Between depths of 29 and 38 inches, the lower part of the subsoil is mottled, very dark gray, firm, heavy shaly silt loam. Black to dark-gray silty shale bedrock is at a depth of 38 inches.

In Aurora soils root growth is limited mainly to the soil above the bedrock. This zone has a moderate available water capacity. A seasonal high water table is at a depth of 18 to 24 inches. It is perched on the slowly permeable subsoil and generally delays plowing in spring.

Some areas of Aurora soils are acid and need lime. Other areas are neutral and do not need lime. The content of organic matter and nitrogen is medium. The capacity of these soils to supply phosphorus and potassium is medium. Bedrock and seasonal wetness are the main limitations for most farm and nonfarm uses. Much of the bedrock is rippable, but it contains thin strata of harder, more resistant rocks in places.

Representative profile of Aurora silt loam, 0 to 6 percent slopes, in a cultivated field in the town of Pompey, 50 feet east of Sweet Road, 3,000 feet south of State Route 173:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam, gray (10YR 6/1) dry; moderate, medium and coarse, granular structure; friable; many roots; 10 percent fine shale fragments; neutral; abrupt, smooth boundary.

A2—9 to 12 inches, brown (10YR 5/3) silt loam, light gray (2.5Y 7/2) dry; weak, fine, subangular blocky structure; friable; many roots; many fine pores; 10 percent shale fragments; slightly acid; clear, wavy boundary.

B&A—12 to 18 inches, dark-brown (10YR 4/3) heavy silt loam, very pale brown (10YR 7/3) dry; few, fine, distinct yellowish-brown and gray mottles; moderate, medium, subangular blocky structure; firm, slightly sticky; many roots; many fine and medium pores; patchy clay linings in larger pores; 1/8- to 1/4-inch-thick, brown (10YR 5/3) silt coats on ped faces, light gray (2.5Y 7/2); 12 percent shale fragments; neutral; clear, wavy boundary.

B2t—18 to 29 inches, dark grayish-brown (10YR 4/2) heavy shaly silt loam; many, medium, distinct dark yellowish-brown (10YR 4/4), and few, fine, distinct gray mottles; moderate, medium, subangular blocky structure in weak coarse prisms; firm, slightly sticky; common roots; many fine and medium pores; clay linings in larger pores; continuous thin clay films on ped faces; 20 percent shale fragments; neutral; clear, wavy boundary.

B3—29 to 38 inches, very dark gray (10YR 3/1) heavy shaly silt loam; few, fine, distinct brown and yellowish-brown

mottles; weak, fine, subangular blocky structure; firm, slightly sticky; common roots; common fine and medium pores, patchy clay linings in larger pores; discontinuous clay films on ped faces; 30 percent shale fragments; mildly alkaline (weakly calcareous); clear, smooth boundary.

R—38 inches, black (10YR 2/1) to dark-gray (10YR 4/1) silty shale bedrock, partly weathered with dark yellowish-brown (10YR 4/4) silt coating in upper 6 to 12 inches; few fine roots in silt coatings; mildly alkaline (weakly calcareous).

The solum ranges from 20 to 40 inches in thickness. Depth to bedrock generally ranges from 20 to 40 inches. In places a thin C horizon is present where the depth to bedrock ranges from 30 to 40 inches.

The A horizon ranges from silt loam to light silty clay loam and is 5 to 25 percent coarse fragments. The Ap and A1 horizons range from very dark gray (10YR 3/1) to dark brown (10YR 4/3) in color. The A2 horizon has hues of 10YR to 2.5Y, values of 4 to 6, and chromas of 2 to 4 when moist. The A2 horizon, when dry, has values of 6 to 8 and chromas of 1 to 3. In places a few faint mottles are present in the A2 horizon. Reaction in the A horizon ranges from strongly acid to neutral.

The B horizon ranges from silt loam to light silty clay loam and is 18 to 35 percent clay. Coarse fragments in the B horizon, mainly shale and some angular sandstone and limestone, range from 5 to 30 percent by volume. The B horizon has hues of 7.5YR to 5Y, values of 3 to 5, and chromas of 1 to 4. It has distinct gray and yellowish-brown mottles in the upper part that become fainter and decrease in number with increasing depth. Reaction in the B horizon ranges from medium acid to mildly alkaline, but in the lower part this horizon is weakly calcareous in places.

The C horizon, where present, has color and texture similar to the B horizon. Reaction in the C horizon ranges from neutral to moderately alkaline, but in the lower part the horizon is weakly calcareous in places.

The moderately well drained Aurora soils are closely associated with the somewhat poorly drained Angola and Darien soils and the poorly drained Varick soils and formed in similar material. They are also near the shallow Farmington and Benson soils in places.

Aurora silt loam, 0 to 6 percent slopes (AwB).—This nearly level to gently sloping soil is typically on convex-shaped hilltops that receive little or no runoff from adjacent higher soils. A few areas are on hillsides that have been dissected by shallow drainageways at intervals of 200 to 500 feet. Areas are irregular in shape. Many areas are larger than 10 acres, but some are larger than 50 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of somewhat poorly drained Angola soils in shallow depressions or along drainageways. These wetter soils make up 15 percent of some areas, and they delay tillage unless they are drained. Also included are small areas of shallow Farmington soils and small areas of deep Honeoye or Lansing soils.

This soil is well suited to crops, pasture, and trees. If this soil is used intensively for row crops, erosion-control measures are generally needed on the longer slopes. In some areas wet spots delay tillage and need to be drained. In a few places outcrops of hard bedrock hinder plowing and excavation. Capability unit IIe–7; woodland suitability group 2o1.

Aurora silt loam, 6 to 12 percent slopes (AwC).—This soil is generally on hillsides. Many areas are larger than 10 acres. Some areas are long and narrow. Many of the larger areas are dissected by shallow to moderately deep drainageways at intervals of 200 to 400 feet.

This soil has a profile similar to the one described as representative of the series, but in places the surface layer contains more shale fragments and is lower in organic-matter content.

Included with this soil in mapping are small areas of shallow Farmington soils and small areas of deep Honeoye or Lansing soils. Also included are small areas of poorly drained Angola soils in some of the drainageways and areas of severely eroded shaly and very shaly Aurora soils.

This soil is suited to crops, pasture, and trees. Runoff is moderately rapid, and the hazard of erosion is severe. Consequently, measures that control runoff and erosion are needed if this soil is used intensively for crops. In places outcrops of hard bedrock hinder tillage and excavation. Capability unit IIIe–6; woodland suitability group 2o1.

Aurora silt loam, 12 to 18 percent slopes (AwD).—This moderately steep soil is on hillsides or valley sides. Some areas that are dissected by closely spaced drainageways have short, complex slopes. Many areas are long and narrow and are larger than 10 acres.

This soil has a profile similar to the one described as representative of the series, but it is slightly better drained and is browner.

Included with this soil in mapping are small areas of shallow Farmington soils and small areas of deep Honeoye or Lansing soils. Also included are a few small areas of Angola soils in drainageways or in seep spots and areas of severely eroded Aurora soils.

Most of the acreage of this soil is in trees, or it has been used mainly for pasture with little or no tillage. It is suited to crops, pasture, and trees. Because of the moderately steep slopes, this soil is better suited to hay or pasture crops than to most other uses. Runoff is rapid, and the hazard of erosion is severe. Consequently, if this soil is used for row crops or small grain, it needs intensive erosion-control measures. The included shallow soils are very droughty. Capability unit IVe–2; woodland suitability group 2r2.

Aurora silt loam, 12 to 18 percent slopes, eroded (AwD2).—This moderately steep soil is on hillsides and valley sides. Some areas that are dissected by closely spaced drainageways have short, complex slopes. Many areas are long and narrow and are larger than 10 acres.

This soil has a profile similar to the one described as representative of the series, but it is 6 to 12 inches shallower over bedrock, is browner, contains more shale fragments, and has a lower content of organic matter in the surface layer.

Included with this soil in mapping are small areas of shallow Farmington soils and deep Honeoye and Lansing soils. Also included are small areas of Angola soils in drainageways and in seep spots.

Nearly all areas of this soil have been cleared and cultivated. An average of 6 to 12 inches of the soil has been removed by erosion. In many places gullies extend into the upper 12 inches of the bedrock. Many areas are idle and are reverting to brush and trees, and some areas have been reforested. The hazard of further erosion is severe; therefore, tillage needs to be confined mainly to renovation for hay or pasture. In places outcrops of hard bedrock hinder tillage or

excavation. Capability unit IVe–2; woodland suitability group 2r2.

Aurora-Farmington-Rock outcrop association, steep (AXE).—The soils of this association are mainly on valley sides where slopes range from 18 to 45 percent. Also in this association are very steep gorges where slopes range from 35 to 65 percent. Ledges of bedrock outcrops are prominent features of the landscape. Most of the areas are long and narrow. They range in size from 30 to more than 200 acres, and a few of the largest areas are larger than 500 acres. These are long side hills that are more than 1,000 feet wide.

About 40 percent of the association is Aurora soils, about 30 percent is Farmington soils, and about 20 percent is rock outcrop. The remaining 10 percent is minor soils.

Aurora and Farmington soils have profiles similar to the ones described as representative of their respective series, but they generally have more shale and flat angular sandstone fragments on the surface. Depth to bedrock is variable over short distances, and scattered areas of Rock outcrop are common. In places the bedrock escarpments are nearly vertical, especially in the gorges.

Minor soils in this association are the deep Honeoye or Lansing soils in pockets where the bedrock is more than 40 inches deep and spots of Lyons or Angola soils in small seep areas.

Most of the acreage of this association is in trees. Some of the areas that have slopes of less than 30 percent have been cleared but are now idle or in low-quality pasture. Many of the idle areas are brushy and are slowly reverting to forest. Aurora and Farmington soils in capability unit VIIs–1; Aurora soils in woodland suitability group 2r5, Farmington soils in woodland suitability group 5x1; Rock outcrop not assigned to a capability unit or woodland suitability group.

Benson Series

The Benson series consists of shallow, somewhat excessively drained or excessively drained, medium-textured soils on uplands. These soils formed in thin deposits of calcareous glacial till that are 10 to 20 inches thick over limestone or hard calcareous shale bedrock. The rock fragments in the soil are mainly limestone or calcareous hard shale. These soils range from level to very steep and are on bedrock ridges.

In a representative profile in a formerly cultivated area, the surface layer is dark-brown silt loam 8 inches thick. Between depths of 8 and 10 inches, the upper part of the subsoil is very friable brown silt loam. Between depths of 10 and 15 inches, the subsoil is very friable, brown very channery loam. Between depths of 15 and 18 inches, the lower part of the subsoil is friable, very dark grayish-brown very channery silt loam. Limestone bedrock is at a depth of 18 inches.

In Benson soils root growth is limited mainly to the 10 to 20 inches of moderately permeable soil above the bedrock. Available water capacity ranges from very low to moderate. Consequently, water for plants becomes deficient by the middle of summer, especially in the shallowest and stoniest areas. The capacity of these soils to supply nitrogen, phosphorus, and potassium is medium. They generally do not need lime. Moisture deficiency limits the response of crops to fertilizer. Many bedrock outcrops hinder tillage. Hard bedrock is the main limitation for most farm and nonfarm uses.

Representative profile of Benson silt loam, undulating, in a hayfield in the town of Manlius, 75 feet south of Salt Springs Road, 75 feet east of Palmer Road:

Ap—0 to 8 inches, dark-brown (10YR 3/3) silt loam, light brownish gray (10YR 6/2) dry; moderate, medium, granular structure; friable; many roots; 10 percent limestone fragments; neutral; clear, smooth boundary.

B21—8 to 10 inches, brown (7.5YR 4/4) light silt loam; weak, fine and very fine, subangular blocky structure; very friable; common roots; common fine and medium pores; 10 percent limestone fragments; neutral; clear, wavy boundary.

B22—10 to 15 inches, brown (10YR 4/3) very channery loam; weak, thin, platy structure, very friable; common roots; common fine and few medium and coarse pores; 40 percent limestone fragments; neutral; clear, wavy boundary.

B3—15 to 18 inches, very dark grayish-brown (10YR 3/2) very channery silt loam; weak, medium, subangular blocky structure; friable, slightly sticky; few roots; many fine pores that have patchy clay linings; 50 percent limestone fragments; mildly alkaline (calcareous).

R—18 inches, dark-gray (N 4/0) limestone, strongly calcareous, vertical cracks and fissures 2 to 5 feet apart, contain B3 horizon material; horizontal rock cracks in upper foot contain silt coats.

Solum thickness and depth to bedrock range from 10 to 20 inches. Content of coarse fragments ranges from 5 to 35 percent in the A horizon and in the upper part of the B horizon and from 35 to 55 percent in the lower part of the B and C horizons.

The A horizon has hues of 10YR to 7.5YR, values of 3 and 4, and chromas of 2 and 3. Reaction in the A horizon ranges from slightly acid to neutral.

The B horizon has hues of 10YR to 5YR, values of 3 to 5, and chromas of 2 to 6. The darkest colors are inherited from dark-gray to black shale or limestone. Texture of the fine earth in the B horizon ranges from loam to slightly silty clay loam. Consistence is friable or very friable. Reaction in the B horizon ranges from slightly acid to moderately alkaline (calcareous).

The C horizon, where present, ranges from 1 to 5 inches in thickness. It is dark gray (10YR 4/1) to dark reddish brown (5YR 3/3). Texture of the fine earth in the C horizon ranges from loam to light silty clay loam. Consistence is friable and reaction is moderately alkaline (calcareous).

Benson soils are closely associated with the well drained to moderately well drained Wassaic soils that are 20 to 40 inches deep over bedrock. They are also near the well-drained Honeoye soils and the well drained to moderately well drained Cazenovia soils that formed in deep till.

Benson silt loam, undulating (BeB).—This soil is mostly nearly level or very gently sloping on bedrock-controlled hilltops. Slopes range from 0 to 8 percent. The nearly level areas have the most uniform depth to the limestone bedrock. Many of these nearly level areas are larger than 50 acres. The more sloping or undulating areas have less uniform depth to bedrock and include many scattered ledges of bedrock. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of moderately deep Wassaic soils and areas of deep Honeoye or Cazenovia soils. These deeper inclusions have little or no effect on use and management.

This soil is used for crops, pasture, and trees. The soil is suited to early season pasture. By midsummer the pasture is generally thin and dried out. Tree growth is slow in many areas. This soil is generally too droughty for good crop response even under good management. Bedrock ledges hinder tillage. Capability unit IIIs–3; woodland suitability group 5d1.

Benson silt loam, rolling (BeC).—This soil is on bedrock-controlled hills. Slopes range from 8 to 25 percent. Most areas of this soil are less than 10 acres in size, and only a few are larger than 20 acres.

This soil has a profile similar to the one described as representative of the series, but the depth to bedrock is generally more variable.

Included with this soil in mapping are small areas of Wassaic soils where the depth to bedrock is 20 to 40 inches, and small areas of soils where the depth to bedrock adjacent to the outcrops is less than 10 inches. Also included are a few small areas of deep Honeoye or Cazenovia soils.

This soil is used for crops, pasture, and trees. Slope and bedrock outcrops hinder tillage; consequently, this soil is better suited to hay or pasture crops than to most other uses. Rock outcrops hinder mowing. Pastures generally become short by midsummer. Tree growth is variable. Capability unit IVe–4; woodland suitability group 5d1.

Benson-Wassaic-Rock outcrop association, sloping (BNC).—The soils in this association are mainly on the broad flat tops or the sides of limestone bedrock-controlled landforms. On the broad flat tops slopes are mostly nearly level and are 0 to 3 percent. Exposures of bare limestone bedrock of varying sizes are prominent features of these broad tops. On the hillsides slopes are 3 to 25 percent. Many limestone bedrock outcrops are prominent features of the landscape. Some of the ledges are nearly vertical and range from 2 to 10 feet in height. Most of the areas are irregular in shape and range from 10 to more than 100 acres in size.

About 40 percent of the association is Benson soils, about 20 percent is Wassaic soils, and about 20 percent is Rock outcrop. About 10 percent of the association is a very shallow soil, similar to Benson soil, but it is less than 10 inches deep over the bedrock. The remaining 10 percent is minor soils.

Benson and Wassaic soils have profiles similar to those described as representative of their respective series, but they generally contain more angular limestone fragments. Depth to bedrock is fairly uniform, or it changes gradually on the broader, flat tops of hills, so that exposures of bare rock in places are as large as half an acre. Depth to bedrock is variable on the gently sloping to moderately steep hillsides, and it is most variable on the steepest slopes, where Rock outcrops are numerous or very numerous.

Minor soils in this association are the deep Honeoye, Cazenovia, or Ontario soils in pockets where the depth to bedrock is more than 40 inches.

Most of the acreage of this association is in woodland which exhibits a widely variable rate of tree growth, generally related directly to the depth of the soil over bedrock. Some of the nearly level areas and very shallow areas support scattered stunted trees. Cleared areas are now idle or in low-quality pasture. Benson and Wassaic soils in capability unit VIs–1; Benson soils in woodland suitability group 5d1 and Wassaic soils in woodland suitability group 2r2; Rock outcrop not assigned to a capability unit or woodland suitability group.

Benson-Wassaic-Rock outcrop association, very steep (BNF).—The soils in this association are mainly on bedrock-controlled hillsides or escarpments where slopes range mainly from 25 to 45 percent. Other areas of soils are on the very steep sides of gorges that dissect the limestone bedrock formations, and where slopes are 35 to 70 percent. Rock outcrops of limestone, many of which are nearly vertical cliffs, are prominent features of the landscape. Individual areas are irregular in shape and range in size from about 20 acres to more than 200 acres.

About 40 percent of the association is Benson soils, about 20 percent is Wassaic soils, and about 20 percent is Rock outcrop. About 10 percent of the association is a very shallow soil, similar to Benson soil, but less than 10 inches deep over bedrock. The remaining 10 percent is minor soils.

Benson and Wassaic soils have profiles similar to those described as representative of their respective series, but they generally contain more angular limestone fragments and boulders. Depth to bedrock is variable over very short distances. The soils grade from more than 40 inches deep to very shallow depth. Bedrock outcrops are very numerous.

Minor soils in this association are the deep Honeoye, Cazenovia, or Ontario soils in pockets where depth to bedrock is more than 40 inches.

Most of the acreage of this association is in trees, much of which exhibit fairly good growth. This is evidently because the trees are able to tap seepage water in the numerous crevices in the limestone rock. The steep and very steep slopes and the many nearly vertical bedrock ledges and cliffs hamper forest management and logging. A few of the less sloping areas are in low-quality pasture or are idle. Benson and Wassaic soils in capability unit VIIs–1; Benson soil in woodland suitability group 5x1, Wassaic soil in woodland suitability group 2r5; Rock outcrop not assigned to a capability unit or woodland suitability group.

Bombay Series

The Bombay series consists of deep, moderately well drained, moderately coarse textured soils on uplands. These soils formed in moderately coarse textured, neutral to moderately alkaline glacial till that has a high content of fine sand. The till contains varying amounts of semirounded gravel and stones that are mainly red and gray sandstone but in places are limestone. Minor amounts of gneiss, granite, and quartzite are also present.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown gravelly loam 10 inches thick. Between depths of 10 and 16 inches, the subsoil is mottled, yellowish-brown fine sandy loam. Between depths of 16 and 29 inches, the upper part of the subsoil is firm, mottled, brown heavy fine sandy loam. The lower part of the subsoil, between depths of 29 and 38 inches, is friable, brown gravelly fine sandy loam. The substratum, between depths of 38 and 60

inches, is friable, brown gravelly fine sandy loam that is calcareous below a depth of 48 inches.

Bombay soils have a moderately permeable subsoil and a moderately slowly permeable substratum. Root growth is limited to the upper 18 to 24 inches of the soil by a seasonally high water table early in spring, but a few roots extend below this depth as the water table recedes. This zone has a moderate to high available water capacity. The seasonally high water table delays plowing. Bombay soils commonly receive runoff and seepage from adjacent higher soils.

Bombay soils are acid, and they need lime. The content of organic matter and nitrogen is medium. The capacity of these soils to supply phosphorus and potassium is low to medium. Consequently, heavy applications of complete fertilizer are needed for good crop response. Bombay soils respond well to management and fertilization.

Representative profile of Bombay gravelly loam, 2 to 8 percent slopes, in a cultivated field in the town of Lysander, 1,400 feet west of Fenner Road, 1,300 feet south of Church Road:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) gravelly loam; moderate, fine, granular structure; friable; many fine roots; 15 percent gravel and cobbles; medium acid; abrupt, smooth boundary.

A&B—10 to 16 inches, yellowish-brown (10YR 5/4) fine sandy loam, very pale brown (10YR 7/3) dry; few, fine, distinct strong-brown mottles; weak, thick, platy structure; friable; common fine roots; many fine pores; 10 percent gravel and cobbles; few washed sand grains; medium acid; abrupt, wavy boundary.

B2t—16 to 29 inches, dark-brown (7.5YR 4/4) heavy fine sandy loam; many, fine, distinct yellowish-brown and gray mottles; weak, medium, subangular blocky structure; firm; few fine roots; common medium pores that have thin clay linings; few, thin, discontinuous clay films on ped faces; 10 percent gravel and cobbles; slightly acid; clear, wavy boundary.

B3—29 to 38 inches, brown (10YR 4/3) gravelly fine sandy loam; weak, coarse, subangular blocky structure; friable; common pores; a few large pores that have thin patchy clay linings; thin patchy clay films on ped faces; few washed sand grains; 15 percent gravel and cobbles; slightly acid; gradual, wavy boundary.

C—38 to 60 inches, brown (10YR 4/3) gravelly heavy fine sandy loam; weak, thick, platy structure; friable; 15 percent gravel; neutral to a depth of 48 inches, moderately alkaline (calcareous) below.

The solum ranges from 30 to 48 inches in thickness. Depth to carbonates ranges from 30 to 60 inches. Depth to bedrock is more than 40 inches and generally is many feet. In the solum coarse fragments range from 10 to 30 percent and in the C horizon they range from 10 to 35 percent.

The Ap and A1 horizons range from very dark grayish brown to dark brown. The A2 horizon, where present, has hues of 7.5YR to 2.5Y, values of 5 and 6, and chromas of 3 and 4 when moist and values of 6 to 8 and chromas of 1 to 3 when dry. The fine-earth fraction of the A2 horizon ranges from light loam to fine sandy loam. Reaction of the A horizon in unlimed areas ranges from strongly acid to slightly acid.

The B horizon has hues of 5YR to 2.5Y, values of 4 and 5, and chromas of 3 and 4, with common to many high-chroma mottles and none to common low-chroma mottles. The fine-earth fraction of the B horizon ranges from loam to fine sandy loam. Thin patchy clay films are on ped faces and in pores. Reaction ranges from strongly acid to neutral.

The C horizon ranges from weak red (2.5YR 4/3) to light olive brown (2.5Y 5/4) in color. Texture is fine sandy loam to loam. Reaction of the C horizon ranges from neutral to moderately alkaline (calcareous).

Bombay soils are closely associated with the well-drained Madrid soils and the somewhat poorly drained Appleton soils and formed in similar material.

Bombay soils in Onondaga County have gray mottles in the upper part of the Bt horizon that are not within the range defined for the series. Also, they have redder hues, but these differences do not alter their usefulness and behavior.

Bombay gravelly loam, 2 to 8 percent slopes (BoB).—This soil is on smooth or slightly convex undulating uplands where some runoff accumulates from higher areas or runoff is somewhat slow. Areas are irregular in shape and larger than 10 acres.

Included with this soil in mapping are small areas of somewhat poorly drained Appleton soils in depressions and along drainageways. These wetter soils make up as much as 15 percent of some areas, and they commonly delay tillage unless they are drained. Also included are spots of well-drained Madrid soils on knolls, but these soils have little affect on use and management.

This soil is suited to cultivated crops, hay, pasture, or trees. It is well suited to most crops commonly grown in the county. The hazard of erosion is slight to moderate, especially on the longer slopes, if this soil is cultivated and not protected. Capability unit IIe–6; woodland suitability group 2o1.

Brockport Series

The Brockport series consists of moderately deep, somewhat poorly drained, moderately fine textured soils. These soils formed in glacial till or mixed glacial till and residuum of soft-gray or greenish-gray clay shales similar to the underlying bedrock, which is at a depth of 20 to 40 inches. Brockport soils are nearly level to gently sloping and are on relatively low uplands where relief is influenced by the underlying bedrock.

In a representative profile in a cultivated area, the surface layer is very dark grayish-brown light silty clay loam 12 inches thick. Between depths of 12 and 24 inches is firm, plastic, mottled, olive-gray subsoil that is silty clay loam in the upper part and silty clay below a depth of 16 inches. Between depths of 24 and 33 inches, the substratum is firm, olive-gray very shaly silty clay. Light olive-gray to greenish-gray soft clay shale bedrock is at a depth of 33 inches.

In Brockport soils root growth is limited by wetness in the upper 18 to 24 inches of soil. Roots grow mainly along cracks in the subsoil. Available water capacity is moderate to high. A seasonal high water table is at a depth of 6 to 12 inches in April. The soils have a very slowly permeable subsoil and are slow to dry out; consequently, many areas cannot be plowed until late in May or June. These soils clod readily, especially if they are plowed when too wet or too dry. Satisfactory seedbeds are difficult to establish.

Brockport soils are naturally fertile and need little or no lime. The heavy texture and wetness, however, limit root growth; consequently, plants cannot utilize the natural fertility and respond only moderately well to applications of fertilizer. Areas that have been drained are moderately well suited to crops and pasture. Wetness, very slow permeability, and heavy texture are the main limitations for most farm and nonfarm uses.

Representative profile of Brockport silty clay loam, 0 to 2 percent slopes, in a cultivated field in the town

of Van Buren, 1,000 feet west of West Dead Creek Road, 1,200 feet north of Old Route 31:

Ap—0 to 12 inches, very dark grayish-brown (2.5Y 3/2) light silty clay loam; moderate, medium, granular structure; friable, slightly sticky and plastic; many fine roots; 3 percent coarse fragments; neutral; abrupt, smooth boundary.

B&A—12 to 16 inches, olive-gray (5Y 5/2) light silty clay loam; common, fine, distinct brown mottles; moderate, fine, subangular blocky structure in moderate, coarse prisms; firm, sticky and slightly plastic; few fine roots; few fine and medium pores; patchy clay linings in larger pores; prisms and ped faces have gray (5Y 5/1) silt coats; 5 percent shale and gravel; neutral; clear, smooth boundary.

B2t—16 to 24 inches, olive-gray (5Y 5/2) silty clay; many fine and medium, distinct dark yellowish-brown (10YR 4/4) mottles; moderate, coarse, prismatic structure; firm, sticky and plastic; continuous, prominent, greenish-gray (5GY 5/1) clay coats on prism faces and lining larger pores; few fine roots; few fine and medium pores; 5 percent shale fragments; neutral; clear, smooth boundary.

C—24 to 33 inches, olive-gray (5Y 5/2) very shaly silty clay; weak, platy structure, appears to be inherited from bedrock; firm; greenish-gray (5GY 6/1) clay films on plate faces and soft shale chips; few roots; 50 percent shale fragments; neutral; clear, smooth boundary.

R—33 to 50 inches, soft olive-gray (5Y 5/2), light olive-gray (5Y 6/2), and greenish-gray (5GY 6/1) clay shale bedrock that can be penetrated with a sharp-pointed shovel; neutral at depth of 36 inches, mildly alkaline (calcareous) at depth of 50 inches.

The solum ranges from 20 to 30 inches in thickness. Depth to bedrock ranges from 20 to 40 inches. Content of coarse fragments, dominantly shale, but including sandstone and limestone, ranges from 2 to 35 percent by volume in the solum, and larger amounts are near the bedrock.

The Ap horizon has hues of 7.5YR to 2.5Y, values of 3 to 5, and chroma of 2. Some undisturbed soils have an A2 horizon that has hues of 2.5Y to 7.5YR, values of 5 or 6, and chromas of 1 or 2, and common to many high-chroma mottles. Reaction of the A horizon in unlimed areas ranges from slightly acid to neutral.

The Bt horizon has hues of 10YR to 5GY, values of 4 or 5, and chromas of 2 to 4. Texture of the Bt horizon ranges from silty clay loam to clay. Reaction in the B horizon ranges from slightly acid to mildly alkaline.

The R horizon is weathered shale bedrock, and ranges from neutral to moderately alkaline (calcareous) in reaction. The bedrock is soft olive-gray to greenish-gray clay shale that has thin layers of harder calcareous sandstone, limestone, or dolomite in places. The layers of harder rock range from 1 to 4 inches in thickness, and are thin enough to be rippable.

Brockport soils are commonly intermingled with Lockport soils; consequently, they are mapped only in undifferentiated groups with Lockport soils. Brockport and Lockport soils are similar in all major features, but Brockport soils are dominantly grayish and Lockport soils are reddish.

Camillus Series

The Camillus series consists of moderately deep, well-drained, medium-textured soils that are 20 to 40 inches deep over soft-gray silty shale bedrock. These soils formed mainly in glacial till high in content of shale and partly in residuum. They are on bedrock-controlled landforms on uplands. Many areas of these soils are larger than 50 acres.

In a representative profile in a formerly cultivated area, the surface layer is dark grayish-brown silt loam 9 inches thick. Between depths of 9 and 22 inches, the subsoil is friable silt loam that is yellowish brown in the upper part and brown to dark brown below a depth of 16 inches. Between depths of 22 and 38 inches, the substratum is friable, brown very shaly silt loam. Soft silty shale bedrock is at a depth of 38 inches. It is neutral in reaction in the upper part and is moderately alkaline and calcareous at a depth of 60 inches.

In Camillus soils root growth of most plants is limited to the 20 to 40 inches of soil material above the bedrock. This zone has a moderate to high available water capacity. Because the shale bedrock is fairly pervious, these soils have a moderately permeable subsoil and are generally well drained. In unlimed areas Camillus soils range from medium acid to neutral in reaction. Consequently some areas of this soil need lime, but others do not. The supply of nitrogen generally is medium, but eroded areas generally are deficient in nitrogen. The capacity of these soils to supply phosphorous and potassium is medium. Applications of complete fertilizers are needed for best crop response. Camillus soils respond well to management and fertilization. These soils are among the best in the county for growing alfalfa.

Slope and erosion are the main limitations to most nonfarm uses that require good drainage. Many areas are excellent housing sites because the soil and shale bedrock are easy to grade and excavate. Many of the rolling and hilly sites have esthetic value, but the hazard of erosion is generally severe during construction.

Representative profile of Camillus silt loam, 2 to 6 percent slopes, in an idle field in the town of Camillus, 200 feet north of State Route 5, 400 feet east of the Kasson Road intersection:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium and coarse, granular structure; friable moist, nonsticky wet; many fine and medium roots; 10 percent fine shale fragments; neutral; abrupt, smooth boundary.

B21—9 to 16 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, subangular blocky structure; friable moist, nonsticky wet; many fine and medium roots; many medium and large pores; 10 percent fine shale fragments; slightly acid; clear, wavy boundary.

B22—16 to 22 inches, brown to dark-brown (10YR 4/3) silt loam; weak, medium and coarse, subangular blocky structure; friable moist, nonsticky wet; few fine and medium roots; many medium and large pores; 10 percent shale fragments; medium acid; abrupt, smooth boundary.

C—22 to 38 inches, brown (7.5YR 5/4) very shaly silt loam; inherited platy structure from bedrock; friable moist, nonsticky wet; few medium and fine roots; 60 percent shale fragments; neutral; gradual, wavy boundary.

R—38 to 60 inches, olive-gray (5Y 5/2) and gray (5Y 5/1) soft, brittle, silty shale bedrock that has strata ranging from 1/4 inch to 3 inches thick; distinct gray silt films and discontinuous thin clay films on some horizontal shale faces; bedrock moderately alkaline (calcareous) at depth of 60 inches.

The solum ranges from 18 to 30 inches in thickness. Depth to soft shale bedrock ranges from 20 to 40 inches. Content of coarse fragments, mainly shale, ranges from 0 to 15 percent in the solum.

The Ap horizon ranges from very dark gray (10YR 3/1) to grayish brown (2.5Y 5/2). Reaction in the A horizon ranges from medium acid to neutral.

The B horizon has hues of 10YR to 2.5Y, values of 4 to 6, and chromas of 2 to 4. Some higher chroma mottles are present below a depth of 16 inches in places. Reaction in the B horizon ranges from medium acid to neutral.

The C horizon, where present, is silt loam that is 35 to 75 percent coarse fragments of soft shale. Reaction in the C horizon is neutral and mildly alkaline.

Camillus soils are closely associated with the well-drained

Ontario soils and the finer textured, moderately well drained to well drained Lairdsville soils, which formed in similar material. Camillus soils are grayer than Palatine soils, which formed in black or very dark gray shale.

Camillus silt loam, 2 to 6 percent slopes (CaB).—In most areas this soil is undulating and has short, complex slopes. Areas are irregular in shape and larger than 10 acres in size, and many areas are larger than 50 acres. This soil has the profile described as representative of the series. Included in mapping are small areas of Ontario soils in small pockets of deeper glacial till. These inclusions are not significant to use and management.

This soil is well suited to crops, pasture, and trees. It responds very well to good management. The hazard of erosion is severe; consequently, measures to control water and erosion are needed if the soil is left unprotected. This soil is also well suited to urban development. Capability unit IIe–1; woodland suitability group 2o1.

Camillus silt loam, 6 to 12 percent slopes (CaC).—In most areas this soil is strongly undulating or rolling and has short, complex slopes. Many areas are irregular in shape and range from 10 to 20 acres in size. A few areas are larger than 50 acres.

This soil has a profile similar to the one described as representative of the series, but it generally is 6 to 8 inches shallower to the shale bedrock. Included in mapping are small areas of Ontario soils in pockets of deeper glacial till.

Most areas of this soil are in trees or in houses and urban developments. Only a few areas are cleared and are used for crops and pasture. This soil is suited to crops, pasture, and trees. The hazard of erosion is severe if the soil is left exposed. Because most areas have short, complex slopes, this soil is better suited to hay crops than to most other uses. Contour measures to control erosion are generally impractical to establish. Capability unit IIIe–1; woodland suitability group 2r1.

Camillus silt loam, 6 to 12 percent slopes, eroded (CaC2).—Most areas of this soil are irregular in shape and 10 to 20 acres in size. The soil is mainly strongly undulating to rolling and has short, complex slopes. Only a few areas have smooth, simple slopes.

This soil has a profile similar to the one described as representative of the series, but the surface layer is grayer and has a higher content of shale fragments and a lower content of organic matter. It is 12 to 20 inches thinner over the shale bedrock, and in places the shale bedrock is exposed.

Included with this soil in mapping are small areas of Ontario soils in pockets of deeper glacial till, and areas of shallow soils, similar to Camillus soils, where the depth to shale bedrock is less than 20 inches.

This soil is suited to crops, pasture, and trees. It is better suited to hay crops than to most other uses. If used for row crops, the soil needs intensive measures to control erosion and runoff. Because of the short, complex slopes, contour measures to control erosion are generally impractical to establish. Capability unit IVe–1; woodland suitability group 2r1.

Camillus silt loam, 12 to 18 percent slopes, eroded (CaD2).—Most areas of this soil are near bedrock escarpments and are hilly. Slopes are hilly and complex. Areas are less than 10 acres in size.

This soil has a profile similar to the one described as representative of the series, but it is thinner to the shale bedrock, and there are many exposures of bedrock.

Included with this soil in mapping are wooded areas that are not eroded. Also included are small areas of similar but darker colored Palatine soils and small areas of Ontario soils in small pockets of deeper glacial till.

This soil is used for crops, pasture, and trees. Runoff is rapid or very rapid, and the hazard of further erosion is very severe. Because of this hazard and the moderately steep, short, complex slopes, this soil is better suited to hay crops than to most other uses. If the soil is used for row crops, adequate erosion-control measures are extremely difficult to establish. Capability unit IVe–1; woodland suitability group 2r3.

Camillus and Lairdsville shaly soils, steep (CBE).—This undifferentiated group consists of steep and very steep Camillus and Lairdsville soils on bedrock escarpments. Individual areas may consist of both soils or of only one of the soils. These soils have profiles similar to those described as representative of their respective series, but they are thinner and contain more shale fragments. Included in mapping are small areas of bedrock outcroppings that make up as much as 15 percent of some areas.

These soils are suited to trees, wildlife habitat, and native pasture. Grazing needs to be controlled to maintain good plant cover as protection against erosion. The soils are too steep for cultivated crops. Runoff is rapid or very rapid, and the hazard of erosion is very severe. Tree growth is moderate to good, but careful management is needed to maintain a satisfactory stand and to control erosion during logging. Capability unit VIe–1; woodland suitability group 3r3.

Canandaigua Series

The Canandaigua series consists of deep, poorly drained and very poorly drained, medium-textured soils on lake plains. These soils formed in silt loam or very fine sandy loam deposits that contain moderate amounts of clay. They are on low parts of lake plains.

In a representative profile in a formerly cultivated area, the surface layer is mucky silt loam 8 inches thick. Between depths of 8 and 19 inches, the subsoil is mottled, pinkish-gray, friable silt loam. Between depths of 19 and 31 inches, the subsoil is mottled, light brownish-gray, friable very fine sandy loam. Between depths of 31 and 54 inches, the strongly calcareous substratum consists of thinly stratified layers of silt and very fine sand and an occasional layer of clay. The substratum is friable and is dominantly mottled gray.

Canandaigua soils have a moderately permeable subsoil and, in most places, a slowly permeable substratum. Unless they are drained, water is at or near the surface from autumn until late in spring. Harvesting is hampered in places by surface water in wet years. Root growth is limited to the upper 12 inches of

soil in undrained areas. In drained areas roots can penetrate as deep as the drainage is effective. Drained areas have high available water capacity. Many areas of Canandaigua soils, even when drained, receive runoff and seepage from adjacent higher soils. Undrained areas are suited to sod crops that tolerate wetness. If adequately drained the soils are well suited to such annual row crops as corn, beans, and vegetables. Because of wetness the suppply of nitrogen generally is deficient in spring. The natural supply of nitrogen, however, is high, and if the soils are adequately drained, the supply of nitrogen generally is adequate for most crops in midsummer. The capacity of these soils to supply potassium and phosphorus is medium. Only a few areas need lime. Complete fertilizer generally is needed if the soils are drained and cropped intensively.

Representative profile of Canandaigua mucky silt loam in an idle area that was formerly cultivated in the town of Lysander, 50 feet east of State Route 48, 2,500 feet north of Church Road:

Ap—0 to 8 inches, very dark grayish-brown (7.5YR 2/2) mucky silt loam, high in content of organic matter; moderate, fine and medium, granular structure; friable; many roots; neutral; clear, smooth boundary.

B21g—8 to 12 inches, pinkish-gray (7.5YR 6/2) coarse silt loam; few, medium, distinct yellowish-brown and strong-brown mottles; weak, medium and fine, subangular blocky structure; friable; common roots; many fine and medium pores; mildly alkaline; clear, smooth boundary.

B22g—12 to 19 inches, pinkish-gray (7.5YR 6/2) silt loam; many, coarse, prominent strong-brown and reddish-yellow and common, medium, distinct light-gray mottles; moderate, coarse, prismatic structure parting to weak, coarse, subangular blocky; prism faces have gray (10YR 6/1) silt films; few fine roots; many fine and medium pores; thin patchy clay films in larger pores; few thin patchy clay films on blocky faces; mildly alkaline; gradual, wavy boundary.

B3g—19 to 31 inches, light brownish-gray (10YR 6/2) heavy very fine sandy loam; common, medium, distinct yellowish-brown, dark yellowish-brown, and light-gray mottles; weak, coarse and very coarse, prismatic structure parting to weak, fine and medium, blocky; friable; few fine roots; thin light-gray patchy clay films on prism faces; few fine and medium pores; thin patchy clay films in larger pores; mildly alkaline becoming moderately alkaline (calcareous) at a depth of 29 inches; clear, wavy boundary.

C—31 to 54 inches, gray (10YR 6/1) thinly stratified silt, very fine sand, and fine sand that has very thin layers of light-brown (7.5YR 6/4) silty clay; common, coarse, distinct dark yellowish-brown, olive-brown, and light olive-brown mottles that decrease in size and number with increasing depth; weak, fine and medium and thick, platy structure; friable; moderately alkaline (strongly calacerous).

The solum ranges from 20 to 40 inches in thickness. Depth to carbonates ranges from 18 to 60 inches. Depth to bedrock is more than 40 inches and generally is more than 10 feet. The solum generally is free of coarse fragments but, in places, it contains as much as 5 percent gravel and small stones by volume.

The dark-colored Ap horizon ranges from black to very dark grayish brown in color. It is less than 10 inches thick and is less than a third of the thickness of the solum. In undisturbed areas the A1 horizon ranges from 4 to 6 inches in thickness, and in some of the wettest areas it is muck. The A horizon is mainly silt loam or mucky silt loam, but it ranges to fine sandy loam or mucky fine sandy loam that is high in content of silt. Reaction in the A horizon ranges from slightly acid to mildly alkaline.

The B horizon ranges from light gray (5YR 7/1) to grayish brown (2.5Y 5/2) in color. It has hues of 5YR to 2.5Y, values of 5 to 7, chromas of 1 and 2, and few to many high chroma mottles. The B horizon is very fine sandy loam to light silty clay loam. Reaction in the B horizon ranges from slightly acid to moderately alkaline, and in places it is calcareous in the lower part.

The C horizon is mainly stratified silt and very fine sand that has thin bands of silty clay in places, and is silty clay below a depth of 40 inches in places. Reaction in the C horizon is neutral to moderately alkaline.

Canandaigua soils are closely associated with the somewhat poorly drained Niagara soils, which formed in similar material. They are coarser textured than Lakemont and Fonda soils.

Canandaigua mucky silt loam (Cd).—This level or nearly level soil is on flats or in depressions on lake plains where the water table is at or near the surface for long periods. Water ponds in places. Most areas are irregular in shape and larger than 10 acres in size, but some are larger than 50 acres.

Included with this soil in mapping are fairly extensive areas where the surface layer is silt loam instead of mucky silt loam, but the effect on use and management is very slight. Also included are areas of Palms muck in the lowest depressions and areas of better drained Niagara soils on slight rises or knolls.

If this soil is undrained, it is suited to wetland hay, pasture, and trees. If adequately drained, it is well suited to such annual row crops as corn and beans. This soil generally is too wet for winter small grain crops and too high in content of nitrogen for spring small grains. Capability unit IVw–3; woodland suitability group 4w1.

Carlisle Series

The Carlisle series consists of deep, very poorly drained, muck soils that formed in woody organic deposits. These soils are in bogs and have more than 51 inches of organic material over a mineral substratum of calcareous marl, or sand, silt, clay, or combinations of the three.

In a representative profile in a forest, the surface layer is friable, black granular muck about 12 inches thick. It is underlain by mucky material that extends to a depth of about 111 inches. Color is black to a depth of about 65 inches and very dark brown below. Partly decomposed wood fragments are scattered through the material below a depth of 65 inches. Below a depth of 111 inches, the mineral substratum is gray, sticky and plastic clay loam that is calcareous.

In Carlisle soils water is at or ponded on the surface during the wetter parts of the year. Root growth is limited by prolonged wetness to the upper 12 inches unless the soil is drained. In drained areas roots extend as deep as the drainage is effective. Available water capacity is high. Drained muck subsides by compaction and oxidation. It is also lost by soil blowing. Consequently drainage systems need to be deepened periodically. Some areas without adequate outlets need to be pumped. In some areas pumping is reversed to provide irrigation during dry periods. Drained Carlisle muck is highly productive for such specialty crops as lettuce, onions, celery, and potatoes. The supply of nitrogen is high. The capacity of these soils to supply phosphorus and potassium is low to medium. Undrained areas are better suited to

swamp woods than to most other uses. Drained areas that are abandoned because of subsidence and thinning of the muck are commonly better suited to wetland wildlife habitat. Wetness and poor stability are the main limitations for most nonfarm uses.

Representative profile of Carlisle muck in a forest in the town of Cicero, 150 feet south of Island Road, 4,700 feet east of Northern Boulevard:

Oa1—0 to 12 inches, black (5YR 2/1) on broken face, rubbed and pressed, sapric material; about 20 percent woody, herbaceous, and mossy fibers, about 2 percent rubbed; moderate to strong, fine granular structure; friable; many roots; about 5 percent mineral content; slightly acid; abrupt, smooth boundary.

Oa2—12 to 30 inches, black (N 2/0) on broken face, rubbed and pressed, sapric material; about 20 percent herbaceous fibers, about 5 percent rubbed; massive; nonsticky, slightly plastic; few roots; about 5 percent mineral content; neutral; clear boundary.

Oa3—30 to 65 inches, black (10YR 2/1) on broken face, rubbed and pressed, sapric material; about 25 percent herbaceous fibers, 5 percent rubbed; massive; nonsticky, slightly plastic; about 5 percent mineral content; slightly acid; clear boundary.

Oa4—65 to 108 inches, very dark brown (10YR 2/2) on broken face, rubbed and pressed, sapric material; about 15 percent woody and herbaceous fibers, 5 percent rubbed; massive; nonsticky, slightly plastic; 10 percent wood chips; 5 percent mineral content; slightly acid; clear boundary.

Oa5—108 to 111 inches, very dark brown (10YR 2/2) on broken face, rubbed and pressed, sapric material; about 50 percent mineral content; massive; slightly sticky and slightly plastic; neutral; clear boundary.

IIC2—111 to 116 inches, gray (5Y 6/1) light clay loam; massive; sticky and plastic; mildly alkaline (calcareous).

The organic deposits are more than 51 inches thick. Depth to bedrock is more than 51 inches and generally is more than 10 feet. Reaction in the surface and subsurface layers ranges from strongly acid to mildly alkaline, but it is dominantly slightly acid or neutral. The upper tiers to a depth of 36 inches are black (N 2/0) to very dark brown (10YR 2/2) and are dominantly woody and herbaceous fibers and sapric material, but some hemic material is present in places. The bottom tiers, below a depth of 36 or more inches, range from black (N 2/0) to dark reddish brown (5YR 2/2). They are mainly sapric material of herbaceous and woody fibers, and they contain some layers of hemic material in places. Reaction in the bottom tiers ranges from medium acid to moderately alkaline.

Carlisle muck is closely associated with Palms muck and Edwards muck. Carlisle muck is more than 51 inches deep to mineral or marl material, whereas Palms and Edwards muck are less than 51 inches deep to mineral or marl material.

Carlisle muck (Ce).—This soil is in swampy depressions mainly on the lake plains. Most areas are irregular in shape and larger than 10 acres in size. Some areas, especially in Cicero Swamp and Peat Swamp, are very large.

Included with this soil in mapping are areas of Palms or Edwards muck where there is less than 51 inches of organic material over a mineral or marl substratum. Also included are a few small areas of Canandaigua, Fonda, and Lamson soils, mainly along the edges of depressions or on small low knolls.

Areas of Carlisle muck that are used for crops are intensively drained. Areas still forested are mostly undrained or are partly drained as a result of ditching for roads or draining of adjacent areas for crops. Drained areas are used mainly for such truck crops as lettuce and onions. Only a few areas are used for field crops. Capability unit IIIw–1; woodland suitability group 5w1.

Cazenovia Series

The Cazenovia series consists of deep, well drained and moderately well drained, medium-textured soils that have a moderately fine textured subsoil. These soils formed in glacial till rich in reddish clay shale, limestone, and, in places, reworked reddish lacustrine clay. They are on uplands.

In a representative profile in a cultivated area, the surface layer is dark-brown silt loam 9 inches thick. Between depths of 9 and 12 inches is a thin, leached subsurface layer of brown, friable silt loam. Between depths of 12 and 15 inches, the upper part of the subsoil is reddish-brown, friable silt loam. Between depths of 15 and 36 inches, the subsoil is firm, reddish-brown silty clay loam that becomes gravelly at a depth of about 31 inches. Between depths of 36 and 70 inches, the underlying calcareous substratum is firm, gravelly silty clay loam that is streaked with colors of reddish brown, dark reddish gray, gray, and dark reddish brown.

Cazenovia soils have a seasonal high water table at a depth of 18 to 24 inches where runoff is somewhat slow or where water accumulates. In places the seasonal high water table is a little deeper. It is perched on the slowly permeable subsoil and substratum. Root growth is mainly in the top 24 to 36 inches of soil. Available water capacity in this zone is high. The natural supply of nitrogen and phosphorus is generally medium, and the supply of potassium is high. In unlimed areas reaction in the surface layer is medium acid to neutral. In places Cazenovia soils contain stones and boulders, generally limestone, that hinder tillage. Such areas are indicated on the soil map by symbols. Slope, the hazard of erosion, and slight seasonal wetness are the main limitations for most farm and nonfarm uses.

Representative profile of Cazenovia silt loam, 2 to 8 percent slopes, in a cultivated area in the town of Manlius, 300 feet west of Enders Road, 600 feet north of the intersection of Enders Road and State Route 92:

Ap—0 to 9 inches, dark-brown (7.5YR 4/2) silt loam, pinkish gray (7.5YR 6/2) dry; moderate, fine and medium, granular structure; friable; many roots; 10 percent coarse fragments; slightly acid; abrupt, smooth boundary.

A2—9 to 12 inches, brown (7.5YR 4/4) silt loam, pinkish gray (7.5YR 7/2) dry; weak, thick, platy structure; friable; many roots; common pores; 10 percent coarse fragments; slightly acid; clear, wavy boundary.

B&A—12 to 15 inches, reddish-brown (5YR 4/3) heavy silt loam; moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky; friable, slightly sticky; many roots; common pores; fingers 2 to 3 inches apart of 1/8- to 1/4-inch-thick, brown (7.5YR 4/4) silt coats, pinkish gray (7.5YR 7/2) dry, on vertical faces of prisms; reddish-gray (5YR 5/2) coarse silt coatings on blocky faces; patchy clay linings in larger pores in the B part of the horizon; 12 percent coarse fragments; neutral; clear, wavy boundary.

B21t—15 to 31 inches, reddish-brown (5YR 4/3) silty clay loam; strong, medium and coarse, angular blocky structure; firm, sticky; dark reddish-gray (5YR 4/2) clay films on ped faces; common roots; few fine and medium pores; common medium and coarse pores that have continuous clay linings; 10 percent coarse fragments; slightly acid; clear, wavy boundary.

B22t—31 to 36 inches, reddish-brown (5YR 4/3) gravelly silty clay loam; moderate, coarse, subangular blocky structure; firm, slightly sticky; reddish-gray (5YR

5/2) clay films on ped faces; very few roots; common fine pores, few medium and coarse pores that have thin clay linings; 15 percent coarse fragments; neutral; gradual, wavy boundary.

C1—36 to 50 inches, weakly stratified reddish-brown (5YR 4/3), dark reddish-gray (5YR 4/2), and dark reddish-brown (5YR 3/3) gravelly silty clay loam; moderate, medium and thick, platy structure; firm, slightly sticky; very few fine roots; common fine pores; 20 percent coarse fragments; moderately alkaline (calcareous); gradual, smooth boundary.

C2—50 to 70 inches, moderately stratified reddish-brown (5YR 4/3), dark reddish-gray (5YR 4/2), and dark reddish-brown (5YR 3/3) gravelly silty clay loam that has gray (5Y 6/1) streaks; moderate, medium and thick, platy structure; firm, slightly sticky; few fine pores; 20 percent coarse fragments; moderately alkaline (calcareous).

Thickness of the solum and depth to carbonates range from 20 to 45 inches. Bedrock is at a depth of more than 40 inches and generally is deeper than 10 feet. Content of coarse fragments ranges from 2 to 25 percent in the solum and from 10 to 40 percent in the C horizon.

The Ap horizon has hues of 10YR to 5YR, values of 3 to 5, and chromas of 1 to 3. In undisturbed areas the A1 horizon has values of 2 to 4 and chromas of 1 to 3. The A2 horizon has hues of 10YR to 5YR, values of 4 to 6, and chromas of 2 to 4 when moist, and values of 5 to 7 and chromas of 1 to 3 when dry. The A2 horizon ranges from fine sandy loam to heavy silt loam in texture and from medium acid to neutral in reaction.

The Bt horizon has hues of 7.5YR to 2.5YR, values of 3 to 5, and chromas of 3 or 4, and has few to common high-chroma mottles in places. The Bt horizon ranges from sandy clay loam to silty clay loam. Reaction in the Bt horizon ranges from medium acid to mildly alkaline.

The C horizon ranges from brown (7.5YR 5/2) to dark reddish brown (2.5YR 3/4) in color and from loam to silty clay loam in texture.

Cazenovia soils are closely associated with the somewhat poorly drained and moderately well drained Ovid soils and the poorly drained Lyons soils. All formed in similar material.

Cazenovia silt loam, 2 to 8 percent slopes (CfB).—This gently sloping soil is on hilltops that receive little or no runoff from adjacent soils. Slopes are mainly convex, and in many areas are gently undulating. Areas of this soil are irregular in shape and most are larger than 10 acres. This soil has the profile described as representative of the series. Included in mapping are small areas of Ovid soils in shallow depressions and drainageways. These wetter soils make up as much as 15 percent of some areas, and they delay tillage unless they are drained.

This soil is well suited to crops, pasture, and trees. It responds very well to good management. Many areas that are intensively cultivated are moderately eroded, and in these areas the soil tends to clod if plowed when too wet. Measures to control erosion and runoff are needed on many areas. Capability unit IIe–7; woodland suitability group 2o1.

Cazenovia silt loam, 8 to 15 percent slopes (CfC).—This soil has convex-shaped and mainly simple slopes. Some rolling areas of limited acreage, however, have short, complex slopes. Most areas of this soil are irregular in shape and are smaller than 20 acres. Only a few areas are larger than 50 acres. Many areas are smaller than 10 acres.

This soil has a profile similar to the one described as representative of the series, but the subsurface layer generally is thinner or is lacking. Included in mapping are small areas of Ovid soils in shallow depressions and drainageways. These wetter soils make up as much as 10 percent of some areas and are important because they delay tillage unless they are drained.

This soil is suited to crops, pasture, and trees. Much of the acreage is still in forest. Cropped areas generally have not been used intensively for row crops because the hazard of erosion is moderate or slight. Because runoff is rapid and the subsoil is slowly permeable, this soil is subject to erosion if the surface is left unprotected. Consequently, erosion-control measures are needed where the soil is used for row crops. The rolling areas are better suited to sod-forming crops because such erosion-control measures as contouring and terracing generally are not practical. Capability unit IIIe–6; woodland suitability group 2o1.

Cazenovia silt loam, 8 to 15 percent slopes, eroded (CfC2).—This soil has mostly uniform slopes that have convex shapes. Some rolling areas of limited acreage, however, have short, complex slopes. Most areas are irregular in shape and less than 20 acres in size. They have lost 8 to 12 inches or more of the original surface layer through erosion. Consequently the present surface layer is partly or almost entirely subsoil material. It is heavy silt loam that is low in content of organic matter. Some places show little or no evidence of erosion. Scattered small depressions and drainageways contain deposits of the eroded material on the wetter Ovid soil in places.

This soil has a profile similar to the one described as representative of the series, but it has a lighter colored, heavier textured surface layer and a shallower depth to the substratum.

This soil is suited to crops, pasture, and trees. Most of the acreage is or has been used for crops. Runoff is rapid, and the hazard of further erosion is severe. The heavy textured surface layer clods readily; consequently, a good seedbed is difficult to establish. In many places crop growth is uneven and many bald spots are present. Intensive erosion-control measures are needed if the soil is used for row crops. Organic-matter content needs to be increased, so many areas of this soil, especially the rolling areas, are better suited to long-term hay crops than to most other uses. Capability unit IVe–1; woodland suitability group 2o1.

Cazenovia soils, 15 to 25 percent slopes (CgD).—In most cropped areas this moderately steep or hilly soil is severely eroded and has a surface layer of silty clay loam. The surface layer ranges from silt loam in uneroded areas to silty clay loam in eroded areas. This soil is generally on narrow hillsides that receive a large amount of runoff from adjacent higher soils. Most areas are smaller than 20 acres in size.

This soil has a profile similar to the one described as representative of the series, but it is shallower to the substratum.

Included with this soil in mapping are areas of Ontario, Honeoye, or Schoharie soils. Also included are some gravelly or stony areas.

This soil is suited to crops, pasture, and trees. Runoff is rapid or very rapid, and the hazard of erosion is severe or very severe. If cultivated, the soil is better suited to hay than to other uses. Most of the slopes are so steep that the use of machinery is hazard-

ous. Capability unit IVe–1; woodland suitability group 2r2.

Collamer Series

The Collamer series consists of deep, moderately well drained, medium-textured soils on lake plains. These soils formed in stone-free lake-deposited silt and very fine sand that have a moderate content of clay and a moderate to high content of lime. They are on undulating tops of lake plains.

In a representative profile in a cultivated area, the surface layer is dark grayish-brown silt loam 10 inches thick. Between depths of 10 and 16 inches is friable, yellowish-brown silt loam. Between depths of 16 and 24 inches, the subsoil is friable, mottled, dark-brown silt loam. Between depths of 24 to 42 inches, the subsoil is friable, mottled, brown heavy silt loam. The substratum, between depths of 42 and 50 inches, is stratified, calcareous, friable silt loam, silt, and very fine sand that is brown, reddish brown, and dark grayish brown.

Collamer soils have a moderately permeable to moderately slowly permeable subsoil and a slowly permeable substratum. A seasonal high water table is at a depth of 12 to 18 inches. Root growth is confined to the upper 24 to 36 inches of soil. Available water capacity is high. Most areas of Collamer soils need lime, but some do not. The capacity of these soils to supply nitrogen, phosphorus, and potassium is medium. Applications of complete fertilizer are needed for most crops. Crops on Collamer soils respond well to good management and fertilization. The surface soil structure in these silty soils breaks down readily under continuous tillage, and it develops a floury or single-grained consistence which flows when wet and crusts when dry. Consequently a cropping system that adds organic matter and builds soil structure is needed. Seasonal wetness and variable stability are the main limitations for most nonfarm uses.

Representative profile of Collamer silt loam, 2 to 6 percent slopes, in a cultivated field in the town of Clay, 700 feet north of State Route 31, 2,000 feet due east of the Penn Central Railroad, 1,400 feet east-northeast of the intersection of the railroad and State Route 31, 5,200 feet west of Soule Road:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable; many roots; many fine and medium pores; few yellowish-brown (10YR 5/4) remnants of A2 horizon; neutral; abrupt, smooth boundary.

A&B—10 to 16 inches, yellowish-brown (10YR 5/4) silt loam, very pale brown (10YR 7/3) dry; moderate, medium, subangular blocky structure with 1/4-inch diameter ped centers of dark yellowish brown (10YR 4/4); friable; few roots; few coarse pores; slightly acid; clear, smooth boundary.

B&A—16 to 24 inches, dark-brown (7.5YR 4/4) silt loam; many, medium, faint, brown (7.5YR 5/4 and 10YR 5/3) mottles; moderate, coarse, subangular blocky structure; friable; few fine roots; few fine pores; 1- to 3-millimeters-thick ped coats of pinkish gray (7.5YR 6/2) in upper part and brown (10YR 4/3) and light gray (10YR 7/2) in lower part; channels of pinkish gray also appear as streaks; few black stains; slightly acid; clear, wavy boundary.

B21t—24 to 32 inches, brown (10YR 4/3) heavy silt loam; common, medium, distinct yellowish-brown (10YR 5/6) and few, fine, distinct light brownish-gray (10YR 6/2) mottles; moderate, medium and coarse, subangular blocky structure; friable; few fine roots; many fine pores; few coarse pores that have thin clay linings; thin patchy clay films on ped faces; neutral; clear, wavy boundary.

B22t—32 to 42 inches, brown (7.5YR 4/2) heavy silt loam; common, medium, distinct gray (10YR 6/1) mottles; moderate, medium and coarse, subangular blocky structure; friable; few fine roots; many fine pores; few medium and coarse pores that have thin clay linings; thin brown (7.5YR 4/2) clay films on ped faces; neutral; abrupt, wavy boundary.

C—42 to 50 inches, weakly stratified reddish-brown (5YR 4/3) silt loam that has thinner layers of brown (7.5YR 4/4) and dark grayish-brown (10YR 4/2) silt and very fine sand; weak, medium, platy structure; friable; moderately alkaline (calcareous).

The solum ranges from 30 to 48 inches in thickness. Depth to bedrock is more than 40 inches. Depth to free carbonates ranges from 30 to 72 inches. Collamer soils are generally free of coarse fragments, but a few stones or pebbles are present in places.

The Ap horizon has hues of 7.5YR and 10YR, values of 3 to 5, and chromas of 2 to 4. In undisturbed areas the A1 horizon is 2 to 6 inches thick and has a value of 1 and a lower chroma. The A2 horizon, if present, ranges from yellowish brown (10YR 5/4) to pale brown (10YR 6/3) when moist, and from very pale brown (10YR 7/3) to pinkish white (5YR 8/2) when dry. It contains some high-chroma mottles in places. Reaction in the A horizon ranges from strongly acid to neutral.

The B horizon has hues of 5YR to 2.5Y, values of 3 to 5, and chromas of 3 or 4. Mottles range from few to many in high chroma and from none to few in low chroma in the upper 10 inches of the B horizon, but in places they increase in number and size below a depth of 10 inches. The B horizon is heavy silt loam or light silty clay loam. A few thin clay layers or fine or very fine sandy loam layers totaling less than 6 inches in thickness are in the B horizon in places. Reaction in the B horizon ranges from strongly acid to mildly alkaline.

The C horizon consists of stratified silt loam, silt, and very fine sand and thin layers of fine sand or clay in places. Reaction in the C horizon ranges from neutral to moderately alkaline (calcareous) above a depth of 6 feet and is moderately alkaline (calcareous) below this depth.

Collamer soils are closely associated with the well-drained Dunkirk soils, the somewhat poorly drained Niagara soils, and the poorly drained and very poorly drained Canandaigua soils. All formed in similar material.

Collamer soils in Onondaga County have gray mottles in the upper part of the Bt horizon that are not within the defined range for the series, but this difference does not alter their usefulness and behavior.

Collamer silt loam, 0 to 2 percent slopes (ChA).—This level or nearly level soil is mainly in areas on the lake plains where it receives little or no runoff from adjacent areas. Many of these areas are irregular in shape and larger than 10 acres in size.

This soil has a profile similar to the one described as representative of the series, but it is slightly wetter and has a darker surface layer.

Included with this soil in mapping are areas of somewhat poorly drained Niagara soils in shallow depressions that make up as much as 20 percent of some areas. These wetter soils delay tillage in spring unless they are drained.

This soil is well suited to crops and is highly responsive to good management. It is also suited to pasture and trees. Capability unit IIw–1; woodland suitability group 2o1.

Collamer silt loam, 2 to 6 percent slopes (ChB).—Many areas of this gently sloping or gently undulating soil are irregular in shape and larger than 20 acres in size. Some are larger than 50 acres. Some

areas receive runoff from adjacent higher lying areas, but others do not. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of somewhat poorly drained Niagara soils in depressions and shallow drainageways. These wetter soils make up as much as 15 percent of some areas, and they delay tillage in spring unless they are drained. Also included are small areas of well-drained Dunkirk soils on small, higher lying knolls.

This soil is suited to crops, pasture, and trees. It is well suited to many crops and is highly responsive to good management. Erosion is a hazard because the soil flows readily and rills and shallow gullies form readily where water concentrates. Erosion-control measures on the undulating areas are difficult to establish in places. Drainage of wet spots generally is needed for timely tillage and harvesting of crops. Capability unit IIe–5; woodland suitability group 2o1.

Colonie Series

The Colonie series consists of deep, coarse-textured, well-drained to excessively drained soils that formed in sandy lake deposits. These soils are on deltas that formed where sand was dropped from streams entering glacial lakes.

In a representative profile in a formerly cultivated area, the surface layer is dark-brown loamy fine sand 6 inches thick that has a thin covering of very dark brown duff. Between depths of 6 and 22 inches the upper part of the subsoil is brown and yellowish-brown, very friable to loose loamy fine sand. Between depths of 22 and 65 inches, the lower part of the subsoil is brown, loose fine sand that contains thin bands of dark-brown loamy fine sand and fine sand. Between depths of 65 and 72 inches, the substratum consists of brown, loose fine sand that has a few small splotches of dark brown.

Colonie soils are rapidly permeable and are seldom saturated. They are quick to dry out after rains and can be plowed early in spring. The root zone of most plants is in the upper 2 to 3 feet of soil. Available water capacity for plants is low to moderate. By midsummer most crops show signs of wilting after only a few days without rain. Such deep-rooted plants as alfalfa have roots many feet deep. Colonie soils are low or very low in natural fertility and are strongly acid to very strongly acid. Crops are highly responsive to fertilization, especially if irrigation is used. Water intake is moderately rapid to rapid. These soils are well suited to intensive truck cropping and are adapted to a wide variety of vegetables and small fruit. Colonie soils are subject to soil blowing and, in sloping areas, to water erosion because the fine-sand particles are easily moved.

Representative profile of Colonie loamy fine sand, 0 to 6 percent slopes, in formerly cultivated brushland in the town of Lysander, 2,200 feet west of Sixty Road, 4,800 feet north of Kellogg Road, 2,900 feet south of Lamson Road, 2,800 feet east of Smokey Hollow Road in Three Rivers State Game Management Area:

AO—1/2 inch to 0, very dark brown (7.5YR 2/2) duff that has few grains of very fine sand; loose; abrupt, broken boundary.

Ap—0 to 6 inches, dark-brown (7.5YR 3/2) loamy fine sand, brown (7.5YR 5/2) dry; very weak, fine, granular structure; very friable; many roots; very strongly acid; abrupt, smooth boundary.

B21—6 to 12 inches, brown (7.5YR 5/4) loamy fine sand that fades with increasing depth to yellowish-brown (10YR 5/4); very weak, medium, platy structure; very friable; many roots; 20 percent very fine sand; very strongly acid; gradual, wavy boundary.

B22—12 to 22 inches, yellowish-brown (10YR 5/4) loamy fine sand; single grained; loose; few roots; 30 percent very fine sand; strongly acid; gradual, wavy boundary.

B23—22 to 37 inches, brown (7.5YR 5/4) fine sand; single grained; loose; 1/4- to 1/2-inch-thick, wavy-boundary lamellae or bands of dark-brown (7.5YR 4/4) loamy fine sand; single grained; very friable; slightly firm, rounded sand pellets coated with silt particles; very few roots; strongly acid; gradual, wavy boundary.

B24—37 to 65 inches, brown (7.5YR 5/2) fine sand; single grained; loose; four wavy, 1/4- to 1/2-inch-thick lamellae of dark-brown (7.5YR 4/4) fine sand; massive; very friable; medium acid; gradual, wavy boundary.

C—65 to 72 inches, brown (7.5YR 5/2) fine sand; few 1/4- to 1/2-inch-diameter, dark-brown (7.5YR 4/4) stains; single grained; loose; medium acid.

The solum ranges from 48 to 120 inches in thickness. Depth to bedrock is more than 48 inches and generally is more than 10 feet. The solum becomes less acid with increasing depth and generally is medium acid at a depth of 30 to 50 inches.

The Ap horizon has hues of 10YR to 7.5YR, values of 3 to 5, and chromas of 2 and 3. Reaction in the Ap horizon ranges from very strongly acid to strongly acid.

The B horizon has hues of 5YR to 2.5Y, values of 4 to 6, and chromas of 3 to 6. Texture to a depth of 40 inches ranges from loamy very fine sand to fine sand. Below a depth of 24 inches, roughly horizontal lamellae of dark-brown fine sand or very fine sand loamy fine sand that is faintly heavier in texture are present in most places. These bands range in thickness from 1/16 inch to 1 inch and are as deep as 120 inches. Below a depth of 40 inches, thin bands of silt or clay are present in places, but they are less than 6 inches thick within the upper 6 feet of soil. Reaction in the B horizon ranges from very strongly acid to medium acid above a depth of 40 inches and is strongly acid to neutral below a depth of 40 inches.

Colonie soils are closely associated with the moderately well drained Croghan soils, the somewhat poorly drained to poorly drained Naumburg soils, and the poorly drained to somewhat poorly drained Wareham soils. All formed in similar material.

Colonie loamy fine sand, 0 to 6 percent slopes (CIB).—This level to gently undulating soil is mainly on the tops of sandy deltas, many of which are larger than 50 acres. Only a few areas receive runoff from adjacent higher lying areas. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Arkport soils that are higher in content of silt and areas of Otisville and Alton soils where gravel crops out. These inclusions make up as much as 10 percent of some areas, but they have little significance in use and management. Also included are small areas of wetter Croghan and Galen soils in the deeper depressions and some areas that have stratified gravel below a depth of 40 inches.

This soil is suited to crops and trees. It is too droughty for pasture. It is well suited to intensive truck cropping if heavy fertilization and irrigation are used. This soil is easily moved, so many undulating areas can be smoothed to obtain uniform slopes for better water distribution. Soil blowing is a severe hazard if the surface is left unprotected. Capability unit IIIs–1; woodland suitability group 4s1.

Colonie loamy fine sand, rolling (CIC).—Most areas of this soil are small and consist of undulating to rolling dunes or the faces of sand deltas or the sides of moderately deep drainageways where slopes are mostly short and complex.

Included with this soil in mapping are small areas of Otisville and Alton soils that have outcropping layers of gravel. Also included are a few small areas of wetter Croghan or Galen soils along the bottoms of the drainageways, a few hilly areas, and some areas where stratified gravel is below a depth of 40 inches.

This soil is suited to cultivated crops and trees. It is too droughty for pasture. If it is used for row crops, erosion needs to be controlled, but the short, complex slopes make such erosion-control measures as contour tillage difficult to establish. Land smoothing that eliminates the short, complex slopes should be considered in special situations. Soil blowing is a hazard if the soil is left unprotected. Capability unit IVs–1; woodland suitability group 4s1.

Conesus Series

The Conesus series consists of deep, moderately well drained, medium-textured soils that formed in glacial till. The till derived mainly from gray alkaline and calcareous shale and from sandstone and limestone. Elevations generally are above 1,200 feet.

In a representative profile in a formerly cultivated area, the surface layer is very dark grayish-brown gravelly silt loam 9 inches thick. Between depths of 9 and 14 inches the upper part of the subsoil is friable, brown gravelly silt loam. Between depths of 14 and 25 inches, the subsoil is firm, mottled, dark-brown gravelly heavy loam. Between depths of 25 and 40 inches, the lower part of the subsoil is faintly mottled, dark grayish-brown, firm gravelly loam. The substratum, between depths of 40 and 60 inches, is grayish-brown, firm, gravelly loam glacial till that is neutral in the upper part and is calcareous below a depth of 56 inches.

Conesus soils have a seasonal high water table at a depth of 15 to 20 inches. Root growth is mainly limited to the upper 2 to 3 feet of soil. Available water capacity is moderate to high. These soils receive some runoff from adjacent areas, so crops are only rarely affected by drought. Conesus soils generally need lime. The supply of nitrogen is medium, and the capacity of these soils to supply phosphorus and potassium is also medium, so complete fertilizer is needed for most crops. Nitrogen generally is deficient in the cool, wet spring months. Crops respond very well to good management and fertilization. The high elevations and shorter growing seasons reduce yields of some crops. The content of gravel and stones in the surface layer hampers the use of some types of tillage and harvesting equipment. Seasonal wetness is the main limitation for most nonfarm uses.

Representative profile of Conesus gravelly silt loam, 3 to 8 percent slopes, in a formerly cultivated field in the town of Otisco, 50 feet south of Cook Road, 800 feet west of Case Road:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2), dark-brown (10YR 3/3) crushed and rubbed, gravelly silt loam; moderate, medium and coarse, granular structure; friable; many roots; 15 percent coarse fragments; slightly acid; abrupt, smooth boundary.

B&A—9 to 14 inches, brown (10YR 4/3) gravelly silt loam, moderate, medium, subangular blocky structure; friable; blocky face has 1-milimeter to 2-millimeter-thick brown (10YR 5/3) silt films, light gray (10YR 7/2) dry; many roots; many fine pores; patchy clay linings in larger pores; 20 percent coarse fragments; slightly acid; gradual, wavy boundary.

B21t—14 to 25 inches, dark-brown (10YR 4/3) gravelly heavy loam; common, medium, distinct yellowish-brown mottles; moderate, medium, subangular blocky structure; firm, slightly sticky; continuous grayish-brown (2.5Y 5/2) clay films on ped faces; common roots; many fine and medium pores; continuous clay linings in larger pores; 25 percent coarse fragments; slightly acid; clear, wavy boundary.

B22t—25 to 40 inches, dark grayish-brown (2.5Y 4/2) gravelly heavy loam; few, faint gray mottles; moderate, medium, angular and subangular blocky structure; firm, slightly sticky; grayish-brown (2.5Y 5/2) clay films on ped faces; common roots; many fine and medium pores that have continuous clay linings; 30 percent coarse fragments; neutral; gradual, wavy boundary.

C—40 to 60 inches, grayish-brown (2.5Y 5/2) gravelly loam; weak, medium structure and thick, platy; firm; few fine roots; few pores; 30 percent coarse fragments; neutral at depth of 44 inches, moderately alkaline (calcareous) at depth of 56 inches.

The solum ranges from 30 to 45 inches in thickness. Depth to bedrock is more than 40 inches. Depth to carbonates ranges from 30 to 60 inches. Content of coarse fragments ranges from 5 to 35 percent in the solum and from 20 to 50 percent in the C horizon.

The Ap horizon ranges from very dark grayish brown (2.5Y 3/2) to brown (10YR 4/3) and has hues of 10YR and 2.5Y. The A1 horizon, in undisturbed areas, is 2 to 4 inches thick and is one value and one chroma darker. Reaction in the A horizon ranges from strongly acid to slightly acid. The A2 horizon, where present, has hues of 10YR to 2.5Y, values of 5 or 6, and chromas of 2 to 4. High-chroma mottles are present in places.

The fine-earth fraction in the A&B horizons or B&A horizons ranges from silt loam to loam. The B horizon part has values 1 or 2 lower than the A horizon part. The Bt horizon has hues of 10YR to 5Y, values of 3 and 4, and chromas of 2 to 4. Mottles generally are present in the Bt horizon. The fine earth in the Bt horizon ranges from heavy loam to silt loam. Reaction in the Bt horizon ranges from medium acid to neutral.

The C horizon generally is dense, firm, gravelly or very gravelly loam or silt loam glacial till that has colors similar to the overlying B horizons. Reaction in the C horizon ranges from neutral to moderately alkaline (calcareous).

Conesus soils are closely associated with the well-drained Lansing soils, the somewhat poorly drained Appleton soils, and the poorly drained Lyons soils. All formed in similar material.

Conesus gravelly silt loam, 0 to 3 percent slopes (CoA).—This nearly level soil generally is on hilltops where slopes are slight and convex. It receives little or no water from adjacent areas. Most areas of this soil are smaller than 20 acres.

This soil has a profile similar to the one described as representative of the series, but it generally is slightly wetter and the surface layer generally is darker and higher in content of organic matter. Included in mapping are small areas of Appleton soils in shallow depressions and drainageways. These wetter soils make up as much as 15 percent of some areas, and they delay tillage in spring unless they are drained.

This soil is well suited to crops, pasture, and trees. It is particularly well suited to all crops commonly grown in the county, especially those crops that are

grown in support of dairying. Drainage of the included wet spots generally is needed. Erosion-control practices generally are not needed. Capability unit IIw–3; woodland suitability group 2o1.

Conesus gravelly silt loam, 3 to 8 percent slopes (CoB).—This gently sloping soil generally is on the sides of hills that are smooth to slightly convex in shape. Many areas receive some runoff and seepage from adjacent higher lying soils. Many areas of this soil are larger than 20 acres, and some are larger than 50 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Appleton soils in shallow concave drainageways and depressions. Also included are small areas of Lansing soils on slightly higher, convex knolls.

This soil is well suited to crops, pasture, and trees. If cropped, the wetter soils generally need drainage. Measures that control erosion and runoff generally are needed if this soil is used for row crops, especially on the longer slopes. Capability unit IIe–6; woodland suitability group 2o1.

Croghan Series

The Croghan series consists of deep, moderately well drained, coarse-textured soils that formed in sand deposits of deltas on the lake plains. These soils are on the tops of broad sand deltas from which water drains slowly.

In a representative profile in a cultivated area, the surface layer is very dark grayish-brown loamy fine sand 9 inches thick. Between depths of 9 and 11 inches is a thin, leached subsurface layer of loose, brown fine sand. Between depths of 11 and 14 inches, the upper part of the subsoil is dark reddish-brown, very friable loamy fine sand. Between depths of 14 and 26 inches, the subsoil is mottled, dark-brown, loose fine sand or loamy fine sand. Between depths of 26 and 50 inches, the lower layer of the subsoil is mottled, brown to dark-brown, loose fine or medium sand.

Croghan soils have a seasonal high water table at a depth of 18 to 24 inches. Root growth is limited mainly to the upper 2 to 3 feet of soil. Available water capacity is low to moderate. Croghan soils are strongly acid or very strongly acid, and are low or very low in plant nutrients. Crops, however, respond well to fertilization, especially if irrigated. Water intake is rapid. Croghan soils are suited to intensive truck crop farming if adequate liming, fertilizing, and irrigation are used. Seasonal wetness and sandy texture are the main limitations for most nonfarm uses.

Representative profile of Croghan loamy fine sand, 0 to 6 percent slopes, in an idle field in the town of Lysander, 60 feet south of Kellogg Road, 1,750 feet east of Smokey Hollow Road:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) loamy fine sand; weak, medium and fine, granular structure; very friable moist; common fine roots; strongly acid; abrupt, smooth boundary.

A2—9 to 11 inches, brown (7.5YR 5/2) fine sand; single grained; loose moist; few fine roots; strongly acid; abrupt, wavy boundary.

B21h—11 to 14 inches, dark reddish-brown (5YR 3/3) loamy fine sand; weak, medium and fine, granular structure; very friable moist; few fine roots; strongly acid; abrupt, wavy boundary.

B22ir—14 to 26 inches, dark-brown (7.5YR 3/2) fine sand or loamy fine sand, few, medium, distinct yellowish-red, strong-brown, and dark reddish-brown mottles; single grained; loose moist; few, fine to coarse, reddish-brown (2.5YR 3/4) iron nodules; few fine roots; strongly acid; clear, wavy boundary.

B23—26 to 50 inches, brown to dark-brown (7.5YR 4/2) fine or medium sand that has common, fine to coarse, distinct yellowish-red (5YR 5/6) and strong-brown (7.5YR 5/8) mottles; single grained; loose moist; strongly acid.

The solum ranges from 28 to 60 inches in thickness. Depth to contrasting material is more than 40 inches. The solum ranges from loamy fine sand to medium sand, and is dominantly loamy fine sand and fine sand. The solum generally is free of coarse fragments, but as much as 5 percent gravel is present in places. The solum is strongly acid or very strongly acid.

In undisturbed areas the A1 horizon ranges from black to dark gray and the A2 horizon ranges from brown (7.5YR 5/2) to white (10YR 8/1).

The Bh horizon, where present, and the Bir horizon range from very dusky red (2.5YR 2/2) to yellowish brown (10YR 5/8), reddish yellow (5YR 6/8), and yellowish red (5YR 5/8).

The C horizon is gray (10YR 5/1) to grayish-brown (2.5Y 5/2) fine sand or sand. Reaction is strongly acid to very strongly acid in the upper part of the C horizon and commonly decreases with increasing depth.

Croghan soils are closely associated with the well-drained to excessively drained Colonie soils and the somewhat poorly drained and poorly drained Naumburg soils. All formed in similar material.

The annual temperature of Croghan soils in Onondaga County is a few degrees warmer and the A2 horizon is slightly darker than defined in the range for the series, but this difference does not alter their usefulness or behavior.

Croghan loamy fine sand, 0 to 6 percent slopes (CrB).—This soil is mostly level or nearly level, but in a few areas that are mainly on the sides of shallow drainageways it is gently sloping. Most areas of this soil are larger than 10 acres.

Included with this soil in mapping are small areas of wetter Naumburg soils in drainageways or in shallow depressions. Also included are small areas of Colonie soils on small convex knolls.

This soil is used for crops, pasture, and trees. Crops need lime, intensive fertilization, and irrigation for best response. Pastures generally are poor and are burned out by midsummer. Plant cover on the many idle areas generally is thin, consisting of poverty grass, bracken, dewberries, and blueberries. Soil blowing is a hazard if the surface is left unprotected. Capability unit IIIs–2; woodland suitability group 4s1.

Darien Series

The Darien series consists of deep, somewhat poorly drained, medium-textured soils that have a moderately alkaline glacial till derived mainly from dark-gray shale and lesser amounts of limestone. They are on uplands.

In a representative profile in a cultivated area, the surface layer is very dark grayish-brown silt loam 9 inches thick. Between depths of 9 and 16 inches, the upper part of subsoil is mottled, dark grayish-brown gravelly silt loam to loam. Between depths of 16 and 30 inches, the lower part of the subsoil is firm, mottled, dark grayish-brown gravelly silty clay loam. Between depths of 30 and 60 inches is a firm, calcar-

eous substratum that is mottled, dark grayish-brown very gravelly silty clay loam.

Darien soils have a seasonal high water table at a depth of 6 to 12 inches. It is perched on the slowly permeable or very slowly permeable subsoil and substratum. Rooting depth is limited by the water table mainly to the upper 24 inches during most of the growing season. Available water capacity in this zone is moderate to high. Inherent capacity of these soils to supply phosphorus generally is medium, and to supply potassium, high. The supply of nitrogen generally is high, but it is released slowly when the soils are cold and wet. In unlimed areas reaction in the surface layer is strongly acid to neutral. Seasonal wetness is the main limitation of farming. Seasonal wetness and slow permeability or very slow permeability are the major limitations for many nonfarm uses.

Representative profile of Darien silt loam from an area of Angola-Darien silt loams, 0 to 6 percent slopes, in a cultivated field in the town of Otisco, 50 feet east of Case Road, 1,600 feet north of Cook Road:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine, subangular blocky structure; friable, slightly sticky; many roots; 10 percent shale and stone fragments; neutral; abrupt, wavy boundary.

B&A—9 to 16 inches, dark grayish-brown (2.5Y 4/2) gravelly silt loam to gravelly loam; common, fine, distinct light-gray, light olive-brown, and yellowish-brown mottles; moderate, medium and coarse, subangular bocky structure that has grayish-brown (2.5Y 5/2) silt loam exteriors as much as 1/4 inch thick; friable, slightly sticky; 20 percent shale and stone fragments; common roots; many fine and medium pores; thin patchy clay linings in larger pores; neutral; clear, wavy boundary.

B2t—16 to 30 inches, dark grayish-brown (2.5Y 4/2) gravelly silty clay loam; many, fine and medium, distinct yellowish-brown and light olive-brown and common, medium, faint light-gray mottles; moderate, medium and coarse, subangular and angular blocky structure; firm, slightly sticky and plastic; 25 percent shale and stone fragments; few roots; continuous gray (5Y 5/1) clay films on ped faces; many fine and medium pores, few large pores; continuous clay linings in larger pores; neutral; gradual, wavy boundary.

C—30 to 60 inches, dark grayish-brown (2.5Y 4/2) very gravelly silty clay loam; many, fine and medium, distinct light olive-brown and light-gray and few, fine, distinct dark yellowish-brown mottles that decrease in size and number with increasing depth; moderate, medium and thick, platy structure; firm, slightly sticky; 40 percent stone and shale fragments; few fine roots in upper part; common fine and medium pores; few large pores; moderately alkaline (calcareous).

The solum ranges from 30 to 40 inches in thickness. Depth to calcareous material ranges from 24 to 40 inches. Depth to shale bedrock generally is 40 to 96 inches, but it is more than 120 inches in places.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) to grayish brown (2.5Y 5/2) in color. In unlimed areas reaction in the A horizon ranges from strongly acid to neutral. The A2 horizon, where present, ranges from grayish brown (10YR 5/2) to olive gray (5Y 5/2) in color. It is silt loam to light clay loam that contains 5 to 30 percent coarse fragments. The A2 horizon extends into the upper part of the B2t horizon as thin fingers or silty films along the block faces to a depth of 12 to 20 inches.

The B2t horizon ranges from dark grayish brown (10YR 4/2) to dark olive gray (5Y 3/2) in color and has common to many light-gray, olive-brown, and yellowish-brown mottles. The B2 horizon ranges from silty clay loam to clay loam and is 5 to 30 percent coarse fragments. Reaction in the B2 horizon ranges from medium acid to mildly alkaline, and thickness ranges from 10 to 30 inches.

The C horizon ranges from dark grayish brown (10YR 4/2) to dark olive gray (5Y 3/2) in color and from heavy loam to very gravelly silty clay loam in texture. It is 5 to 60 percent coarse fragments. Reaction in the C horizon ranges from neutral to moderately alkaline and calcareous. Fifty percent or more of the coarse fragments in the solum and the C horizon are fragments of shale.

Darien soils are closely associated with the moderately well drained Aurora soils, the somewhat poorly drained, moderately deep Angola soils, and the poorly drained Lyons soils. All formed in similar material.

Darien silt loam (Da).—This level or nearly level soil is on low landforms which receive prolonged seepage or runoff from adjacent higher lying soils. Individual areas are irregular in shape and generally are smaller than 20 acres in size. Only a few areas are larger than 40 acres.

This soil has a profile similar to the one described as representative of the series, but it has a slightly darker surface layer and higher organic-matter content.

Included with this soil in mapping are small areas of poorly drained Lyons soils in shallow depressions and along narrow drainageways. These wetter soils make up as much as 15 percent of some areas, and they delay tillage in spring unless they are drained. Also included are small areas of moderately well drained Cazenovia and Lima soils on slight rises of knolls. These better drained soils make up as much as 10 percent of some areas, but have little significance on use and management.

This soil is suited to cultivated crops, hay, pasture, and trees. Undrained areas are better suited to short-season annual crops, or to hay crops and legumes that can tolerate wetness, than to most other uses. This soil needs drainage for most crops and, if adequately drained, is well suited to many crops commonly grown in the county. It is particularly well suited to annual row crops. Adequate drainage generally is difficult to establish because of the slowly permeable or very slowly permeable subsoil and substratum. The soil clods readily if plowed when too wet, so a cropping system that maintains good soil structure and a high organic-matter content is needed. Capability unit IIIw–2; woodland suitability group 3w1.

Dunkirk Series

The Dunkirk series consists of deep, well-drained, medium-textured soils that formed in glacial lake deposits of silt and very fine sand moderate in content of clay. These soils are on lake plains.

In a representative profile the surface layer is dark-brown silt loam 5 inches thick. Between depths of 5 and 16 inches are leached subsurface layers of very friable and friable, yellowish-brown and brown silt loam. Between depths of 16 and 36 inches, the subsoil is firm, brown heavy silt loam. Between depths of 36 and 40 inches, the substratum is firm, brown heavy silt loam that has thin layers of very fine sand and silt. Below this, and extending to a depth of 72 inches, the substratum is firm layers of dark grayish-brown and grayish-brown silt and pale-brown very fine sand.

In Dunkirk soils the water table generally is several feet below the surface, but in places it is perched on the slowly permeable or moderately slowly permeable subsoil and substratum at a depth of 24 inches for short periods. Root growth is generally confined to the upper 30 to 40 inches of soil. Available water capacity in this zone is high. The capacity of these soils to supply phosphorus, potassium, and nitrogen is generally medium. In unlimed areas reaction in the surface layer is strongly acid to neutral. The hazard of erosion of these soils is the principal limitation to farming. The hazard of erosion and poor stability are the major limitations for many nonfarm uses.

Representative profile of Dunkirk silt loam, rolling, in a formerly cultivated, idle field in the town of Clay, 70 feet east of Gaskin Road, 1,800 feet south of the intersection of Gaskin Road and State Route 57, 3,800 feet north of State Route 31, under a powerline:

Ap—0 to 5 inches, dark-brown (10YR 4/3) silt loam, light gray (10YR 7/2) dry; moderate, medium, granular structure; very friable; many fine roots; medium acid; abrupt, smooth boundary.

A1—5 to 11 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, platy structure; very friable; silt flow in old root channels; many fine roots; strongly acid; gradual, wavy boundary.

A22—11 to 16 inches, brown (10YR 5/3) silt loam; very weak, medium, subangular blocky structure; friable; common fine roots; many irregularly shaped pores; strongly acid; clear, wavy boundary.

B2t—21 to 36 inches, brown (10YR 4/3) heavy silt loam; weak, medium, subangular blocky structure; firm; few fine roots; common pores; pale-brown (10YR 6/3) silt and very fine sand coats, 1 to 2 millimeters thick, on ped faces; patchy clay linings in medium and large pores; medium acid; gradual, wavy boundary.

B2t—21 to 36 inches, brown (10YR 4/3) heavy silt loam; moderate, medium and coarse, subangular and angular blocky structure; firm, slightly sticky; few fine roots; common pores; clay linings in larger pores; patchy clay films on ped faces; scattered, pale-brown, very fine sand grains on ped faces; medium acid; gradual, wavy boundary.

C1—36 to 40 inches, brown (10YR 4/3) heavy silt loam that has thin bands of very fine sand and silt; firm; few roots; neutral; clear, wavy boundary.

C2—40 to 72 inches, dark grayish-brown (10YR 4/2) layers of silt that have thin pale-brown (10YR 6/3) very fine sand and grayish-brown (10YR 5/2) coarse silt bands; neutral at a depth of 48 inches, calcareous at a depth of 60 inches.

The solum ranges from 20 to 45 inches in thickness. Depth to calcareous material ranges from 20 to 72 inches. Depth to bedrock is more than 40 inches and generally is more than 10 feet.

The Ap horizon ranges from very dark grayish brown to dark brown, brown, and grayish brown and has hues of 10YR and 7.5YR. In undisturbed areas the A1 horizon is 3 to 5 inches thick and one unit of value darker. The Ap and A1 horizons are mainly silt loam, but they range from very fine sandy loam to light silty clay loam in texture. The A2 horizon has hues of 7.5YR to 2.5Y, values of 5 to 6, and chromas of 2 to 4. The A2 horizon is mainly silt loam but ranges to fine sandy loam. Reaction in the A horizon ranges from strongly acid to neutral.

The B horizon has hues of 5YR to 2.5Y, but is dominantly 7.5YR to 10YR. It has values of 4 and chromas of 2 to 4, and has faint mottles in places. The B horizon ranges from heavy silt loam to light silty clay loam above a depth of 40 inches, but it contains thin silty clay layers in places. Reaction in the B horizon ranges from medium acid to mildly alkaline, and the horizon is calcareous in the lowest 2 to 3 inches in places.

The C horizon is stratified silt and very fine sand and contains thin bands of clay in places. Reaction in the C horizon ranges from medium acid to moderately alkaline (calcareous) above a depth of 6 feet and is moderately alkaline (calcareous) below.

Dunkirk soils are closely associated with the moderately well drained Collamer soils and the somewhat poorly drained Niagara soils. All formed in similar material.

Dunkirk silt loam, rolling (DuC).—This soil is mainly on lake plains. Slopes are short and complex and generally range from 6 to 12 percent, but range to as much as 20 percent in places. Individual areas are irregular in shape and generally are smaller than 10 acres.

Included with this soil in mapping are fairly extensive areas of Dunkirk soils that are eroded or severely eroded. These soils differ from that described as representative of the series in that the subsurface layer is thinner or is lacking, and in places the heavier textured subsoil is mixed into the plow layer. Also, the surface layer is generally lighter colored and lower in organic-matter content. Also included are small areas of Collamer soils along drainageways and in depressions. These wetter soils make up as much as 15 percent of some areas and delay tillage in places. Other inclusions are areas of sandier Arkport soils and more clayey Schoharie soils.

This soil is suited to crops, pasture, and trees. The hazard of erosion is very severe if it is left without protective cover. Because of the hazard of erosion and the short, complex slopes, which preclude the use of the contour measures for erosion control, cropped areas of this soil are better suited to hay and pasture than to most other uses. Capability unit IVe–9; woodland suitability group 2rl.

Edwards Series

The Edwards series consists of soils that have 16 to 50 inches of well-decomposed organic material over highly calcareous marl. These soils are very poorly drained and are in bogs.

In a representative profile the surface layer is black muck 8 inches thick. Between depths of 8 and 24 inches is a layer of dark reddish-brown, friable muck. Between depths of 24 and 132 inches, the substratum is white and light-gray, friable silty marl. The lower part of the substratum is slightly sticky, olive-gray silt that extends to a depth of 140 inches or more.

Edwards soils, unless drained, have a water table that is at or near the surface for long periods. Water ponds in places. Rooting depth is variable and is affected by depth to the water table and the marl substratum. Available water capacity is high. The capacity of these soils to supply phosphorus and potassium is generally low to medium. The content of nitrogen is high, but unless these soils are drained, it is slowly available. In unlimed areas reaction in the surface layer is neutral to moderately alkaline. Wetness and thickness of the muck over marl are the principal limitations to farming these soils. They are subject to subsidence and oxidation if drained. Drained and cultivated areas are also subject to soil blowing. Prolonged wetness and the very poor stability of the muck and underlying mineral soil material are the major limitations for most nonfarm uses. The soils are well suited to wetland wildlife habitat.

Representative profile of Edwards muck in an un-

drained forest in the town of Camillus, 900 feet east of Newport Road, 4,500 feet south-southeast of the intersection of Newport Road and Canton Street:

Oa1—0 to 8 inches, black (5YR 2/1) on broken face, rubbed and pressed, muck; about 10 percent fiber undisturbed, 2 percent rubbed; sapric material; strong, coarse, granular structure; friable; many fine roots; about 10 percent mineral content; neutral; gradual, wavy boundary.

Oa2—8 to 24 inches, dark reddish-brown (5YR 2/2) broken, rubbed, and pressed muck; about 30 percent fiber undisturbed, about 3 percent rubbed, sapric material; weak, medium and thick, platy structure; friable, slightly sticky; few fine roots; 10 percent mineral content; neutral; clear, wavy boundary.

IILca1—24 to 45 inches, white (10YR 8/1) silty marl, about 5 percent fiber undisturbed, 2 percent rubbed; common, coarse, distinct pink mottles; massive; friable; very strongly calcarous; gradual, wavy boundary.

IILca2—45 to 132 inches, light-gray (10YR 7/1) silty marl; common, medium, faint pinkish-gray mottles; massive; friable; very strongly calcareous; clear, wavy boundary.

IIIC—132 to 140 inches, olive-gray (5Y 4/2) silt; massive; slightly sticky; strongly calcareous.

The organic material over marl ranges from 16 to 51 inches in thickness. Depth to bedrock is more than 40 inches and generally is more than 10 feet. The organic material ranges from black (N 2/0) to dark reddish brown (5YR 3/2) in color and from granular to massive in structure. Fiber content in undisturbed areas ranges from 0 to 30 percent and, when rubbed, from 0 to 10 percent. The marl substratum ranges from 6 inches to many feet in thickness and from white (N 8/0) to light gray (10YR 7/2) or pink (5YR 8/3) in color. In places it contains many shells and shell fragments and fragments of tufa rock. In places layers of muck are interbedded in the marl or marl is interbedded in the muck. Mineral material other than marl generally is not above a depth of 51 inches, but it is as shallow as 24 inches in thinnest muck over thin marl.

Edwards muck is closely associated with Martisco muck, which has a thinner deposit of muck over the underlying marl. Edwards muck is shallower than Carlisle muck. It is similar to Palms muck in depth or organic material, but Palms muck is underlain with sand, silt, or silty clay instead of marl.

Edwards muck (Ed).—This soil is in some of the depressional bog areas of the county. It is mainly in valleys close to limestone bedrock escarpments and, to a lesser extent, it is on lake plains. Individual areas are roughly oval or long in shape and vary in size from less than 10 acres to more than 100 acres. Included in mapping are small areas of shallower Martisco muck and deeper Carlisle muck.

Most areas of this soil are in trees. A few drained areas are used for vegetable crops or are idle. Some areas that were formerly drained and now abandoned are cattail marshes. Unless this soil is drained, it is not suited to farming. The thickness of the organic material over marl is variable from place to place, and if drainage is intended, onsite investigation is needed. Capability unit IVw–5; woodland suitability group 5w1.

Farmington Series

The Farmington series consists of shallow, well-drained and somewhat excessively drained, medium-textured soils that are medium to low in content of lime. These soils formed in a thin covering of glacial till 10 to 20 inches deep over limestone or hard calcareous shale and fine-grained sandstone bedrock. They are on hilltops and hillsides of bedrock-controlled landforms.

In a representative profile in a meadow, the surface layer is very dark grayish-brown silt loam 8 inches thick. Between depths of 8 and 16 inches is a yellowish-brown to brown, friable, gravelly loam subsoil that rests on hard, gray, calcareous sandstone bedrock.

In Farmington soils the water table generally is at a depth of several feet, but in places it is perched in a 2-inch zone above the bedrock for short periods. Root growth is limited mainly to the 10- to 20-inch zone above the bedrock, although a few roots extend down cracks in the upper 12 inches of the rock. Available water capacity is low to moderate in the moderately permeable soil material above the rock. Plants are damaged by lack of water during most growing seasons, except in the wettest years. Unlimed areas of Farmington soils are strongly acid to slightly acid. The soils are medium to low in content of nitrogen, phosphorus, and potassium; consequently, lime and complete fertilizer are needed for most crops. Bedrock outcrops hinder tillage in places. The shallow depth over bedrock is one of the main limitations for nonfarm uses.

Representative profile of Farmington silt loam from an area of Farmington-Aurora association, sloping, in alfalfa-grass meadow on a nearly level hilltop in the town of Pompey, 100 feet south of U.S. Highway 20, 2,000 feet east of Gulf Road:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam, dark brown (10YR 3/3) rubbed; moderate, fine and medium, granular structure; friable; many roots; 10 percent angular sandstone and shale fragments; neutral; abrupt, smooth boundary.

B2—8 to 16 inches, yellowish-brown (10YR 5/4) gravelly loam, fading with increasing depth to brown (10YR 5/3); weak, fine and medium, subangular blocky structure; friable, nonsticky; many roots; many fine and medium pores; common earthworm channels; 15 percent angular stone fragments; slightly acid; abrupt, smooth boundary.

R—16 inches, calcareous, fine-grained gray sandstone bedrock that has thin vertical cracks 1 to 4 feet apart. Horizontal beds are 1 to 4 inches thick. Some roots extend 12 inches deep into vertical cracks.

Thickness of the solum ranges from 10 to 20 inches and corresponds with the depth to bedrock. The bedrock generally is hard calcareous shale and sandstone. The solum is silt loam or loam. Content of coarse fragments in the solum ranges from 5 to 35 percent.

In unlimed areas reaction in the A horizon ranges from strongly acid to slightly acid. The Ap horizon ranges from very dark grayish brown to grayish brown in color. In undisturbed areas the A1 horizon generally is black to very dark grayish brown.

The B horizon ranges from strong brown to olive brown, and in places contains some high-chroma mottles in the lower 2 inches above the rock. Reaction in the B horizon is medium acid to neutral.

Farmington soils are mapped only with soils of the Aurora series and Rock outcrop. They are shallower and better drained than Aurora soils. They are similar to Benson and Arnot soils, but are more acid than Benson soils and contain fewer coarse fragments than Arnot soils.

Farmington-Aurora association, sloping (FAC).—The soils in this association are on flat-topped hills and are gently sloping to moderately steep on upper parts of hillsides of bedrock-controlled landforms. The areas are on uplands at elevations between 1,000 and 1,600 feet. Outcrops of gray calcareous sandstone and

hard shale bedrock are common, especially on the side slopes. Individual areas are irregular in shape and range from 0 to 25 percent.

About 50 percent of the association is Farmington soils, and about 30 percent is Aurora soils. Minor soils and Rock outcrop make up the other 20 percent.

Depth to bedrock is fairly uniform on the level or nearly level hilltops, but is erratic on the gently sloping to moderately steep hillsides. The few to common bedrock outcrops are mainly on the hillsides, and in places these are nearly vertical rock escarpments that range from 1 to 3 feet thick.

Minor soils in this association are the deep, well-drained Honeoye and Lansing soils, and the deep, moderately well drained Lima and Conesus soils, and the deep, moderately well drained Lima and Conesus soils in pockets where the depth to bedrock is more than 40 inches. These deep soils are mainly gently sloping to moderately steep on side slopes where the depth to rock is variable. The other minor soil is the nearly level, moderately deep, somewhat poorly drained Angola soil which is in shallow depressions on the broad hilltops or in seep spots on the side slopes.

Much of the acreage of this association has been cleared and is used for crops and pasture. Many of these cleared areas, however, are abandoned, and are idle and slowly reverting to brush and forest. Some of the areas are reforested in evergreen trees. Some of the broad, nearly level areas are still being cropped or are in low-quality pasture. Suitability for crops is generally poor because of the shallow, droughty soil conditions. Farmington soil in capability unit IVe–4 and woodland suitability group 5d1; Aurora soils in capability unit IIIe–6 and woodland suitability group 2o1.

Fluvaquents, Frequently Flooded

Fluvaquents, frequently flooded (FL), popularly termed Alluvial land, consist of alluvial soils and recent deposits of alluvial soil materials. Most areas are on narrow flooded plains and alluvial fans of secondary streams throughout the county. Slopes range from 0 to 8 percent. The more sloping areas generally are on fans issuing from high-gradient streams.

In natural drainage the soil material ranges from well drained to very poorly drained over short distances. This material is dominantly silt loam or sandy loam. It is gravel in places, but in some places there are areas of riverwash where the material ranges in size from sand and gravel to boulders. Bedrock is generally at a depth of several feet, but in places it is at a depth of 1 foot. Reaction ranges from medium acid to moderately alkaline.

Areas are frequently flooded and are poorly suited to farming. Some cleared areas are used for pasture, and others are reverting to brush and weeds. Many areas have a cover of water-tolerant trees and shrubs. Flooding and the variable soil properties are severe limitations for most nonfarm uses. Capability unit Vw–2; not assigned to a woodland suitability group.

Fonda Series

The Fonda series consists of deep, very poorly drained, moderately fine textured soils that formed in lake sediment free of coarse fragments. These soils are in lower depressions on lake plains.

In a representative profile in a pasture, formerly a cultivated area, the surface layer is very dark gray mucky silty clay loam 9 inches thick. Between depths of 9 and 33 inches, the subsoil is very firm, strongly mottled, pinkish-gray silty clay. Between depths of 33 and 60 inches, the substratum is firm, light-gray, gray, and dark-gray, strongly calcareous silty clay and clay that has thin layers of yellowish-brown sand.

Fonda soils, unless drained, have a seasonal high water table at or near the surface for 8 to 10 months of the year. Water ponds in places. These soils are slowly permeable or very slowly permeable, and adequate drainage is difficult to establish. If drained, the soils are suited to annual row crops, hay, and pasture. Undrained areas are mainly in swamp woods, and cleared areas are in reeds and sedges. In undrained areas root growth is mainly limited to the upper 12 inches of soil. In adequately drained areas, roots extend down cracks to a depth of 24 inches and a few roots extend deeper. Available water capacity is moderate to high in the upper 12 to 24 inches of soil. Most areas of Fonda soils receive runoff from adjacent higher lying soils, so crops seldom are damaged by lack of water, but they frequently are damaged by too much water. The supply of nitrogen is high, but wetness in spring prevents release of nitrogen at that time. The capacity of these soils to supply phosphorus is medium, and to supply potassium, high.

Representative profile of Fonda mucky silty clay loam in a pasture of grasses, sedges, and buttercups in the town of Manlius, 100 feet east of Burdick State Road, 1,200 feet north of Old Erie Canal, approximately 1 mile north of Fayetteville:

Ap1—0 to 4 inches, very dark gray (10YR 3/1) mucky silty clay loam very dark brown (10YR 2/2) crushed; moderate, medium, granular structure; friable, slightly sticky; many fine roots; 15 percent organic matter; neutral; clear, smooth boundary.

Ap2—4 to 9 inches, very dark gray (10YR 3/1) mucky silty clay loam very dark brown (10YR 2/2) crushed; moderate, medium, subangular blocky structure parting to weak, very fine, subangular blocky; friable, slightly sticky; many fine roots; 10 percent organic matter; neutral; abrupt, smooth boundary.

B21g—9 to 24 inches, pinkish-gray (7.5YR 6/2) silty clay; many, coarse, distinct strong-brown (7.5YR 5/6), yellowish-brown (10YR 5/6), and yellowish-red (5YR 4/8) mottles and few gray (5YR 5/1) mottles and streaks; weak, coarse, prismatic structure parting to moderate, medium, blocky; very firm, very plastic; few fine roots; few fine pores; mildly alkaline; gradual, smooth boundary.

B22g—24 to 33 inches, pinkish-gray (7.5YR 6/2) silty clay, grading with increasing depth to pinkish-gray (5YR 6/2); many, coarse, distinct strong-brown (7.5YR 4/6) and light-gray (N 7/0) mottles; weak, coarse, prismatic structure parting to weak, medium, blocky; very firm, very plastic; very few fine roots; few fine pores; mildly alkaline (weakly calcareous); clear, smooth boundary.

Cg—33 to 60 inches, stratified layers of light-gray (N 7/0), gray (5YR 5/1), and dark-gray (5YR 4/1) silty clay and clay; many, coarse, distinct yellowish-brown mottles above a depth of 42 inches and thin layers of yellowish-brown (10YR 5/4) sand below; weak, very

thick, platy structure; firm, plastic; moderately alkaline (strongly calcareous).

Thickness of the solum and depth to carbonates range from 24 to 44 inches. Depth to bedrock is more than 40 inches.

The Ap and A1 horizons range from black to dark gray or dark brown in color and contain 10 to 25 percent organic matter. In places a thin gray A2 horizon is present. Texture in the A horizon ranges from silt loam to silty clay loam, and reaction ranges from slightly acid to neutral.

The Bg horizon has hues of 5YR to 2.5Y, values of 3 to 6, and chromas of 0 to 2, with or without high-chroma mottles. Texture in the Bg horizon ranges from heavy silty clay loam to clay. Clay films are either lacking or they are few, thin, and patchy on vertical ped faces. Reaction in the Bg horizon ranges from slightly acid to mildly alkaline, and in places it is moderately alkaline (weakly calcareous) in the lower part.

The C horizon is stratified silty clay and clay, but it contains silt and sand layers below depths of 36 inches in places. The C horizon is generally moderately alkaline (calcareous), but ranges to neutral in the upper part in places.

Fonda soils are closely associated with the somewhat poorly drained Rhinebeck soils and the poorly drained Lakemont soils. All formed in similar material.

Fonda mucky silty clay loam (Fo).—This level or nearly level soil is in depressions on the lake plains. Many areas are larger than 10 acres. Included in mapping are small areas of Rhinebeck and Lakemont soils on slight rises and knolls and small areas of Palms muck in the lowest depressions.

Undrained areas of this soil are mainly forested, and cleared areas are in sedges and reeds. Partly drained areas are used for pasture, but many areas are idle. The few intensively drained areas generally are adjacent to drained muck land and are used for annual row crops. Maintenance of the high organic-matter content in the surface layer to insure good tilth is important in these intensively drained areas. Capability unit IVw-2; woodland suitability group 5w1.

Fredon Series

The Fredon series consists of deep, somewhat poorly drained or poorly drained, medium-textured soils. These soils formed in glacial outwash deposits derived mainly from shale, sandstone, and moderate to high amounts of limestone. They are in depressions and low areas of glacial outwash terraces where runoff and internal drainage are slow.

In a representative profile the surface layer is dark grayish-brown loam that contains some gravel and is 8 inches thick. Between depths of 8 and 20 inches, the upper part of the subsoil is mottled, grayish-brown sandy loam that is friable and contains some gravel. Between depths of 20 and 27 inches, the lower part of the subsoil is mottled, dark grayish-brown, friable gravelly sandy loam. Between depths of 27 and 34 inches is a weakly calcareous substratum that is mottled, grayish-brown, slightly firm very gravelly loam. Between depths of 34 and 50 inches is gray, loose very gravelly loamy sand that is weakly stratified.

In spring and during wet periods, Fredon soils have a seasonal high water table at a depth of 6 to 12 inches. In drier periods it recedes quickly through the moderately rapidly permeable to rapidly permeable substratum. Rooting depth is strongly influenced by the water table. Unless the soil is drained, rooting is confined mainly to the upper 12 inches of soil in spring. A few roots extend to a depth of 20 inches or more as the season progresses. Available water capacity of the main root zone is moderate, but plants seldom show moisture stress during periods of normal rainfall. Total nitrogen is high, but it is released very slowly in spring. As the soil warms up, the nitrogen becomes more available and is likely to cause lodging in small grains. The capacity of these soils to supply phosphorus and potassium is generally low to medium. In unlimed areas reaction in the surface layer ranges from strongly acid to neutral. Crops respond very well to applications of fertilizer and lime, especially in drained areas. Prolonged seasonal wetness is the main limitation to farming, but if outlets are available, the soils drain readily. Wetness is also a limitation to many nonfarm uses.

Representative profile of Fredon loam in a formerly cultivated pasture in the town of Elbridge, 400 feet west of State Route 368, 1,500 feet south of the Penn Central Railroad at Halfway:

Ap—0 to 8 inches, dark grayish-brown (2.5Y 4/2) loam; weak, coarse, subangular blocky structure parting to weak, medium, granular; friable; many fine roots; 10 percent coarse fragments (gravel); neutral; abrupt, smooth boundary.

B21g—8 to 13 inches, grayish-brown (2.5Y 5/2) sandy loam; many, medium and coarse, distinct light olive-brown (2.5Y 5/6) mottles; weak, coarse, subangular blocky structure; friable, nonsticky; common fine roots; common pores; 10 percent coarse fragments (gravel); neutral; gradual, wavy boundary.

B22g—13 to 20 inches, grayish-brown (2.5Y 5/2) sandy loam; many, medium, distinct light olive-brown (2.5Y 5/6) mottles; weak, medium and coarse, subangular blocky structure; friable, nonsticky; few fine roots; many pores; 10 percent coarse fragments (gravel); neutral; clear, wavy boundary.

B3g—20 to 27 inches, dark grayish-brown (2.5Y 4/2) gravelly sandy loam; slightly heavier than horizon above; common, coarse, distinct light olive-brown (2.5Y 5/6) mottles; weak, medium and coarse, subangular blocky structure; friable, slightly sticky; common coarse pores; 20 percent coarse fragments; neutral; abrupt, wavy boundary.

IIC1—27 to 34 inches, grayish-brown (2.5Y 5/2) very gravelly loam; common, fine, faint light olive-brown (2.5Y 5/6) mottles; massive; slightly firm, slightly sticky; few coarse pores; 40 percent coarse fragments; mildly alkaline (weakly calcareous).

IIIC2—34 to 50 inches, gray (5Y 5/1) very gravelly loamy sand; weakly stratified; loose; 50 percent coarse fragments; moderately alkaline (calcareous).

The solum ranges from 22 to 35 inches in thickness. Depth to bedrock is more than 6 feet. The Ap horizon ranges from very dark gray to dark brown. In undisturbed areas the A1 horizon ranges from black to dark gray and is 3 to 6 inches thick. Content of coarse fragments in the A horizon ranges from 0 to 15 percent. In unlimed areas reaction in the A horizon ranges from strongly acid to neutral.

The B horizon ranges from weak red to pale brown and has hues of 2.5YR to 2.5Y, values of 5 or 6, and chromas of 2 or 3. High-chroma mottles are common to many. The B horizon is sandy loam to loam, less than 18 percent clay, and 5 to 50 percent coarse fragments. Reaction in the B horizon is medium acid to mildly alkaline.

The C horizon is dominantly stratified sand and gravel, but includes layers of very gravelly loam, sandy loam, or loamy sand. Content of gravel in the C horizon ranges from 35 to 75 percent. The C horizon is commonly moderately alkaline (calcareous), but is neutral above a depth of 60 inches in the more acid profiles.

Fredon soils are closely associated with the well-drained to excessively drained Palmyra soils, the moderately well drained Phelps soils, and the very poorly drained Halsey soils. All formed in similar material.

Fredon soils in Onondaga County lack the contrasting

textural layers above a depth of 40 inches that are characteristic of the defined range for the series. Also, depth to carbonates is commonly less. These differences have little or no effect on use and management.

Fredon loam (Fr).—This soil is in low areas or depressions on outwash plains where runoff and internal drainage are slow. Slopes are mainly less than 2 percent, but a few areas have slopes of as much as 4 percent. Most areas of this soil are smaller than 10 acres.

Included with this soil in mapping are small areas of better drained Phelps soils on small knolls. Also included are areas of wetter Halsey soils in shallow depressions.

Undrained areas of this soil are suited to hay, pasture, and trees. Drained areas are well suited to most crops commonly grown in the county, especially annual row crops and vegetables. Capability unit IIIw–3; woodland suitability group 3w1.

Galen Series

The Galen series consists of deep, moderately well drained, medium-textured soils that formed in sandy material deposited in glacial lakes. These soils are on lake plains.

In a representative profile the surface layer is very dark grayish-brown very fine sandy loam 9 inches thick. Between depths of 9 and 15 inches, the upper part of the subsoil is very friable, mottled, yellowish-brown and brown very fine sandy loam. Between depths of 15 and 30 inches, the subsoil is mottled, brown, friable fine sandy loam that has a few 1- to 3-inch bands of slightly heavier and sticky fine sandy loam. Between depths of 30 and 48 inches the lower part of the subsoil is very friable, brown loamy fine sand and grayish-brown fine sand that is mottled and has a few 1/2- to 1 1/2-inch-thick bands of brown fine sandy loam. Between depths of 48 and 60 inches the substratum is prominently mottled, loose, light brownish-gray loamy fine sand and fine sand.

Galen soils have a seasonal high water table that fluctuates to within 15 to 24 inches of the surface in wet periods. It recedes quickly through moderately permeable soil material in dry periods. Rooting depth in Galen soils is mainly in the upper 24 to 30 inches. This zone has moderate to high available water capacity. The capacity of these soils to supply phosphorus and potassium is low to medium, and to supply nitrogen, medium. Lime needs are variable. Slight seasonal wetness is the main limitation to farming. The soils are easy to till, and crops respond very well to good management.

Representative profile of Galen very fine sandy loam, 2 to 6 percent slopes, in an idle field in the town of Lysander, 500 feet southwest of Emerick Road, 4,600 feet north of State Route 370, 500 feet south of the powerline:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) very fine sandy loam, dark-brown (10YR 3/3) crushed; moderate, medium, granular structure; very friable; many fine and medium roots; slightly acid; abrupt, smooth boundary.

B1—9 to 15 inches, yellowish-brown (10YR 5/4) very fine sandy loam that fades to brown (10YR 5/3) with increasing depth; few, fine, faint yellowish-brown mottles; weak, medium, subangular blocky structure; very friable; common fine roots; common fine pores; slightly acid; clear, wavy boundary.

A'21&Bt—15 to 30 inches, brown (10YR 5/3) fine sandy loam; common, medium, distinct brown and strong-brown mottles; 3 lamellae, 1 to 3 inches thick, totaling 6 inches of brown (7.5YR 5/4) slightly heavy fine sandy loam that has distinct clay bridging between sand grains; weak, fine, subangular blocky structure; lamellae are massive; friable, slightly sticky; few fine roots; common fine and medium pores; patchy clay linings in larger pores in lamellae; neutral; clear, wavy boundary.

A'22&Bt—30 to 48 inches, brown (10YR 5/3) loamy fine sand that fades with increasing depth to grayish-brown (10YR 5/2) fine sand; common, medium, distinct yellowish-brown and strong-brown mottles, and few, fine, distinct grayish-brown mottles between lamellae; massive; very friable; brown (7.5YR 5/4) fine sandy loam lamellae, 1/2 inch to 1 1/2 inches thick, aggregating 4 inches in thickness; common fine pores; lamellae have clay bridges and common fine pores that have thin patchy clay linings; very few fine roots; neutral; clear, wavy boundary.

C—48 to 60 inches, light brownish-gray (10YR 6/2) loamy fine sand and fine sand; common, medium, prominent yellowish-brown and strong-brown mottles, weakly stratified with thin bands of light olive-brown (2.5Y 5/4) silt; single grained; loose; neutral.

The solum ranges from 40 to 60 inches in thickness. Depth to carbonates ranges from 48 to 84 inches. Depth to bedrock is more than 40 inches and generally is more than 10 feet. The solum generally is free of coarse fragments, but it is as much as 5 percent gravel in places.

The Ap and A1 horizons range from very dark grayish brown to grayish brown and dark brown in hues of 7.5YR to 2.5Y. The A2 horizon ranges from reddish brown to brownish yellow in hues of 5YR to 10YR with values of 4 to 6 and chromas of 3 to 6, and contain few to common mottles that have chromas higher than 2. Texture of the A horizon ranges from loamy fine sand to very fine sandy loam. In unlimed areas reaction in the A horizon ranges from strongly acid to neutral.

The B ranges from reddish brown to olive yellow in hues of 5YR to 2.5Y with values of 4 to 6 and chromas of 3 to 6, and has lamellae and small masses of slightly heavy material that is one hue, chroma, and value redder or darker than the main material. Texture of the material between the lamellae ranges from loamy fine sand to very fine sandy loam without clay bridges. The lamellae and heavier masses range from sticky fine sandy loam to very fine sandy loam with distinct clay bridges between sand grains, and lamellae and masses aggregate more than 6 inches in thickness to a depth of 40 inches. In places thin bands of silt and clay are present, but they aggregate less than 6 inches in thickness to a depth of 40 inches. Reaction in the B horizon ranges from medium acid to mildly alkaline.

The C horizon generally is stratified fine and very fine sand or loamy fine or very fine sand, but it contains bands of silt and clay in places. In places it is stratified gravel and sand. Reaction in the C horizon ranges from neutral to moderately alkaline (calcareous) below a depth of 48 inches.

Galen soils are closely associated with the well-drained Arkport soils, the somewhat poorly drained Minoa soils, and the poorly drained and very poorly drained Lamson soils. All formed in similar material.

Galen very fine sandy loam, 0 to 2 percent slopes (GaA).—This level or nearly level soil is in low areas on the lake plains where some runoff accumulates or in flat areas from which runoff is somewhat slow. Individual areas are irregular in shape and generally smaller than 10 acres.

This soil has a profile similar to the one described as representative of the series, but in most places the surface layer is slightly darker.

Included with this soil in mapping are small spots of wetter Minoa soils in depressions. They make up as much as 20 percent of some mapped areas, and they

delay tillage unless drained. Also included are areas where as much as 12 inches of loam and silt loam have accumulated on the surface as a result of the erosion of adjacent higher lying soils.

This soil is well suited to cultivated crops, annual row crops, vegetables, hay, pasture, and trees. Slight seasonal wetness occasionally delays planting briefly. Water erosion is not a problem, but some areas are subject to soil blowing if left exposed. Capability unit IIw–1; woodland suitability group 2o1.

Galen very fine sandy loam, 2 to 6 percent slopes (GaB).—This gently sloping soil is mainly on the foot slopes of undulating areas in the lake plains where some runoff accumulates. Individual areas are irregular in shape and generally smaller than 10 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of wetter Minoa soils along drainageways and in depressions that delay tillage unless drained. Also included are areas of well-drained Arkport soils on knolls.

This soil is suited to cultivated crops, hay, pasture, and trees. It is well suited to row crops and vegetables. Slight seasonal wetness occasionally delays planting briefly. Water erosion and soil blowing are hazards if this soil is cultivated and left unprotected. The soil is well suited to land smoothing in order to provide uniform slopes. Capability unit IIe–5; woodland suitability group 2o1.

Halsey Series

The Halsey series consists of deep, very poorly drained, medium-textured soils that formed in widely varying amounts of water-sorted deposits mainly of silt, sand, and gravel. These soils are in depressions on glacial outwash plains that have a prolonged seasonal high water table.

In a representative profile in an uncultivated area, the surface layer is black mucky loam 7 inches thick. Between depths of 7 and 20 inches is a mottled, gray, very friable, fine sandy loam subsurface layer that is about 10 percent gravel. Between depths of 20 and 27 inches, the subsoil is mottled, gray, friable gravelly loam. Between depths of 27 and 50 inches, the substratum is weakly stratified, calcareous, gray, loose gravel and sand.

Halsey soils have free water on or near the surface for 8 to 10 months of the year unless they are drained. Root growth in these soils is limited mainly to the upper 12 inches by waterlogging. The Halsey soils are moderately permeable. Most areas are forested or used for pasture. Only a few areas are sufficiently drained to be used for crops. Crops in drained areas respond very well to good management and fertilization. Root growth of crops in drained soils is limited mainly to the upper 18 to 24 inches. This zone has a moderate available water capacity. Halsey soils receive seepage and runoff from adjacent higher lying soils, so crops are seldom damaged by lack of water. The supply of nitrogen is high, and the capacity of these soils to supply phosphorus and potassium is low to medium.

Representative profile of Halsey mucky loam, in a pastured woodlot of northern white-cedar in the town of Elbridge, 600 feet west of State Route 368, 1,400 feet south of Halfway and the Penn Central Railroad:

A1—0 to 7 inches, black (10YR 2/1) mucky loam; weak, medium, granular structure; friable; many fine roots; 10 percent gravel; slightly acid; clear, wavy boundary.

A2g—7 to 20 inches, gray (10YR 6/1) fine sandy loam; few, fine yellowish-brown and dark yellowish-brown mottles; weak, fine and medium, subangular blocky structure; very friable; few fine roots; common fine and medium pores; 10 percent gravel; neutral; clear, wavy boundary.

IIB2g—20 to 27 inches, gray (10YR 5/1) gravelly loam; common, coarse, distinct yellowish-brown mottles; weak, medium, subangular blocky structure; friable; few fine roots; common medium and coarse pores; 20 percent gravel; neutral.

IIIC—27 to 50 inches, gray (5Y 5/1), weakly stratified very gravelly sand; single grained; loose; 40 percent gravel; calcareous.

The solum ranges from 20 to 36 inches in thickness. Depth to free carbonates ranges from 18 to 48 inches. Depth to bedrock generally is more than 180 feet.

The A1 and Ap horizons range from black to very dark gray or very dark brown and are high in organic-matter content. Content of coarse fragments ranges from 0 to 20 percent in the A horizon. Reaction in the A horizons ranges from medium acid to neutral. The A2 horizon has hues of 5YR to 2.5Y, values of 4 to 6, and chromas of 0 to 2 with few to common high-chroma mottles. The A horizons are sandy loam, loam, or silt loam.

The B horizon has hues of 5YR to 2.5Y, values of 4 to 6, and chromas of 0 to 2. High-chroma mottles are few to many. The B horizon is sandy loam to silt loam that is 5 to 35 percent coarse fragments, but some subhorizons are as much as 50 percent coarse fragments. Reaction in the B horizon ranges from slightly acid to mildly alkaline.

The C horizon is weakly stratified sand and gravel that is moderately alkaline (calcareous), but it is neutral in places in the upper part of more acid profiles. Content of gravel in the C horizon ranges from 35 to 75 percent.

Halsey soils are closely associated with the well-drained to excessively drained Palmyra soils, the moderately well drained Phelps soils, and the somewhat poorly drained and poorly drained Fredon soils. All formed in similar material.

Halsey soils in Onondaga County commonly have carbonates at shallower depths than defined in the range for the series, but this difference does not alter their usefulness or behavior.

Halsey mucky loam (Ha).—This soil is in depressions on outwash plains. Slopes are mainly less than 2 percent.

Included with this soil in mapping are small areas of Palms muck and Martisco muck in the lowest depressions and areas of better drained Fredon soils on slight knolls. Also included are a few areas that are subject to a nearly permanent seepage where slopes range from 2 to 8 percent.

Most of the acreage of this soil is in trees, but some is used for dry-weather pasture. Prolonged wetness is the main limitation to farming on this soil. A few small, drained areas are used for crops. Capability unit IVw–3; woodland suitability group 5w1.

Hamlin Series

The Hamlin series consists of deep, well-drained, medium-textured soils that formed in recent deposits of alluvium on flood plains. These soils are mainly along flood plains of the larger streams.

In a representative profile the surface layer is very dark grayish-brown silt loam 9 inches thick. Between depths of 9 and 16 inches, the upper part of the subsoil is friable silt loam that is very dark grayish

brown. Between depths of 16 and 41 inches the lower part of the subsoil is dark yellowish-brown silt loam. Between depths of 41 and 60 inches, the substratum is friable, dark grayish-brown silt loam that is distinctly mottled and weakly stratified.

Hamlin soils are subject to flooding, but they flood rarely in the growing season. Except when flooded, the seasonal high water table is at a depth of 24 inches or more. Its depth is influenced by the water level of adjacent streams. Rooting depth in Hamlin soils is mainly in the upper 40 inches. Available water capacity in this zone is high. Hamlin soils are moderately permeable. The capacity of these soils to supply phosphorus and potassium is generally medium. The supply of nitrogen is high to medium depending on the frequency of flooding. In unlimed areas reaction in the surface layer is slightly acid to neutral. There are few limitations to farming on these soils other than infrequent flooding in the growing season. Flooding is also a hazard for many nonfarm uses.

Representative profile of Hamlin silt loam in a cultivated field in the town of Pompey, 75 feet north of Hills Road, 900 feet west of its intersection with Pompey Hollow Road:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam, weak, medium and fine, granular structure; friable; many roots; many pores; neutral; clear, smooth boundary.

B21—9 to 16 inches, very dark grayish-brown (10YR 3/2) silt loam, dark brown (10YR 3/3) rubbed; weak, medium and coarse, prismatic structure parting to weak, fine, subangular blocky; friable; common roots; common pores that have patchy clay linings; neutral; clear, smooth boundary.

B22—16 to 41 inches, dark yellowish-brown (10YR 3/4) silt loam; moderate, coarse, prismatic structure parting to weak, fine and medium, subangular blocky; prism faces are dark brown (10YR 3/3); friable; common roots in upper part grading to few with increasing depth; many pores; patchy clay lining in medium pores, nearly continuous clay linings in large pores; neutral; gradual, smooth boundary.

C—41 to 60 inches, dark grayish-brown (10YR 4/2) silt loam; common, medium, distinct brown and yellowish-brown mottles, weakly stratified with inherited weak, thick and very thick, platy structure; friable; very few fine roots; many pores; patchy clay linings in larger pores; neutral.

The solum ranges from 24 to 42 inches in thickness. Depth to carbonates, to strongly contrasting material, and to bedrock is more than 40 inches. Coarse fragments are absent or few between a depth of 10 and 40 inches. Reaction is slightly acid to neutral in the upper 20 inches and neutral to mildly alkaline between depths of 20 and 40 inches.

The Ap horizon has hues of 10YR to 7.5YR, values of 3 and 4, and chromas of 1 to 3.

The B horizon has hues of 10YR to 7.5YR, values of 3 to 5, and chromas of 2 to 4. Low values and chromas are inherited from deposition of material high in content of organic matter and are not a result of wetness. The B horizon is fine sandy loam to silt loam. Browner colors in the B horizon are generally associated with soils on the higher bottoms that are less frequently flooded. In places mottles are present below a depth of 24 inches.

The C horizon has hues of 10YR to 5YR, values of 4 and 5, and chroma of 2. The C horizon generally shows evidence of weak stratification. It is mainly silt loam, loam, and fine sandy loam but it includes strata of silty clay in places and, in some places stratified sand and gravel. Reaction in the C horizon ranges from neutral to moderately alkaline (calcareous).

Hamlin soils are closely associated with the moderately well drained to somewhat poorly drained Teel soils and the poorly drained to very poorly drained Wayland soils. All formed in similar material.

Hamlin silt loam (Hb).—This level or nearly level, well-drained soil is on flood plains and is subject to flooding at least once in five years. Also, many areas are subject to annual floods, generally early in spring. This soil is generally next to the main streams where overflow deposits are thickest. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Teel soils in shallow depressions and partly filled abandoned stream channels. Also included are a few small areas of Howard gravelly silt loam on fans, or areas of Herkimer silt loam on small fans where high-gradient side streams enter major valleys.

This soil is well suited to most crops except small grains, which are subject to lodging. In places winter grain is damaged by prolonged floods early in spring. Special measures are needed to prevent streambank cutting in some areas. Gouging of the soil by rapidly flowing floodwater is a hazard in some areas if the surface is left unprotected. Capability unit IIw–2; woodland suitability group 2o2.

Hamlin silt loam, high bottom (Hc).—This level or nearly level, well-drained soil is on second bottoms that are 2 to 4 feet higher than the first bottoms. These higher bottoms are less frequently flooded. They are subject to the higher floods which occur once in every 5 to 20 years. Most areas are on the broader bottom lands and are away from the main stream channel. Areas are mainly irregular in shape, and few areas are larger than 20 acres.

This soil has a profile similar to the one described as representative of the series, but it is lower in content of organic matter and has a lighter colored, brown subsoil.

Included with this soil in mapping are small areas of Teel soils in shallow depressions and in remnants of old, partly filled stream channels. Also included are a few small areas of Howard gravelly silt loam or Herkimer silt loam where small, high-gradient side streams enter major valleys.

This soil is well suited to most crops commonly grown in the county. It is one of the most fertile soils in the county. Crops are seldom damaged by flooding. Streambank cutting is a problem in a few places. Capability unit I–1; woodland suitability group 2o2.

Herkimer Series

The Herkimer series consists of deep, dominantly well-drained, medium-textured soils that formed in outwash material consisting mostly of black and gray shale and some limestone. These soils are on alluvial fans of streams that actively cut through shale bedrock.

In a representative profile the surface layer and upper part of the subsoil consist of 14 inches of very dark gray, friable silt loam that is about 10 percent soft shale fragments. Between depths of 14 and 24 inches, the subsoil is friable, very dark grayish-brown silt loam that is about 10 percent shale fragments. Between depths of 24 and 55 inches, the lower part of the subsoil is very friable, dark-gray shaly loam. Between depths of 55 and 66 inches, the substratum is firm, gray very shaly loam. Between depths of 66 and 72 inches is black very shaly loam that is very friable and weakly calcareous.

Herkimer soils are subject to infrequent flash flooding. They have a seasonal high water table at a depth of 24 inches in places. They are moderately permeable. Rooting depth is limited mainly to the upper 40 inches. Available water capacity of this zone is high. The capacity of these soils to supply phosphorus, potassium, and nitrogen is generally medium. In unlimed areas reaction in the surface layer is medium acid to neutral. Falsh flooding and slight seasonal wetness in places are the principal limitations to farming on these soils, but they also affect many nonfarm uses.

Representative profile of Herkimer silt loam in a cultivated field in the town of De Witt, 25 feet west of Gates Road, 75 feet south of State Route 173:

Ap—0 to 8 inches, very dark gray (10YR 3/1) silt loam; moderate, fine, granular structure; friable; many roots; 10 percent coarse fragments, mainly soft shale; neutral; abrupt, smooth boundary.

B1—8 to 14 inches, very dark gray (10YR 3/1) silt loam; moderate, medium, subangular blocky structure parting to moderate, fine and medium, granular; friable; many roots; common pores; 10 percent soft shale fragments, few stone fragments; neutral; clear, smooth boundary.

B21—14 to 24 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine and medium, subangular blocky structure; friable; common roots; common pores; 10 percent coarse fragments, mainly soft shale; neutral; gradual, wavy boundary.

B22—24 to 55 inches, dark-gray (10YR 4/1) shaly loam; weak, fine and medium, subangular blocky structure; very friable; few roots; common pores that have very few, thin, patchy clay films in larger pores and ped faces; 20 percent shale fragments, few stone fragments; neutral; gradual, wavy boundary.

IIC1—55 to 66 inches, gray (10YR 5/1) very shaly loam, grayish-brown (10YR 5/2) crushed; massive; firm; few roots; few pores that have thin patchy clay films; 40 percent coarse fragments, mainly shale; midly alkaline; clear, smooth boundary.

IIIC2–66 to 72 inches, black (10YR 2/1) very shaly loam; single grained; very friable; 60 percent shale fragments; moderately alkaline (weakly calcareous).

The solum ranges from 40 to 60 inches in thickness. Depth to carbonates ranges from 40 to 72 inches. Depth to bedrock is more than 40 inches.

The Ap and A1 horizons range from black (N 2/0) to very dark grayish brown (10YR 3/2). Coarse fragments in the A horizon range from 5 to 15 percent and are mainly soft shale. Reaction in the A horizon ranges from medium acid to neutral.

The B horizon ranges from black (N 2/0) to dark yellowish brown (10YR 4/4) or olive brown (2.5Y 4/4) and is mainly dark gray (10YR 4/1) to dark grayish brown (2.5Y 4/2) Dark colors are inherited from the dark-gray and black shale. The B horizon is loam to silt loam in places, and has some high-chroma mottles in the lower part. Content of coarse fragments in the B horizon ranges from 10 to 35 percent and is mainly soft shale. Reaction in the B horizon ranges from slightly acid to mildly alkaline.

The C horizon generally is black (N 2/0) to dark-gray (10YR 4/1) very shaly loam, but in places contains nonconforming layers of gray (N 5/0) to grayish-brown (2.5Y 5/2) material below a depth of 40 inches. Content of coarse fragments in the C horizon ranges from 35 to 60 percent. Reaction in the C horizon ranges from neutral to moderately alkaline (calcareous).

Herkimer soils in the survey area have a thicker solum than is defined in the range for the series, but this differences has little effect on use and management.

Herkimer soils are closely associated with the well-drained to excessively drained Palmyra soils and the well-drained and somewhat excessively drained Howard soils. All formed in similar material. They are also near the Hamlin and Teel soils, which formed on bottom lands.

Herkimer silt loam (He).—This mostly nearly level to gently sloping soil is on alluvial fans of streams that cut through shale bedrock formations. Slopes are dominantly between 1 and 10 percent. A few areas have steeper slopes.

Included with this soil in mapping are small areas of soils that have a surface layer of shaly silt loam and loam. Also included in areas bordering streams are areas of Fluvaquents, frequently flooded. Other inclusions along the toe edges of fans are a few small areas of Teel and Hamlin soils on flood plains.

This soil is suited to cultivated crops, hay, pasture, and trees. Most areas are used for crops. Erosion is a hazard on the gently sloping areas, especially on the longer slopes if they are cultivated and not protected. In places streams deposit shaly rubble during flash floods, so some channel maintenance is needed in these areas. Capability unit IIe–2; woodland suitability group 2o1.

Hilton Series

The Hilton series consists of deep, moderately well drained, medium-textured soils that formed in calcareous glacial till derived mainly from sandstone and limestone and some shale. These soils are on uplands from which runoff is somewhat slow or where runoff accumulates to a slight degree.

In a representative profile the surface layer is dark-brown loam about 9 inches thick. Between depths of 9 and 11 inches is a thin, leached subsurface layer of friable, brown loam. Between depths of 11 and 21 inches, the upper part of the subsoil is friable, dark-brown loam arranged in structural blocks. Coatings of pale-brown, loamy, leached material surround these blocks. Between depths of 21 and 45 inches, the lower part of the subsoil is friable, mottled, brown heavy loam. Between depths of 45 and 60 or more inches is a calcareous substratum of firm, mottled, grayish-brown gravelly loam. All layers above the substratum contain about 10 percent gravel.

Hilton soils have a seasonal high water table at a depth of 15 to 24 inches. It is perched on the slowly permeable or very slowly permeable substratum. Rooting depth is mainly in the upper 24 to 36 inches of soil. Available water capacity of this zone is high. The capacity of these soils to supply phosphorus, potassium, and nitrogen is generally medium. In unlimed areas reaction in the surface layer is strongly acid to slightly acid. Slight seasonal wetness is the main limitation to farming these soils. The seasonal high water table and the slowly permeable or very slowly permeable substrata are limitations for many nonfarm uses.

Representative profile of Hilton loam, 0 to 3 percent slopes, in an alfalfa-grass meadow in the town of Clay, 500 feet south of Ver Plank Road, 2,600 feet west of Morgan Road:

Ap—0 to 9 inches, dark-brown (7.5YR 3/2) light loam; moderate, medium granular structure; friable; many roots; many fine pores; 10 percent coarse fragments; slightly acid; abrupt, smooth boundary.

A2—9 to 11 inches, brown (7.5YR 5/4) light loam; light gray (10YR 7/2) dry; weak, medium, subangular blocky structure; friable; common roots; many fine and medium pores; 10 percent coarse fragments; some

large krotovina; slightly acid; clear, wavy boundary.

B&A—11 to 21 inches, dark-brown (7.5YR 4/4) loam; weak, medium, subangular blocky structure; friable; peds surrounded by 1/8- to 1/4-inch films (decreasing to 1/16 inch thick at bottom) of brown (7.5YR 5/4) light loam, white (10YR 8/2) dry, that has few, fine, high-chroma mottles; common fine roots; many fine and medium pores; thin, patchy clay linings in larger pores in ped centers; 10 percent coarse fragments; some large krotovina; neutral; clear, wavy boundary.

B2t—21 to 35 inches, brown (10YR 4/3) heavy loam; many, fine and medium, distinct yellowish-brown and dark yellowish-brown mottles; moderate, coarse, subangular blocky structure; friable, slightly sticky; few fine roots; many fine and medium pores that have clay linings; thin, patchy, dark grayish-brown (10YR 4/2) clay films on ped faces; 10 percent coarse fragments; neutral; clear, smooth boundary.

B3—35 to 45 inches, brown (10YR 4/3) heavy loam; many, medium, faint dark grayish-brown and dark yellowish-brown and few, medium, distinct yellowish-brown mottles; weak, coarse, subangular blocky structure; friable; few fine roots; few fine and medium pores that have clay linings; 10 percent coarse fragments; neutral; gradual, wavy boundary.

C—45 to 60 inches, grayish-brown (10YR 5/2) gravelly loam; few brown and yellowish-brown mottles in upper part; weak, medium and thick, platy structure; firm; few fine and medium pores; 20 percent coarse fragments; moderately alkaline (calcareous).

The solum ranges from 24 to 48 inches in thickness. Depth to carbonates ranges from 20 to 50 inches. Depth to bedrock is more than 40 inches. Content of coarse fragments in the A horizon ranges from 5 to 25 percent and commonly increases with increasing depth to as much as 50 percent in the C horizon in some places.

The Ap horizon ranges in color from dark grayish brown (10YR 3/2) to brown (7.5YR 5/2) and in texture from fine sandy loam to silt loam. In undisturbed areas the A1 horizon ranges in color from very dark gray to brown. The A2 horizon has hues of 10YR to 5YR, values of 4 or 5, and chromas of 3 or 4, and contains some high-chroma mottles in places. The A2 horizon interfingers around peds in the top of the B horizon to a depth of 15 to 24 inches. Texture of the A2 horizon ranges from fine sandy loam to loam. In unlimed areas reaction in the A horizon ranges from strongly acid to slightly acid.

The B horizon has hues of 10YR to 2.5YR, values of 3 to 5, chromas of 3 and 4, and is mottled. Texture of the B horizon ranges from loam to light sandy clay loam. Reaction in the B horizon ranges from medium acid to neutral.

The C horizon is firm or very firm, gray to reddish-brown loam or fine sandy loam that is massive or has weak, platy structure.

Hilton soils are closely associated with the well-drained Ontario or Madrid soils and the somewhat poorly drained Appleton soils. All formed in similar material.

Hilton loam, 0 to 3 percent slopes (HIA).—This level or nearly level soil is mainly on the tops of till plains from which water drains slowly, even though little or no runoff is received from adjacent higher lying soils. Many areas are smaller than 10 acres and only a few areas are larger than 20 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small spots of Appleton soils in shallow depressions that make up as much as 20 percent of some areas. These somewhat poorly drained soils delay tillage in spring unless they are artificially drained. Also included are areas of Ontario and Madrid soils on slight knolls, but these have little or no significance in use and management.

This soil is suited to crops, pasture, and trees. Most of the acreage is cropped. The soil is well suited to most crops commonly grown in the county. Slight wetness occasionally delays planting briefly. Erosion is not a hazard, but drainage of the included wet spots generally is needed for timely tillage. Capability unit IIw–3; woodland suitability group 2o1.

Hilton loam, 3 to 8 percent slopes (HIB).—This gently sloping soil is mainly on uplands that receive some runoff and seepage from adjacent higher lying soils. Areas are mainly small to intermediate in size, ranging mainly from smaller than 10 acres to larger than 20 acres.

This soil has a profile similar to the one described as representative of the series, but in areas where it is moderately eroded, the surface layer is lighter in color, lower in organic matter, and has a higher content of gravel and small stones.

Included with this soil in mapping are small areas of Appleton soil in shallow depressions and narrow drainageways. This somewhat poorly drained Appleton soil makes up as much as 15 percent of some areas, and it delays tillage unless it is drained. Also included are areas of Ontario and Madrid soils on slight convex knolls, but these better drained soils have little significance on use and management.

This soil is suited to crops, pasture, and trees. It is well suited to many crops commonly grown in the county including vegetables. Slight wetness occasionally delays planting briefly. Erosion is a hazard if this soil is cultivated and not protected. Capability unit IIe–6; woodland suitability group 2o1.

Honeoye Series

The Honeoye series consists of deep, well-drained, medium-textured soils that formed in calcareous glacial till. The till consists mostly of material derived from limestone and gray silty shale and from smaller amounts of sandstone and crystalline rock. These soils are mainly on till plains of the lower uplands at elevations of 700 to 1,400 feet.

In a representative profile in a meadow, the surface layer is dark grayish-brown silt loam 8 inches thick. Between depths of 8 and 10 inches is a thin, leached subsurface layer of brown, friable silt loam. Between depths of 10 and 14 inches is brown, friable heavy loam. Silt coats are around structural blocks in this layer. Between depths of 14 inches and 23 inches, the subsoil is brown, firm heavy loam that lacks the silt coatings around the structural blocks. Between depths of 23 inches and 29 inches, the lower layer of the subsoil is firm, dark-brown heavy gravelly loam. The substratum, between depths of 29 to 50 inches, is firm, dark grayish-brown gravelly loam that is strongly calcareous.

Honeoye soils are moderately permeable and are saturated for short periods following rains. In places they have a seasonal high water table at a depth of 24 to 36 inches. Roots readily penetrate the surface and subsoil, but only a few roots are present in the substratum. Consequently most roots are in the upper 24 to 36 inches of the soil, which has high available water capacity. The less sloping Honeoye soils are well suited to farming, and crops in areas of these soils respond well to management and fertilization. Lime needs are none to slight. Honeoye soils have

medium supplies of nitrogen, phosphorus, and potassium.

Representative profile of Honeoye silt loam, 2 to 8 percent slopes, in an alfalfa meadow in the town of Marcellus, 150 feet north of Seal Road, 400 feet west of Town Line Road:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam, dark brown (10YR 4/3) crushed, light brownish gray (10YR 6/2) dry, pale brown (10YR 6/3) dry and crushed; moderate, medium and coarse, granular structure; friable; many roots; 10 percent coarse fragments; slightly acid; abrupt, smooth boundary.

A2—8 to 10 inches, brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; weak, fine, subangular blocky structure; friable; many roots; many fine and medium pores; 10 percent coarse fragments; slightly acid; clear, irregular boundary.

B&A—10 to 14 inches, brown (10YR 4/3) heavy loam; moderate, coarse, subangular blocky structure; friable; many roots; many pores; patchy clay linings in larger pores; 1- to 4-millimeter-thick brown (10YR 5/3) silt coats on ped faces, very pale brown (10YR 7/3) dry; common, light-gray (10YR 7/1), washed fine sand grains on ped faces; 10 percent coarse fragments; slightly acid; granular, wavy boundary.

B2t—14 to 23 inches, brown (10YR 4/3) heavy loam; moderate, coarse, subangular blocky structure parting to weak, fine, subangular blocky; firm, slightly sticky; common roots; many pores that have thin clay linings; patchy clay films on ped faces; 10 percent coarse fragments; neutral; gradual, wavy boundary.

B3t—23 to 29 inches, dark-brown (10YR 4/3) heavy gravelly loam; weak, very thick, platy structure parting to weak, fine, blocky; firm, slightly sticky; few fine roots; common fine and medium pores that have patchy clay linings, thin clay linings on plates and on block faces; common, fine, black rotted shale fragments; light-gray segregated lime on a few ped faces; 20 percent coarse fragments; mildly alkaline and weakly calcareous; gradual, wavy boundary.

IIC—29 to 50 inches, dark grayish-brown (10YR 4/2) gravelly loam; weak, medium and thick, platy structure; firm; few fine roots; few pores; 30 percent coarse fragments; segregated lime on plate faces in upper part; moderately alkaline; strongly calcareous.

The solum ranges from 16 to 36 inches in thickness. Depth to calcareous material ranges from 16 to 32 inches, and depth to bedrock is more than 40 inches. Content of coarse fragments, including stone-size fragments, ranges from 5 to 30 percent by volume in the solum and from 20 to 65 percent in the C horizon.

The Ap horizon ranges from grayish brown (10YR 5/2) to dark brown (7.5YR 3/2). Undisturbed soils have an A1 horizon 4 to 6 inches thick that ranges from black (N 2/0) to dark brown (10YR 3/3). The A2 horizon ranges from grayish brown (2.5Y 5/2) to reddish brown (5YR 5/3) when moist and pinkish gray (5YR 7/2) to light gray (2.5Y 7/2) when dry. Reaction of the A horizon ranges from medium acid to neutral.

The B&A horizon has brown (10YR 4/3) to reddish brown (5YR 4/4) slightly heavier textured B-horizon material surrounded by lighter brown, more friable silty A-horizon material similar to that in the overlying A2 horizon. The B2t horizon is brown (10YR 4/3) to reddish brown (5YR 4/4), and the fine earth in this horizon is loam to heavy silt loam. Reaction of the B horizon ranges from slightly acid to mildly alkaline.

The C horizon has hues of 2.5Y to 5YR, values of 4 and 5, and chromas of 2 and 3. The fine earth is loam or silt loam.

Honeoye soils are closely associated with the moderately well drained Lima soils, the somewhat poorly drained Kendaia soils, and the poorly drained Lyons soils. All formed in similar material.

Honeoye silt loam, 2 to 8 percent slopes (HnB).—This gently sloping soil is mainly on convex hilltops or the upper parts of hillsides or in undulating areas that receive little or no runoff from adjacent higher soils. Many areas are larger than 50 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas where the surface layer is more than 15 percent gravel. The gravel content, however, generally is not great enough to materially affect the use of the soil for most farming operations. Also included are small areas of Lima soils in shallow depressions or drainageways. These wetter soils make up as much as 15 percent of some areas, and they delay fieldwork unless they are drained. Other inclusions are small areas of Aurora soils that have shale bedrock at a depth of less than 40 inches.

This soil is well suited to crops, pasture, and trees. Much of the acreage is cultivated. The soil responds very well to good management and to cropping systems that maintain organic-matter content and good soil structure. Erosion is a moderate hazard on the longer slopes if the soil is cultivated and not protected. Capability unit IIe–1; woodland suitability group 2o1.

Honeoye silt loam, 8 to 15 percent slopes (HnC).—This sloping soil is on convex side slopes and convex hilltops of uplands. Most areas are smaller than 20 acres. Cultivated areas of this soil generally are moderately eroded and have a lighter colored surface layer that is lower in content of organic matter than the one in undisturbed areas.

This soil has a profile similar to the one described as representative of the series, but it has a slightly thinner solum.

Included with this soil in mapping are small areas where the surface layer is gravelly silt loam and gravelly loam. In these areas the soil is commonly severely eroded, but the areas are included because of their limited extent and little effect on use and management. Also included are small areas of Lima soils in shallow depressions or drainageways and small seep spots of Lima soils. The wetter soils make up as much as 10 percent of some areas, and they delay tillage unless drained. Other inclusions are small areas of Aurora soils that have shale bedrock at a depth of less than 40 inches.

This soil is suited to crops, pasture, and trees. Much of it has been cropped intensively and is moderately eroded to severely eroded. If used for row crops, this soil needs management that controls runoff and erosion and conserves moisture. In many of the areas of moderately eroded and severely eroded soils, a cropping system is needed that increases organic-matter content and improves soil structure. Also, erosion has reduced the capacity of the soil to hold water for plants. Crops, consequently, are more severely damaged by drought in these eroded spots. Capability unit IIIe–2; woodland suitability group 2o1.

Honeoye silt loam, rolling (HnCK).—This soil has short, complex slopes. It is mostly rolling on till plains of the uplands. A few areas are on hillsides where drainageways are so closely spaced that slopes are short and complex. Most areas are smaller than 20 acres.

This soil has a profile similar to the one described as representative of the series, but in places it is eroded and has more gravel in the surface layer.

Included in mapping are small areas of Lima soils in depressions and narrow drainageways.

This soil is suited to crops, pasture, and trees. If used for crops, it is best suited to long-term hay. Erosion-control measures that include contour rows, terraces, and diversions generally are impractical on the short, complex slopes. Slope erosion and slow permeability of the substratum are the main limitations for most nonfarm uses. Capability unit IVe–1; woodland suitability group 2o1.

Honeoye and Lansing gravelly silt loams, 15 to 25 percent slopes (HoD).—This undifferentiated group consists of moderately steep and hilly Honeoye and Lansing gravelly silt loams. Most areas are mainly Honeoye gravelly silt loam, other areas mainly Lansing gravelly silt loam, and a few areas are made up of both soils. These soils have profiles similar to those described as representative of their respective series, but they vary from place to place, and in most places, the Honeoye soil has more gravel on the surface. These soils are mainly on hills and the sides of valleys. Most areas have smooth single slopes. In some areas that have enough closely spaced deep drainageways, slopes are complex and hilly. Most areas are long and narrow and smaller than 20 acres in size. Only a few areas are larger than 50 acres.

Many areas of these soils that are cropped or have been cropped are severely eroded. In these areas, the surface layer contains less organic matter and is lighter in color in places. In many areas the soils receive a large amount of runoff from adjacent higher soils.

Included with the soils in mapping are small areas of wetter Lima and Conesus soils in depressions, along drainageways, in seep spots, and on foot slopes. Also included are small areas of Aurora soils that have shale bedrock at a depth of less than 40 inches.

The soils of this group are suited mainly to hay, pasture, and trees. Runoff is very rapid, and the hazard of erosion is severe if these soils are used for cultivated crops. The use of farm machinery on these moderately steep and hilly slopes is hazardous. Tillage needs to be largely confined to renovation for hay and pasture. Capability unit IVe–1; woodland suitability group 2r2.

Honeoye very stony soils, sloping (HSC).—These soils generally are on uplands where limestone boulders were deposited by glacier. Slopes range from 0 to 25 percent. These soils have a profile similar to the one described as representative of the series, but so many large stones and boulders are on the surface that tillage is impractical. Also, so many stones and boulders are below the surface that digging and excavating are extremely difficult. Included in mapping are small areas of moderately well drained Lima soils that generally have a high content of stones and boulders. These soils are in depressions and along drainageways.

Honeoye soils are used mostly for pasture and trees. Most pastures are of poor quality because the stones prevent mowing and limit other management practices. Many areas adjacent to Syracuse are now urban and are mainly used for homesites. Capability unit VIs–1; woodland suitability group 2o1.

Honeoye, Lansing and Ontario soils, steep (HTE).—These soils are on uplands. Slopes range from 25 to 35 percent. Most areas generally contain just one of these soils. In places, however, areas contain two of them or all three. Each of these soils has a profile similar to the one described as representative of its respective series, but the solum is generally thinner and in places the soils are very stony. Honeoye and Lansing soils are mainly on steep valley sides and Ontario soils are mainly on the steep sides of drumlins. Individual areas are much longer than they are wide and range from less than 10 acres to more than 50 acres in size. Included in mapping on these steep upland landscapes are small areas of Cazenovia, Mohawk, and Madrid soils.

These soils are too steep for cropping, but they provide some pasture and are well suited to trees. Cleared areas used for pasture generally are brushy. Other cleared areas are mostly idle and support a thick growth of weeds and brush. In places they are reverting to forest. A few scattered areas are used for homesites. Capability unit VIe–1; woodland suitability group 2r5.

Honeoye, Lansing and Ontario soils, very steep (HTF).—These soils are on uplands. Slopes are more than 35 percent. Most areas are generally made up of just one of these soils, but some contain two of them and others all three. Each of these soils has a profile similar to the one described as representative of its respective series, but the solum is generally thinner, and in places these soils are very stony. The Honeoye and Lansing soils are mainly on very steep valley sides, and the Ontario soils are mainly on the very steep sides of drumlins. Individual areas are long and narrow and generally are less than 50 acres in size. Included in mapping are small areas of very steep Cazenovia and Madrid soils.

These soils are suited to woodland and to some recreational uses. They are too steep for cropping and are poorly suited to pasture. Most cleared areas are now idle and support a thick growth of weeds and brush. They are slowly reverting to forest. Capability unit VIIe–1; woodland suitability group 2r5.

Howard Series

The Howard series consists of deep, well-drained and somewhat excessively drained, medium-textured and moderately coarse textured soils that formed in stratified sand and gravel outwash material. The gravel consists mainly of sandstone, shale, and limestone. These soils are mainly on glacial outwash deposits. In places they are on old alluvial fans in the larger valleys.

In a representative profile in a cultivated area, the surface layer is dark-brown gravelly fine sandy loam 9 inches thick. Between depths of 9 and 16 inches is a subsurface layer of very friable, brown gravelly fine sandy loam. Between depths of 16 and 24 inches, the upper part of the subsoil is friable, dark reddish-brown gravelly sandy loam. Between depths of 24 and 36 inches, the lower part of the subsoil is friable, dark reddish-gray very gravelly sandy loam. Between depths of 36 and 180 inches, the substratum is stratified layers of loose pinkish-gray, brown, and dark-

brown very gravelly sand, fine sand, fine sandy loam, sand, and gravel.

Roots of deep-rooted plants readily penetrate the rapidly permeable, gravelly substratum, but most rooting is in the upper 30 to 40 inches of soil. This zone has low to moderate available water capacity. Many of the steeper rolling areas are very droughty. Howard soils are quick to warm up in spring and are some of the first soils in the county ready for plowing and planting. Crops respond very well to good management and fertilization. Howard soils have a moderate to high infiltration rate and are very rapidly permeable in the substratum; consequently, the level and gently sloping areas are well suited to truck crops if irrigation and intensive fertilization are used. Some of the soils need lime; others do not. The supply of nitrogen is low to medium. The capacity of these soils to supply phosphorus and potassium is low to medium, but plants are able to utilize much of the applied fertilizer.

Representative profile of Howard gravelly fine sandy loam, 0 to 3 percent slopes, in a cultivated field in the town of Skaneateles, 300 feet south of Stump Road, 300 feet west of Hoyt Road in the east bank of the gravel pit:

Ap—0 to 9 inches, dark-brown (7.5YR 3/2) gravelly fine sandy loam, pinkish gray (7.5YR 6/2) dry; weak, fine and medium, granular structure; very friable; many roots; 15 percent gravel; neutral; abrupt, smooth boundary.

A2—9 to 13 inches, brown (7.5YR 4/4) gravelly fine sandy loam, light brown (7.5YR 6/4) dry; very weak, fine, granular structure; very friable; many roots; many fine pores; few washed sand grains; 15 percent gravel; neutral; clear, wavy boundary.

A&B—13 to 16 inches, brown (7.5YR 4/4) gravelly fine sandy loam; very weak, fine, granular structure; very friable; sand-grain material, 1/2 to 1 inch thick, surrounding fine to medium, subangular blocky peds of slightly heavier, friable, reddish-brown (5YR 4/3) gravelly fine sandy loam; common fine roots; common fine pores; common, washed, pinkish-gray (7.5YR 7/2) sand grains on ped faces; few clay bridges in centers of peds; 15 percent gravel; neutral; abrupt, wavy boundary.

B21t—16 to 24 inches, dark reddish-brown (5YR 3/4) gravelly sandy loam; weak, medium, subangular blocky structure; friable, slightly sticky; common fine roots; many fine and medium pores that have thin clay linings; prominent clay bridges between sand grains; patchy clay films on gravel; 25 percent gravel; neutral; clear, irregular boundary that has shallow tongues into horizon below.

IIB22t—24 to 36 inches, dark reddish-gray (5YR 4/2) very gravelly sandy loam; very weak, medium, subangular blocky structure; friable, slightly sticky; common fine roots; many medium and coarse pores that have clay linings; clay bridges between sand grains; patchy clay films on gravel; 40 percent gravel; neutral; clear, irregular boundary that has tongues into the C horizon 12 to 18 inches deep and 2 to 6 feet apart.

IIC1—36 to 60 inches, pinkish-gray (7.5YR 6/2), brown (7.5YR 5/2, 4/2), and dark-brown (7.5YR 3/2) very gravelly sand; single grained; loose; few fine roots in upper 12 inches; 60 percent gravel; mildly alkaline (calcareous); abrupt, wavy boundary.

IIIC2—60 to 180 inches, pinkish-gray (7.5YR 6/2) stratified fine sand that has thin layers of fine sandy loam and thick strata of sand and gravel from 12 to 24 inches thick; upper sand strata 60 inches thick to first sand and gravel strata; moderately alkaline (calcareous).

The solum ranges from 30 to 60 inches in thickness because the B horizon tongues into the C horizon, but the average solum thickness ranges from 30 to 48 inches. Depth to carbonates ranges from 30 to 72 inches. Depth to bedrock is more than 4 feet and generally is more than 10 feet.

The Ap horizon ranges from very dark brown (10YR 2/2) to dark reddish gray (5YR 4/2). In unplowed areas the A1 horizon in places is 1 chroma darker, ranging to very dark gray (10YR 3/1). Texture of the Ap and A1 horizons ranges from fine sandy loam to silt loam in the fine-earth parts, and the content of coarse fragments is 15 to 35 percent. The A2 horizon ranges from 3 to 20 inches in thickness. Its thinnest layers are destroyed by deep plowing in some places. The A2 horizon ranges from brown (10YR 5/4) to reddish brown (5YR 4/3). It ranges from loamy fine sand to silt loam and is 15 to 35 percent coarse fragments, generally gravel. In unlimed areas reaction in the A horizon is strongly acid to medium acid.

The A&B horizon has hues of 10YR to 5YR, values of 4 to 6, and chromas of 2 to 4. The A part of the horizon surrounds the small bodies of slightly heavier B material, which is coated with lighter colored washed sand grains. Texture of the fine-earth part of the A&B horizon ranges from fine sandy loam to silt loam and is 15 to 50 percent coarse fragments. Interiors of peds are faintly sticky in places and contain thin clay films or, where sandy, clay bridges. Reaction in the A&B horizon ranges from strongly acid to medium acid.

The Bt horizon has hues of 10YR to 2.5YR, values of 2 to 5, and chromas of 2 to 4. Texture of the fine-earth part of the Bt horizon ranges from fine sandy loam to heavy loam and is 15 to 50 percent coarse fragments by volume above a depth of 28 inches. It is 35 to 60 percent below a depth of 28 inches. Structure of the Bt horizon is very weak, weak, or moderately fine or medium, subangular blocky, or in places it is structureless (massive). Pores in the Bt horizon are common to many and have clay linings. Prominent clay bridges are present on the sandy textured material and thin clay linings are discontinuous on block faces. Reaction in the Bt horizon ranges from medium acid to neutral.

The C horizon is stratified sand and gravel and locally contains angular rock fragments or cobbles and stones. Reaction in the upper part of the C horizon is neutral in places, but it is always calcareous below a depth of 72 inches. Sand and gravel that are cemented with secondary lime are below a depth of 84 inches.

Howard soils are closely associated with the moderately well drained Phelps soils, the somewhat poorly drained and poorly drained Fredon soils, and the very poorly drained Halsey soils. All formed in similar material.

Howard gravelly fine sandy loam, 0 to 3 percent slopes (HwA).—This level or nearly level soil is in flats on outwash plains. Some areas are larger than 20 acres, but most areas are smaller than 10 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Arkport soils where sand that contains little or no gravel has been deposited. Also included are small areas of Palmyra soils where the outwash material contains more silt and clay. These inclusions have little significance in use and management.

This soil is suited to crops, pasture, and trees. It can be tilled early in the season and is well suited to most crops commonly grown in the county. This soil is particularly well suited to truck crops if irrigation is used. It is not too well suited to pasture because the pasture dries up by midsummer and produces little or no forage until it is revived by fall rains. Capability unit IIs–1; woodland suitability group 2o1.

Howard gravelly fine sandy loam, 3 to 8 percent slopes (HwB).—Areas of this gently sloping or undulating soil that are larger than 10 acres are mainly outwash deposits where slopes are short and complex. Some of the smaller, gently sloping terrace faces have uniform slopes.

Included with this soil in mapping are small areas of Arkport soils that are gravel free and areas of

Palmyra soils that contain more silt and clay and less sand. Also included are a few small areas of Phelps soils in the lowest depressions.

This soil is suited to crops, pasture, and trees. It can be tilled early in the season and is suited to most deep-rooted crops commonly grown in the county. The hazard of water erosion is moderate in the more sloping areas, and some of the sandier areas are subject to soil blowing. Cropping systems that maintain or increase organic-matter content in the soil help control erosion in many of the undulating areas that have short, complex slopes. Capability unit IIs–1; woodland suitability group 2o1.

Howard gravelly fine sandy loam, rolling (HwC).—This soil is on glacial outwash deposits where slopes are mainly short and complex and range from 8 to 15 percent. Many areas are larger than 20 acres.

This soil has a profile similar to the one described as representative of the series, but it generally is more variable in texture of the surface layer and is thinner to stratified sand and gravel.

Included with this soil in mapping are nearly gravel-free spots of Arkport soils that make up as much as 25 percent of some areas, but have little or no significance in use and management. Also included are small areas of wetter Phelps soils in the deeper depressions.

This soil is suited to crops, pasture, and trees. Because of the short, complex slopes, it is better suited to long-term, deep-rooted hay crops than to most other uses. In areas that are used for row crops, a cropping system is needed that helps control runoff and erosion. Early pasture generally is of good quality, but summer pasture generally is poor. Capability unit IVe–10; woodland suitability group 2o1.

Howard gravelly loam, 0 to 3 percent slopes (HxA).—This level or nearly level soil is in flats on gravel terraces. It has a profile similar to the one described as representative of the series, but it has a gravelly loam surface layer and is generally heavier textured throughout the surface layer and subsoil. Included in mapping are small areas of Phelps soils in shallow depressions. These wetter soils seldom make up more than 5 percent of any given area and have little or no significance in use and management.

This soil is well suited to cultivated crops. Lack of moisture in extended dry periods is a slight limitation to use. Erosion is not a hazard, and gravel and cobbles generally do not hinder the growth of such crops as corn, small grains, and hay. Capability unit IIs–1; woodland suitability group 2o1.

Howard gravelly loam, 3 to 8 percent slopes (HxB).—This gently sloping or undulating soil is on glacial outwash deposits or terrace faces. Individual areas are irregular in shape and range from smaller than 10 acres to larger than 20 acres in size.

This soil has a profile similar to the one described as representative of the series, but it has a gravelly loam surface layer and is generally heavier textured throughout the surface layer and subsoil. Included in mapping are small areas of Phelps soils in depressions. These wetter soils generally make up less than 10 percent of any area and have little or no effect on use and management.

This soil is suited to cultivated crops, hay, pasture, and trees. Lack of moisture in extended dry periods is a limitation to use. Erosion is a slight hazard if the soil is cultivated and not protected. Contouring to control erosion generally is not feasible on the complex slopes, but cropping systems that maintain organic-matter content and good soil structure generally provide adequate erosion control. Capability unit IIs–1; woodland suitability group 2o1.

Howard gravelly loam, rolling (HxC).—This soil is mostly on outwash deposits and has short, complex slopes that are dominantly between 8 and 15 percent. A few small areas along the sloping faces of terraces have smooth, simple slopes. Most areas of this soil are smaller than 20 acres.

This soil has a profile similar to the one described as representative of the series, but it has a gravelly loam surface layer and is generally heavier textured throughout the surface layer and subsoil. Included in mapping are small areas of Phelps soils in the deepest depressions.

This soil is suited to crops, pasture, and trees. If it is used for row crops, a cropping system is needed to control erosion and runoff. Some erosion-control measures are difficult, if not impracticable, to establish because of the short, complex slopes. If this soil is used for crops, it is better suited to long-term hay than to most other crops. Because runoff is rapid, the soil is droughty. Capability unit IVe–10; woodland suitability group 2o1.

Howard gravelly silt loam, 0 to 3 percent slopes (HyA).—This level or nearly level soil is on old alluvial fans where some high-gradient streams enter the larger valleys. Individual areas range from smaller than 10 acres to larger than 50 acres in size.

This soil has a profile similar to the one described as representative of the series, but it has a gravelly silt loam surface layer and is generally heavier textured throughout the surface layer and subsoil. Also, it contains more flat angular sandstone and shale fragments and, in places, large stones and boulders.

Included with this soil in mapping are small areas of Fluvaquents, frequently flooded. These inclusions are adjacent to the channels of streams that flow through the fans. Also included are small areas of Palmyra soils that have a higher content of lime and areas of Hamlin and Teel soils where the fans merge with the flood plains.

This soil is suited to cultivated crops, hay, pasture, and trees. It can be tilled early in the season and is suited to most crops commonly grown in the county. In places large amounts of angular stone fragments in the surface layer hinder tillage. Also, this soil is subject to infrequent flash flooding during periods of excessive runoff. Some stream channel maintenance is needed in places to minimize flash-flood damage. Capability unit IIs–1; woodland suitability group 2o1.

Howard gravelly silt loam, 3 to 8 percent slopes (HyB).—This gently sloping soil is generally at the apex of old alluvial fans where some high-gradient streams enter the larger valleys. Individual areas range from smaller than 10 acres to larger than 50 acres in size.

This soil has a profile similar to the one described as representative of the series, but it has a gravelly silt loam surface layer and is generally heavier tex-

tured throughout the surface layer and subsoil. Also, it contains more flat angular sandstone and shale fragments and, in places, large stones and boulders.

Included with this soil in mapping are small areas of Fluvaquents, frequently flooded. These inclusions are adjacent to the channels of streams that flow through the fans. Also included are small areas of similar Palmyra soils that have a higher content of lime and areas of Hamlin and Teel soils where the fans merge with the flood plains.

This soil is suited to cultivated crops, hay, pasture, or trees. It can be tilled early in the season and is suited to most crops commonly grown in the county. Erosion is a hazard, particularly on the longer slopes, if the soil is cultivated and not protected. In places large amounts of angular stone fragments in the surface layer hinder tillage and harvesting. Also, this soil is subject to infrequent flash flooding during periods of excessive runoff. Some stream channel maintenance is needed in places to minimize flash-flood damage. Capability unit IIs–1; woodland suitability group 2o1.

Kendaia Series

The Kendaia series consists of deep, somewhat poorly drained, medium-textured soils that formed in glacial till high in content of lime. These soils are on uplands in areas where runoff is slow or where they receive runoff or seepage from adjacent higher lying soils. They are mainly in depressions on till plains at elevations of less than 1,400 feet.

In a representative profile the surface layer is very dark grayish-brown silt loam 7 inches thick. Between depths of 7 and 17 inches, the upper part of the subsoil is friable, strongly mottled, grayish-brown silt loam. Between depths of 17 and 22 inches, the lower part of the subsoil is friable, mottled, grayish-brown gravelly silt loam. Between depths of 22 and 60 inches, the substratum is firm, mottled, brown and gray, calcareous gravelly silt loam, and between depths of 60 and 114 inches, it is dark-gray very gravelly silt loam.

Kendaia soils have a seasonal high water table at a depth of 6 to 12 inches in April and early in May unless they are artificially drained. In undrained areas root growth is mainly limited by wetness to the upper 12 inches of soil. As the water table recedes in midsummer, roots can penetrate into the moderately permeable subsoil and upper part of the substratum. Available water capacity is moderate to high. Because Kendaia soils collect runoff and seepage from adjacent higher lying soils, plants are seldom damaged by drought, but they are damaged by too much water in some wet years. If adequate artificial drainage is available, Kendaia soils are well suited to many crops, especially such annual row crops as corn, beans, and cabbage. The soils seldom need lime. The supply of nitrogen is low in the spring in places, but it is medium to high by midsummer. The capacity of these soils to supply phosphorus and potassium is medium. Wetness is the main limitation for most nonfarm uses.

Representative profile of Kendaia silt loam, 0 to 3 percent slopes, in a pasture, formerly a cultivated area in the town of Marcellus, 1,800 feet south of State Route 175, 4,000 feet east of Pleasant Valley Road:

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) silt loam, dark brown (10YR 3/3) crushed; moderate, medium and coarse, granular structure; friable; many roots; 5 percent coarse fragments; neutral; clear, wavy boundary.

B2g—7 to 17 inches, grayish-brown (10YR 5/2) silt loam; common, fine, distinct yellowish-brown and light-gray mottles; moderate, coarse, subangular blocky structure; friable; blocks surrounded by 1/8- to 1/2-inch thick coats of brown (10YR 5/3) loam, 45 percent by volume; common, gray, washed grains of fine sand; common roots; many pores; common large worm channels filled with Ap-horizon material; 10 percent coarse fragments; neutral; clear, wavy boundary.

B3g—17 to 22 inches, grayish-brown (10YR 5/2) gravelly silt loam; many, large, distinct yellowish-brown (10YR 5/4) and few, fine, distinct light-gray mottles; moderate, coarse, subangular blocky structure; friable; few fine roots; many fine and medium pores, few coarse pores that have thin patchy clay films; 20 percent coarse fragments; moderately alkaline (calcareous); gradual, wavy boundary.

C1—22 to 60 inches, variegated (about 50 percent each) brown (10YR 5/3) and gray (10YR 5/1) gravelly silt loam; common, medium and coarse, yellowish-brown mottles; moderate, thick and very thick, platy structure; firm; few fine roots; many fine and medium pores, few coarse pores that have thin patchy clay linings; patchy clay films on plate faces; 20 percent coarse fragments; moderately alkaline (calcareous); clear, wavy boundary.

IIC2—60 to 114 inches, dark-gray (10YR 4/1) very gravelly silt loam; moderate, thick and very thick, platy structure; very firm; 40 percent coarse fragments, mainly limestone pebbles, stones, and boulders; moderately alkaline (strongly calcareous).

The solum ranges from 18 to 36 inches in thickness. Depth to carbonates ranges from 15 to 36 inches. Depth to bedrock is more than 40 inches and generally is more than 6 feet. Coarse fragments in the upper part of the solum range from 5 to 30 percent, generally increasing with increasing depth, and range to as much as 50 percent in the C horizon below a depth of 36 inches.

The Ap horizon ranges from very dark grayish brown to dark brown in hues of 10YR to 7.5YR, values of 3 and 4, and chromas of 2 and 3. Reaction in the Ap horizon ranges from slightly acid to neutral. The A2g horizon, where present, ranges from brown to light yellowish brown in hues of 10YR to 7.5YR, values of 5 to 6, and chromas of 2 and 3, and has higher or lower chroma mottles.

The Bg horizon ranges from dark grayish brown to light reddish brown in hues of 2.5Y to 5YR, values of 4 to 6, chromas of 2 to 4, and has higher and lower chroma mottles. Texture of the fine-earth part of the Bg horizon ranges from fine sandy loam to silt loam. Reaction in the Bg horizon ranges from slightly acid to mildly alkaline. The B3 horizon, where present, is moderately alkaline (calcareous).

The C horizon ranges from gray to dark reddish gray in hues of 2.5Y to 5YR, values of 4 and 5, and chromas of 2, which decrease to 1 with increasing depth. Mottles are common to many in the upper part of the C horizon and decrease in size and number with increasing depth. The fine-earth part of the C horizon is silt loam or loam that is dense and compact in place and has platy structure.

Kendaia soils are closely associated with the well-drained Honeoye soils, the moderately well drained Lima soils, and the poorly drained Lyons soils. All formed in similar material.

Kendaia silt loam, 0 to 3 percent slopes (KeA).—This level or nearly level soil is in low areas on till plains. Most areas are smaller than 10 acres, and only a few areas are larger than 20 acres. This soil generally receives considerable runoff or seepage water from adjacent higher lying soils and commonly is

ponded in winter and early in spring. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of wetter Lyons soils in lower depressions. Also included are areas of moderately well drained Lima soils on small knolls.

This soil is suited to crops, pasture, and trees. Undrained areas are better suited to late-planted, short-season crops that can tolerate wetness than to most other uses. If adequate artificial drainage is available, this soil is well suited to many crops, especially such annual row crops as corn, beans, and cabbage. Because drainage systems are generally plugged by snow and ice in winter, such winter grain crops as wheat generally are damaged by too much water. Capability unit IIIw–3; woodland suitability group 3w1.

Kendaia silt loam, 3 to 8 percent slopes (KeB).—This gently sloping soil generally is at the bases of steeper slopes from which it receives runoff and seepage. Slopes are mainly 3 to 5 percent and are typically concave in shape. Most areas of this soil are smaller than 10 acres, and only a few areas are larger than 20 acres.

This soil has a profile similar to the one described as representative of the series, but it generally has a lighter colored surface layer and a browner subsoil.

Included with this soil in mapping are small areas of poorly drained and very poorly drained Lyons soils in the narrow drainageways or in the more active seep spots. These wetter soils make up as much as 15 percent of some areas, and they further delay tillage in spring unless they are drained. Also included are areas of Lima soils on small convex knolls.

This soil is suited to crops, pasture, and trees. Undrained areas are better suited to late, short-season crops or hay that tolerate wetness than to most other uses. If adequate artificial drainage is available, this soil is suited to many crops, especially annual row crops. Measures to control runoff and erosion are needed on areas that receive rapid runoff and eroded material from adjacent higher lying soils. Capability unit IIIw–3; woodland suitability group 3w1.

Lairdsville Series

The Lairdsville series consists of moderately deep, moderately well drained and well drained, medium-textured soils that have a moderately fine textured or fine textured subsoil. These soils formed in residuum or mixed glacial till and residuum of soft red clay shale similar to the underlying shale bedrock, which is at a depth of 20 to 40 inches. They are on uplands where relief is influenced by the underlying bedrock.

In a representative profile in a formerly cultivated area, the surface layer is dark reddish brown heavy silt loam 8 inches thick. Between depths of 8 and 26 inches, the subsoil is very firm, mottled, weak-red heavy silt clay loam. Between depths of 26 and 30 inches, the subsoil is weak-red, very shaly, very firm silty clay loam that contains a high content of red shale fragments. Bedrock, at a depth of 30 inches, is weakly calcareous, red clay shale that has greenish-gray and olive-yellow streaks along vertical joint cracks.

limited to cracks along structure faces of the subsoil, and are mainly limited to a depth of 24 to 30 inches. A few roots extend into cracks and joints of the clay shale bedrock. This rooting zone has moderate available water capacity, so in midsummer plants begin to wilt after 7 to 10 rainless days. Lairdsville soils are slow to dry out in spring and are difficult to plow. They are very cloddy if they are plowed either too wet or too dry. Satisfactory seedbeds generally are very difficult to establish. Surface infiltration of water is slow or very slow. Permeability of the subsoil is slow or very slow. The combination of these two characteristics results in excessive runoff; consequently, Lairdsville soils erode readily even where slopes are gentle. Lairdsville soils need little or no lime and have a moderate supply of nitrogen. The capacity of these soils to supply phosphorus and potassium is high. Winter wheat is one of the better crops grown, and good crops of legume hay can be grown under good management. Row crops are not well suited to these soils.

Representative profile of Lairdsville silt loam, 2 to 6 percent slopes, in an idle, formerly cultivated field in the town of Cicero, 660 feet south of Gillette Road, 150 feet west of South Bay Road:

Ap—0 to 8 inches, dark reddish brown (5YR 3/2) heavy silt loam, pinkish gray (7.5YR 6/2) dry; moderate, medium, granular structure; friable, sticky; many roots; 5 percent rounded gravel; medium acid; abrupt, smooth boundary.

B21t—8 to 17 inches, weak-red (10R 4/3) heavy silty clay loam; few, fine, faint red mottles; moderate and strong, medium and coarse, angular and subangular blocky structure; very firm, sticky; common roots; common pores in ped interiors; 20 percent of pores clay filled; continuous weak-red (10R 4/4) clay films on ped faces; few, 1- to 2-millimeters-thick, greenish-gray (5GY 6/1), weathered shale chips; medium acid; clear, wavy boundary.

B22t—17 to 26 inches, weak-red (10R 4/3) heavy silty clay loam; few, fine, faint red mottles; moderate, coarse, prismatic structure that has prisms 2 to 5 inches across, parting to moderate, medium, subangular blocky; very firm, sticky; few fine roots; common fine pores; distinct, weak-red (10R 4/4) clay films on blocky ped faces; vertical cracks extend downward from major prism cleavages; cleavage faces are greenish gray (5GY 6/1) becoming olive yellow (2.5Y 6/6) inward to form a 1/2- to 3/4-inch thick margin; neutral; clear, wavy boundary.

B3—26 to 30 inches, weak-red (10R 4/3 and 5/3) very shaly silty clay loam; moderate, coarse, prismatic structure parting to moderate, very thick, platy; very firm, sticky; very few fine roots along vertical faces; few fine and medium pores that have thin, continuous clay linings; thin to medium, continuous clay films on ped faces and shale fragments; 60 percent weak-red, soft shale fragments; neutral; gradual, wavy boundary.

R—30 inches, weak-red (10R 4/3) horizontally fractured shale bedrock; silt coatings common in upper 20 inches; vertical joints 2 to 5 feet apart extend deep into shale bedrock and have greenish-gray (5GY 6/1) and olive-yellow (2.5Y 6/6) weathered faces as much as 1 inch thick. Shale is calcareous at depth of 39 inches.

The solum ranges from 20 to 40 inches in thickness and commonly corresponds to the depth to bedrock. Coarse fragments, mainly shale and small amounts of sandstone and limestone, average from 5 to 35 percent in the solum and commonly increase with increasing depth.

The Ap horizon has hues of 10YR to 5YR, values of 3 to 5, and chromas of 2 to 5. Texture ranges from gravelly loam to silty clay loam and locally is very shaly. The coarse texture of the surface layer generally is a result of a surficial mantle of

soil derived from thin glacial till deposits. An A2 horizon, generally present in undisturbed soils, and which may be present in cultivated areas as remnants not destroyed by plowing, has hues of 5YR to 10YR, values of 5 and 6, and chromas of 2 to 4. Reaction in the A horizon ranges from medium acid to neutral.

The Bt horizon has hues of 10R to 7.5YR, values of 3 to 5, chromas of 3 to 6, and few to common high-chroma mottles. Texture of the Bt horizon ranges from heavy clay loam to silty clay loam or clay. Reaction ranges from medium acid to mildly alkaline and is weakly calcareous in places in the lower part.

The C horizon that is present in some places is similar to the B horizon in color and texture. Reaction in the C horizon is mildly alkaline to moderately alkaline. Bedrock is weak-red or mixed red and gray clay shale.

Lairdsville soils are closely associated with the somewhat poorly drained Lockport and Brockport soils. All formed in similar material.

Lairdsville silt loam, 2 to 6 percent slopes (LaB).—Areas of this soil are mainly convex and are on the tops of hills. They range from knolls smaller than 10 acres to areas larger than 50 acres, and they receive little or no runoff from adjacent higher lying soils. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of grayer, similar soils where gray shale is intermixed with red shale in the soil material. These grayer soils have no significance in use and management. Also included are small areas of wetter Lockport soils in depressions and drainageways. These soils further delay tillage unless they are drained.

This soil is suited to crops, pasture, and trees. Cropped areas are better suited to winter grains and hay than to most other uses. The surface layer holds water and is slow to dry out in spring. It clods readily if plowed when too wet or too dry, resulting in poor seedbeds. Runoff and the hazard of erosion are moderate; consequently, measures that safely remove excess water and also control erosion are needed. Capability unit IIe–8; woodland suitability group 2o1.

Lairdsville silty clay loam, 6 to 12 percent slopes, eroded (LbC2).—This sloping soil generally has smooth slopes, but some areas in closely spaced drainageways have short, complex slopes. Most areas are smaller than 20 acres, and slopes generally are short. Runoff is moderate to rapid, and large amounts of runoff from adjacent higher lying soils are a contributing factor to the severe hazard of further erosion.

This soil has a profile similar to the one described as representative of the series, but it has lost from 6 to 12 inches of the original surface layer in many places and is thinner over the shale bedrock.

Included with this soil in mapping are small areas of soils where gray clay shale bedrock is mixed with the red shale. This is a similar soil, differing only in color, and has little significance in use and management. Also included are small areas of wetter Lockport soils in depressions and drainageways and small areas of Lairdsville soils that have moderately steep slopes.

This soil is suited to crops, pasture, and trees. The hazard of further erosion is severe if this soil is left exposed; consequently, it is better suited to small grains and hay crops than to most other uses. The surface layer has a high content of clay and clods readily if tilled at the wrong moisture content. Seedbeds are very difficult to prepare, and germination is spotty. Capability unit IVe–8; woodland suitability group 2r1.

Lakemont Series

The Lakemont series consists of deep, poorly drained, moderately fine textured soils that formed in red calcareous clay that was deposited in glacial lakes. Lakemont soils are in lower depressions on lake plains.

In a representative profile the surface layer is very dark brown silty clay loam 6 inches thick. Between depths of 6 and 10 inches is a subsurface layer of mottled, brown, firm silty clay loam. Between depths of 10 and 31 inches, the subsoil is mottled, reddish-gray and dark reddish-gray, very firm, plastic silty clay that grades with increasing depth to mottled, dark reddish gray. The substratum, between depths of 31 and 60 inches, is dark reddish-gray, very firm silty clay that has white and pinkish-white streaks and nodules of lime.

Lakemont soils have a water table at a depth of 0 to 6 inches in the wetter parts of the year, which generally include April. Most rooting takes place in the upper 12 to 24 inches of soil. This zone has moderate to high available water capacity. Because most areas of Lakemont soils receive seepage and runoff from adjacent better drained soils, crops are seldom damaged by drought. Lakemont soils generally do not need lime. The supply of total nitrogen is high. The capacity of these soils to supply phosphorus is medium, and to supply potassium, high. Wetness in spring, however, prevents release of nitrogen, so crops need additional nitrogen at that time. Later in the season, the heavy release of nitrogen causes lodging of small grains in places. Lakemont soils need drainage for most crops, but slow permeability and very slow permeability in the subsoil and substratum are serious limitations to obtaining adequate drainage.

Representative profile of Lakemont silty clay loam in a formerly cultivated, idle area in the town of Camillus, on the western edge of the Onondaga Pottery Company in a clay pit, 1,300 feet west of Pottery Road, 400 feet north of the abandoned Syracuse-Rochester Trolley Line:

Ap—0 to 6 inches, very dark brown (10YR 2/2) light silty clay loam, very dark grayish brown (10YR 3/2) crushed, grayish brown (10YR 5/2) dry; moderate, fine, subangular blocky structure parting to medium, granular; friable, slightly sticky; many roots; neutral; clear, wavy boundary.

A2g—6 to 10 inches, brown (7.5YR 5/2) silty clay loam; common, medium and coarse, distinct yellowish-brown, strong-brown, and gray mottles; strong, coarse, prismatic structure parting to strong, medium and coarse, angular and subangular blocky; firm, slightly sticky; gray (5Y 5/1) silt coats on ped faces, very dark grayish-brown (10YR 3/2) silt coats on prism faces; common roots along ped faces; many fine and medium pores, few large pores that have clay linings; neutral; abrupt, wavy boundary.

B21tg—10 to 15 inches, reddish-gray (5YR 5/2) silty clay; many, medium, distinct brown (7.5YR 5/4) and strong-brown (7.5YR 5/6) and common, fine, distinct gray (5Y 5/1) mottles; strong, coarse, prismatic structure parting to strong, coarse, blocky; very firm, plastic; 1-millimeter thick greenish-gray (5BG 5/1)

clay films on prism faces; brown (7.5YR 5/2) clay films on block faces that have few, medium, strong-brown and gray mottles; few roots along ped faces; many fine and medium pores filled with gray clay that causes a streaky appearance; few large pores lined with gray or greenish-gray clay; neutral; abrupt, smooth boundary.

B22tg—15 to 31 inches, dark reddish-gray (5YR 4/2) silty clay grading to reddish brown (5YR 4/3) in center of peds; many, medium, distinct brown (7.5YR 5/4) and strong-brown (7.5YR 5/6) and common, fine, distinct greenish-gray (5BG 5/1) mottles; strong, very coarse, prismatic structure parting to strong, coarse, angular blocky; very firm, plastic; continuous, 1-millimeter-thick, greenish-gray (5BG 5/1) clay films on prism faces; brown (7.5YR 5/2) clay films on block faces; few roots along prism and block faces; many fine and medium pores filled with greenish-gray clay; few large pores lined with clay; neutral; clear, wavy boundary.

C—31 to 60 inches, varved, dark reddish-gray (5YR 4/2) silty clay; common, medium, distinct brown, strong-brown, and gray mottles that decrease in size and number with increasing depth; strong, coarse, prismatic structure parting to moderate, medium and thick, platy; very firm, plastic; greenish-gray (5BG 5/1) clay films on prism faces; white and pinkish-white silty lime coats on major plate faces and in larger pores; few coarse pores; few lime nodules below a depth of 40 inches that increase with increasing depth to common and are as large as 1/4 inch in diameter at depth of 60 inches; moderately alkaline (strongly calcareous).

The solum ranges from 24 to 42 inches in thickness. Depth to carbonates ranges from 20 to 36 inches. Depth to bedrock is more than 40 inches and is generally more than 6 feet. The solum generally is free of coarse fragments, but as much as 5 percent gravel and stones is present in places.

The Ap horizon has hues of 10YR to 5YR, values of 2 and 3, and chromas of 0 to 2. The A2g horizon in some places is missing or has been destroyed by plowing. The distinct gray colors are only on the ped surfaces. Reaction in the Ap and A2g horizons ranges from neutral to slightly acid.

The Btg horizon has hues redder than 7.5YR, values of 3 to 5, and chromas of 0 to 2 on outside of peds and 2 to 4 on inside peds. This horizon has common to many mottles. Texture in the Btg horizon ranges from silty clay to clay. Reaction in the Btg horizon ranges from slightly acid to moderately alkaline (calcareous).

The C horizon is silty clay or clay, and it has hues redder than 7.5YR. The C horizon contains thin layers of silt or sand in some places, but such layers generally total less than 6 inches in the upper 60 inches of the soil profile. In some profiles thin layers less than 6 inches thick of greenish-gray clay or silty clay are present in the solum.

Lakemont soils are closely associated with the moderately well drained Schoharie soils, the somewhat poorly drained Odessa soils, and the very poorly drained Fonda soils. All formed in similar material.

Lakemont silty clay loam (Lk).—This level or nearly level soil is in low areas of lake plains that receive runoff from adjacent higher lying soils. Most areas of this soil are smaller than 20 acres. Included in mapping are small areas of wetter Fonda soils in shallow depressions and somewhat poorly drained Odessa soils on small knolls.

This soil remains wet for a long time in spring. Most of the acreage is undrained and is used for pasture or trees. Most of the cleared areas are slowly reverting to brush and trees. The few adequately drained areas are fairly well suited to crops. Maintaining high organic-matter content and good soil structure are the main concerns of management. In places the subsoil and substratum of this soil are used for pottery and brick materials. Capability unit IVw–2; woodland suitability group 5w1.

Lamson Series

The Lamson series consists of deep, poorly drained and very poorly drained, medium-textured soils that formed in lake deposits. These soils are on lake plains.

In a representative profile in a formerly cultivated area, the surface layer is very dark brown very fine sandy loam 9 inches thick. Between depths of 9 and 15 inches is a subsurface layer of loose, mottled, gray very fine sandy loam. Between depths of 15 and 22 inches, the subsoil is friable fine sandy loam that is mottled with brown. Between depths of 22 and 40 inches, the subsoil is mottled, grayish brown. The substratum, between depths of 40 and 60 inches, is gray, friable to loose fine sand, very fine sand, and silt that contains yellowish-brown and gray mottles.

Lamson soils have a seasonal high water table at or near the surface in the wetter parts of the year. Roots of most plants are limited to the upper 12 inches of soil by this wetness. If adequately drained, Lamson soils are well suited to many crops, especially annual row crops and vegetables. Roots can readily penetrate the moderately permeable subsoil to the depth of adequate drainage. If the rooting zone is 24 to 30 inches deep, available water capacity is moderate to high. Because most areas of Lamson soils receive a large amount of seepage and runoff water from adjacent higher lying soils, crops are seldom damaged by lack of water. These soils are generally high in organic matter and in total supplies of nitrogen. Their capacity to supply phosphorus is low to moderate and to supply potassium, low. Crops respond well to fertilization. Many of the layers of sand in the solum and substratum flow if they are saturated, so drainage systems need special measures to prevent being plugged with sand.

Representative profile of Lamson very fine sandy loam in an idle area, 2 1/4 miles north of Baldwinsville, on the east side of the Smokey Hollow road, slightly more than 3/4 mile north of Erie Lackawanna Railroad, about 200 feet east-southeast of the culvert:

Ap—0 to 9 inches, very dark brown (10YR 2/2) very fine sandy loam; few, medium, distinct reddish-brown (5YR 5/4) mottles; very weak, fine, granular structure; very friable; many fine roots; slightly acid; abrupt, smooth boundary.

A2g—9 to 15 inches, gray (10YR 6/1) very fine sandy loam; few, fine, distinct dark yellowish-brown (10YR 4/4) mottles; single grained; loose; common fine roots; slightly acid; clear, wavy boundary.

B21g—15 to 22 inches, brown (7.5YR 4/4) fine sandy loam; common, medium yellowish-brown (10YR 5/6) and many, very coarse light brownish gray (10YR 6/2) and gray (10YR 6/1) mottles; massive; friable; few fine roots; neutral; gradual, wavy boundary.

B22g—22 to 40 inches, grayish-brown (10YR 5/2) light fine sandy loam; common, medium yellowish-brown (10YR 5/6) and gray (10YR 5/1, N 5/0) mottles; 30 percent very coarse, irregularly shaped brown (10YR 5/3) and dark brown (10YR 4/3) bodies highest in very fine sand and silt; massive; friable; mildly alkaline; gradual, wavy boundary.

Cg—40 to 60 inches, gray (10YR 5/1) layers of fine sand, very fine sand, and silt; common, medium, distinct yellowish-brown (10YR 5/4) and faint gray (N 5/0) mottles; massive to single grained; friable to loose; mildly alkaline.

The solum ranges from 30 to 50 inches in thickness. Depth to bedrock or to contrasting material is more than 40 inches, but in most places depth to bedrock is more than 10 feet. The

soil material, to a depth of 40 inches, is generally free of coarse fragments, but is as much as 5 percent such fragments in places.

The Ap horizon and the A1 horizon, where present, have hues of 7.5YR to 2.5Y, values of 2 or 3, and chromas of 1 or 2. Below the Ap horizon hues are 2.5Y to 5YR, values are 4 to 6, and chromas are 1 to 4; except where hue is yellower than 7.5YR, the chroma is 2 or less in 60 percent or more of the matrix from the base of the Ap horizon to a depth of 30 inches. Where hue is 7.5YR or redder, the dominant chroma is higher than 2 in places; but if the soil has structure, the ped faces have chroma of 1 or less. If structure is lacking, the first horizon below the Ap horizon has chroma of 1 or less. The soil below the Ap horizon generally is single grained or massive, but it is weak, very coarse, prismatic in some places. Reaction ranges from medium acid to neutral in the upper horizons and increases to neutral and mildly alkaline at a depth of 40 inches. The C horizon below a depth of 40 inches is moderately alkaline (calcareous) in some places.

Lamson soils are closely associated with the well-drained Arkport soils, the moderately well drained Galen soils, and the somewhat poorly drained Minoa soils. All formed in similar material.

Lamson very fine sandy loam (Lm).—This nearly level soil is on low parts of the lake plains that receive runoff from adjacent higher lying soils. Undrained areas have a seasonal high water table at or near the surface for the 6 to 8 wetter months of the year. Areas of this soil are irregular in shape and are mainly smaller than 20 acres, but a few areas are larger than 50 acres.

Included with this soil in mapping are small areas of Lamson soils that have a mucky surface layer. These soils are in shallow depressions and in lower positions that are subject to prolonged surface ponding. Also included are small areas of better drained Minoa soils on slightly higher knolls and a few small areas of Palms muck in the deeper depressions.

Undrained areas of this soil are suited to pasture and trees. Adequately drained areas are well suited to many crops, especially annual row crops and vegetables. Crops respond well to good management and fertilization. Capability unit IVw–3; woodland suitability group 4w1.

Lansing Series

The Lansing series consists of deep, well-drained, medium-textured soils that have a medium content of lime. These soils formed in calcareous glacial till derived mainly from calcareous gray shale, fine-grained sandstone, and some limestone. They are on uplands at elevations of about 1,000 feet.

In a representative profile the surface layer is dark grayish-brown gravelly silt loam 6 inches thick. Between depths of 6 and 13 inches is a subsurface layer of brown, friable gravelly silt loam. Between depths of 13 and 35 inches the subsoil is dark grayish-brown, firm gravelly heavy loam that has brown silt coatings around blocky structural faces in the upper part. Between depths of 35 and 50 inches, the till substratum is firm, olive-gray very gravelly loam. It is neutral in the upper part and calcareous below a depth of 48 inches.

In Lansing soils the water table generally is at a depth of several feet, but seasonally in places it is at a depth of 24 to 36 inches where it is perched on the slowly permeable or very slowly permeable substratum. Rooting depth is mainly in the upper 30 to 40 inches. Available water capacity of this zone is high. The subsoil is moderately permeable. The capacity of these soils to supply phosphorus, potassium, and nitrogen is generally medium. In unlimed areas reaction in the surface layer is strongly acid to medium acid. Except for slope and the hazard of erosion, there are few limitations for farming. The slowly permeable or very slowly permeable substratum and the seasonal high water table in places are major limitations for some nonfarm uses.

Representative profile of Lansing gravelly silt loam, 8 to 15 percent slopes, in a formerly cultivated, idle field in the town of Otisco, 100 feet south of Cook Road, 2,700 feet west of Case Road, 3,000 feet east of Barker Street:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) gravelly silt loam; moderate, medium, granular structure; friable; many fine roots; 15 percent coarse fragments; medium acid; abrupt, smooth boundary.

A&B—6 to 13 inches, brown (10YR 5/3) gravelly silt loam; light gray (10YR 7/2) dry; moderate, medium, subangular blocky structure; ped centers of dark-brown (10YR 5/3) slightly heavier silt loam; friable; common fine roots; many fine pores; 15 percent coarse fragments; medium acid; clear, wavy boundary.

IIB&A—13 to 23 inches, dark grayish-brown (2.5Y 4/2) gravelly heavy loam; moderate, medium, subangular blocky structure; firm, slightly sticky; thin brown (10YR 5/3) silt films, light-gray (2.5Y 7/2) dry, as thick as 3 millimeters on ped faces in upper part, decreasing to less than 1 millimeter in thickness in lower part; common fine roots; many fine pores that have clay linings in ped centers; 30 percent coarse fragments; medium acid; clear, wavy boundary.

IIB21t—23 to 35 inches, dark grayish-brown (2.5Y 4/2) gravelly and shaly heavy loam; weak, coarse, subangular blocky structure; firm, slightly sticky; thin grayish-brown (2.5Y 5/2) clay films on ped faces; few fine roots; common pores that have clay linings; 30 percent coarse fragments; slightly acid; clear, wavy boundary.

IIC—35 to 50 inches, olive-gray (5Y 5/2) very gravelly loam glacial till; weak, medium and thick, platy structure; firm in place, friable when removed; few fine roots; common fine pores; 35 percent coarse fragments of shale, gravel, and stones; neutral at a depth of 36 inches, and moderately alkaline (calcareous), at depth of 48 inches.

The solum ranges from 32 to 48 inches in thickness. Depth to carbonates ranges from 30 to 50 inches. Depth to bedrock is more than 40 inches and generally is more than 10 feet. Content of coarse fragments ranges from 5 to 30 percent in the A horizon, increases with increasing depth, and ranges from 20 to 50 percent in the C horizon.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) to grayish brown (10YR 5/2), and the A1 horizon in undisturbed areas ranges from very dark gray (10YR 3/1) to dark grayish brown (10YR 4/2). In unlimed areas reaction in the A horizon ranges from strongly acid to medium acid. The A2 and A&B horizons, which extend to a depth of 13 to 20 inches, range in color from brown (10YR 5/3) to light yellowish brown (10YR 6/4), in texture from loam to silt loam in the fine-earth fraction, and in reaction from strongly acid to medium acid.

The B horizon ranges from dark brown (10YR 4/3) to dark grayish brown (2.5Y 4/2) and olive brown (2.5Y 4/4), and has low chroma that is inherited from the soil material and is not a result of wetness. In some places high-chroma mottles are at a depth of more than 24 inches. Texture of the fine-earth fraction of the B horizon ranges from loam to heavy silt loam. Reaction in the B horizon ranges from medium acid to neutral.

The C horizon ranges from dark grayish brown (10YR 4/2) to olive gray (5Y 5/2), and in places it has few to common high-chroma mottles in the upper part. Texture of the fine-earth fraction of the C horizon ranges from loam to silt loam;

reaction ranges from neutral to moderately alkaline (calcareous).

Lansing soils are closely associated with the moderately well drained Conesus soils, the somewhat poorly drained Appleton soils, and the poorly drained Lyons soils. All formed in similar material.

Lansing gravelly silt loam, 2 to 8 percent slopes (LsB).—This gently sloping or undulating soil is mainly on undulating hilltops or smooth side slopes of uplands that receive little or no water from adjacent higher lying soils. Most areas of this soil are smaller than 30 acres, but a few are larger than 50 acres.

This soil has a profile similar to the one described as representative of the series, but it generally has a slightly darker surface layer and in places has mottling in the subsoil below a depth of 24 inches. Included in mapping are small areas of Conesus soils in nearly level areas and in shallow drainageways. In some areas these wetter soils make up as much as 15 percent of the acreage, and they delay tillage in places, especially in spring.

This soil is suited to crops, pasture, and trees. It is particularly well suited to most crops grown in support of dairying. Runoff is moderate, especially on the longer slopes, and measures to control runoff and erosion are needed. The length of the growing season is shortened at high elevations. Capability unit IIe–1; woodland suitability group 2o1.

Lansing gravelly silt loam, 8 to 15 percent slopes (LsC).—This sloping soil is on upland hillsides. Slopes are smooth. Many areas of this soil receive runoff from adjacent higher lying soils. Individual areas are generally long and narrow and smaller than 30 acres, but a few areas are larger than 50 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of severely eroded soils that have a high content of angular stone fragments on the surface. Also included are areas of similar but moderately well drained Conesus soils along foot slopes, in drainageways, and around seeps.

This soil is suited to cultivated crops, hay, pasture, and trees. It is well suited to crops grown in support of dairying. Runoff is moderately rapid to rapid, and measures to control runoff and erosion are needed, especially for row crops. Capability unit IIIe–2; woodland suitability group 2o1.

Lansing gravelly silt loam, rolling (LsCK).—This soil is on uplands where slopes are short and complex or on hillsides that have numerous closely spaced drainageways. Individual areas are irregular in shape or long and narrow. They are generally smaller than 30 acres.

This soil has a profile similar to the one described as representative of the series, but the depth to the substratum is more variable from place to place.

Included with this soil in mapping are small areas of wetter Conesus soils in depressions and along drainageways. Also included are many small, severely eroded areas where the soil has been cleared and intensively cultivated. In these areas the surface layer is lighter colored and contains more stone fragments.

This soil is suited to limited crops, hay, pasture, and trees. Runoff is moderate to rapid, and the hazard of erosion is severe, especially on the hillsides. Contour measures to control erosion are generally not feasible on the complex slopes, so tillage needs to be confined mainly to renovation for hay or pasture. Capability unit IVe–1; woodland suitability group 2o1.

Lima Series

The Lima series consists of deep, moderately well drained, medium-textured soils that have a high content of lime. These soils formed in strongly calcareous glacial till derived mainly from limestone, calcareous gray shale, and sandstone. They are on uplands where runoff is somewhat slow or where some runoff water accumulates. Elevations are mainly less than 1,400 feet.

In a representative profile the surface layer is very dark grayish-brown silt loam 9 inches thick. Between depths of 9 and 15 inches, the upper part of the subsoil is brown and dark-brown, friable silt loam. Between depths of 15 and 22 inches, the subsoil is mottled, dark grayish-brown, firm shaly loam. Between depths of 22 and 30 inches, the subsoil is mottled, dark grayish-brown, firm very shaly loam. Between depths of 30 and 60 inches, the very firm, calcareous till substratum is dark grayish-brown very shaly loam that is mottled in the upper part.

Lima soils have a seasonal high water table at a depth of 15 to 24 inches. It is perched on the slowly permeable or very slowly permeable substratum. Rooting depth is limited mainly to the upper 18 to 30 inches of soil by the dense till substratum and seasonal wetness. This zone has moderate to high available water capacity. Lima soils have a moderately permeable subsoil. The capacity of these soils to supply nitrogen and phosphorus is generally medium. The capacity to supply potassium is medium to high. These soils need little or no lime. They respond very well to good management. Slight wetness seasonally and the slowly permeable or very slowly permeable substratum are the major limitations for both farm and nonfarm uses.

Representative profile of Lima silt loam, 3 to 8 percent slopes, in a cultivated grass meadow in the town of Onondaga, 400 feet south of State Route 175, 4,000 feet east of its intersection with Pleasant Valley Road:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam, dark brown (10YR 3/3) rubbed; moderate, medium, granular structure; friable, slightly sticky; many roots; 5 percent coarse fragments; neutral; abrupt, smooth boundary.

B&A—9 to 12 inches, brown (10YR 4/3) silt loam; moderate, fine, subangular blocky structure; ped coats friable, ped interiors slightly firmer, slightly sticky; common roots; many pores; dark grayish-brown (10YR 4/2) clay films in larger pores in peds; 2- to 4-millimeters-thick, brown (10YR 5/3) silt coats, light gray (10YR 7/2) dry, on ped faces; 5 percent coarse fragments; neutral; clear, wavy boundary.

B21t—12 to 15 inches, dark-brown (10YR 4/3) heavy silt loam; moderate, fine, subangular blocky structure; friable, sticky; common roots; many pores that have clay linings in larger pores; thin, grayish-brown (10YR 4/2) clay films on ped faces; 10 percent coarse fragments; neutral; clear, wavy boundary.

IIB22t—15 to 22 inches, dark grayish-brown (2.5Y 4/2) shaly loam; few, small and medium, distinct dark yellowish-brown mottles; moderate, coarse, prismatic structure parting to moderate, medium and coarse,

subangular blocky; firm, slightly sticky; few roots; many pores; clay linings in medium and large pores; thin continuous clay films on ped faces; 25 percent shale and stone fragments; neutral; clear, wavy boundary.

IIB23t—22 to 30 inches, dark grayish-brown (2.5Y 4/2) very shaly loam; common, fine and medium, distinct dark yellowish-brown and few, fine, faint grayish-brown mottles; moderate, thick, platy structure; firm, slightly sticky; few fine roots; many pores; clay linings in medium and large pores; continuous clay films on plate faces; 40 percent shale and stone fragments; neutral; gradual, wavy boundary.

IIC—30 to 60 inches, dark grayish-brown (2.5Y 4/2) very shaly loam; many, fine, distinct brown mottles in upper part, decreasing in number with increasing depth; moderate, thick, platy structure; very firm; many pores; clay linings in medium and large pores; 45 percent shale and stone fragments; moderately alkaline (calcareous).

The solum ranges from 18 to 32 inches in thickness. Depth to carbonates ranges from 15 to 32 inches. Depth to bedrock is more than 40 inches. Content of coarse fragments ranges from 5 to 25 percent in the A horizon and generally increases with increasing depth. The C horizon is 15 to 50 percent coarse fragments, by volume. These fragments are dominantly limestone, hard shale, and fine-grained sandstone, but in places they are gneiss, granite, and quartz.

The Ap and A1 horizons range from very dark grayish brown (10YR 3/2) to grayish brown (10YR 5/2). Reaction ranges from medium acid to neutral. A brown (10YR 5/3) A2 horizon is present in places, but it generally is destroyed by plowing.

The B&A horizon ranges from brown (10YR 5/3) to dark-brown (10YR 4/3) loam to heavy silt loam and from very pale brown (10YR 7/3) to light-gray (10YR 7/2) dry silt that has very fine sand coatings on the faces of peds. These coatings range to as much as 4 millimeters in thickness.

The Bt horizon ranges from dark grayish brown (2.5Y 4/2) to reddish brown (5YR 5/3), and has common to many high-chroma mottles and a few low-chroma mottles below a depth of 20 inches. Chroma 2 in the Bt horizon is inherited from the dark-gray shale and is not a result of poor drainage. The Bt horizon is loam to heavy silt loam. Reaction in the Bt horizon ranges from slightly acid to moderately alkaline, and most commonly is neutral.

The C horizon ranges from dark grayish brown (2.5Y 4/2) to dark reddish gray (5YR 4/2). It is firm or very firm, moderately alkaline (calcareous) fine sandy loam, loam, or silt loam glacial till.

Lima soils are closely associated with the well-drained Honeoye soils, the somewhat poorly drained Kendaia soils, and the poorly drained Lyons soils. All formed in similar material.

Lima silt loam, 0 to 3 percent slopes (LtA).—This level or nearly level soil is on hilltops from which water drains slowly or on benches of side hills that receive some runoff from adjacent higher lying soils. Most areas are smaller than 20 acres, but a few areas on broad hilltops are larger than 50 acres.

This soil has a profile similar to the one described as representative of the series, but it is slightly wetter and has distinct, bright-colored mottles in the upper part of the subsoil in most places. Included in mapping are small areas of Kendaia soils in shallow depressions and drainageways. These somewhat poorly drained soils make up as much as 15 percent of some areas, and they delay tillage and harvesting unless drained.

This soil is suited to crops, pasture, and trees. It is well suited to most crops commonly grown in the county, especially if the included wet spots are drained. Erosion is not a problem on this soil. Capability unit IIw–3; woodland suitability group 2o1.

Lima silt loam, 3 to 8 percent slopes (LtB).—This soil is gently sloping. It mainly has slopes of 3 to 5 percent, and individual slopes are uniform and smooth. Larger areas are on broad hilltops. Most areas are smaller than 30 acres, but a few areas are larger than 100 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of somewhat poorly drained Kendaia soils in shallow depressions and drainageways. These wetter soils make up as much as 10 percent of some areas, and they delay tillage and harvesting unless drained. Also included are areas of Honeoye soils on small convex knolls, but these have little effect on use and management.

This soil is suited to crops, pasture, and trees. It is well suited to most crops commonly grown in the county, especially if the included wet soils are drained. If this soil is used intensively for row crops, erosion is a problem, especially on the longer slopes and where runoff water concentrates. Crops on this soil respond very well to good management. Capability unit IIe–6; woodland suitability group 2o1.

Lockport Series

The Lockport series consists of moderately deep, somewhat poorly drained, moderately fine textured soils that formed in residuum of mixed glacial till and residuum of soft, red clay shale, similar to the underlying bedrock. These soils are on relatively low uplands where relief is influenced by the underlying bedrock.

In a representative profile the surface layer is dusky-red silty clay loam 9 inches thick. Between depths of 9 and 30 inches, the subsoil is mottled, weak-red, very firm, plastic and sticky silty clay. Between depths of 30 and 36 inches, the substratum is weak-red, very firm shaly silty clay. Below a depth of 36 inches and extending to a depth of 50 inches or more is dusky-red, soft clay shale bedrock that has greenish-gray streaks along vertical cracks.

Lockport soils have a seasonal high water table at a depth of 6 to 12 inches. It is perched on the slowly permeable or very slowly permeable subsoil and substratum. Root growth is limited mainly to the upper 18 to 24 inches of soil by wetness, and roots are mostly along cracks in the subsoil. Available water capacity is moderate. Lockport soils receive runoff and seepage from adjacent higher lying soils, so crops are less severely damaged by drought than associated, better drained soils. Lockport soils clod readily, especially if they are plowed when too wet or too dry. Satisfactory seedbeds are difficult to establish. Infiltration and permeability in this soil are slow or very slow, and erosion is a hazard on the gentle slopes, especially where runoff is received from adjacent higher lying soils. The capacity of these soils to supply nitrogen and phosphorus is medium, and the capacity to supply potassium is high. Heavy texture and wetness limit root growth, so plants cannot fully utilize the soil's natural fertility, and they respond only moderately well to fertilizer. Areas that have been drained are moderately well suited to crops and

pasture. Wetness, slow permeability and very slow permeability of the subsoil, and heavy texture are the main limitations for most farm and nonfarm uses.

Representative profile of Lockport silty clay loam from an area of Lockport and Brockport silty clay loams, 0 to 6 percent slopes, in an idle, formerly cultivated field in the town of Clay, 75 feet east of Wetzel Road, 800 feet north of Buckley Road:

Ap—0 to 9 inches, dusky-red (2.5YR 3/2) silty clay loam, pale red (2.5YR 6/2) dry; moderate, fine, angular blocky structure; firm, sticky; many fine roots; few pores; 3 percent coarse fragments; neutral; abrupt, smooth boundary.

B2t—9 to 30 inches, weak-red (10R 4/3) silty clay; few, fine, distinct gray and yellowish-red mottles; strong, coarse, prismatic structure parting to moderate, medium and coarse, angular blocky; very firm, plastic and very sticky; many fine roots along prism faces at top, decreasing to few at bottom; few roots along block faces; common pores; clay linings in medium and large pores; thick, weak-red (10R 5/2) clay films on prisms and ped faces; 2 percent coarse fragments; neutral; clear, wavy boundary.

C—30 to 36 inches, weak-red (10R 4/4) shaly silty clay; moderate, thick, platy structure; very firm, plastic; few fine roots; common fine and medium pores; patchy, light greenish-gray (5GY 7/1) clay linings in medium pores; thick clay films on plate faces; 25 percent shale fragments; mildly alkaline; clear, smooth boundary.

R—36 to 50 inches, dusky-red (10R 3/4) clay shale bedrock; weathered vertical cracks 1 to 4 feet apart that have greenish-gray (5GY 6/1) streaks, 1/4 to 1 inch wide, in rock along each side of cracks; shale soft enough to be cut with knife, mildly alkaline in upper part, moderately alkaline (weakly calcareous) at depth of 48 inches.

The solum ranges from 18 to 36 inches in thickness. Depth to bedrock ranges from 20 to 40 inches. Content of coarse fragments, dominantly shale but including sandstone and limestone, ranges from 0 to 35 percent by volume in the solum, and the largest amounts of fragments are near the bedrock.

The Ap horizon ranges from dusky red (2.5YR 3/2) to grayish brown (10YR 5/2). Reaction in the A horizon ranges from medium acid to neutral. An A2 horizon is present in places where not destroyed by plowing. It ranges from grayish brown (10YR 5/2) to weak red (10R 5/4) and contains common to many distinct mottles.

The B horizon has hues of 10R to 5YR, values of 4 and 5, and chromas of 3 to 6. Mottles in the B horizon are commonly masked by red and range from few to many. They are high- and low-chroma mottles. Ped faces in this horizon are coated with clay films that have chroma of 2 or less. Texture of the fine-earth fraction of the B horizon ranges from silty clay to clay. Reaction in the B horizon ranges from slightly acid to moderately alkaline.

The C horizon, if present, is weathered shale fragments ranging from dusky red to reddish brown in color and from clay loam to clay in texture of the fine-earth fraction. Reaction in the C horizon ranges from mildly alkaline to moderately alkaline. Bedrock is soft red shale, readily penetrated with a spade, but it contains thin layers of hard sandstone, limestone, and dolomite in places.

Lockport soils are mapped only in an undifferentiated group with Brockport soils. Lockport soils are red and Brockport soils are gray; otherwise, they are very similar. Other common associates are the moderately well drained Lairdsville soils that formed in similar material.

Lockport and Brockport silty clay loams, 0 to 6 percent slopes (LvB).—This undifferentiated group consists of nearly level and gently sloping Lockport and Brockport silty clay loams. Areas consist of one or the other of these soils, or both. Both soils have the profile described as representative of their respective series. They are similar in all major features except color. The Lockport soil has reddish color that is inherited from red shale, and the Brockport soil has colors of gray or greenish gray that are inherited from the underlying shale. The underlying shale is interbedded in many areas. These soils are on uplands where the relief is affected by the underlying shale bedrock. They are in flats where runoff is slow or on gently sloping areas where runoff accumulates. Individual areas are irregular in shape or long and narrow, and are smaller than 10 acres to larger than 20 acres.

Included with these soils in mapping are small areas of similar but better drained Lairdsville soils. They are on slight rises and slopes where runoff is more rapid or does not accumulate to the degree that it does on Lockport and Brockport soils.

The soils of this group are suited to crops, pasture, and trees. Seasonal wetness is one of the major limitations to farming. Erosion is a hazard on the more sloping areas if they are cultivated and not protected. If undrained, the soils are better suited to hay and pasture crops of water-tolerant grasses and legumes than to most other uses. If adequately drained, they are suited to short-season crops. Because of the slowly permeable or very slowly permeable subsoil, drainage generally is difficult to establish, especially on the flatter areas. These soils clod or puddle readily if tilled at the wrong moisture content. Capability unit IIIw–4; woodland suitability group 3w1.

Lordstown Series

The Lordstown series consists of moderately deep, well-drained, medium-textured soils. These soils formed in thin deposits of glacial till or congelifractate derived mainly from the underlying sandstone, siltstone, and shale bedrock. They are on uplands where relief is influenced by the bedrock, and are at the highest elevations, generally above 1,500 feet.

In a representative profile the surface layer is dark-brown channery silt loam 5 inches thick. Between depths of 5 and 15 inches, the upper part of the subsoil is brown and dark-brown, friable channery silt loam. Between depths of 15 and 22 inches, the lower part of the subsoil is friable, dark grayish-brown channery silt loam that rests on fractured gray shale and siltstone bedrock. The bedrock, at a depth of 39 inches, is massive gray sandstone.

In a few places Lordstown soils have a seasonal high water table that is perched in the 2- to 3-inch zone above the bedrock. In other places the water table in the bedrock generally is at a depth of many feet. The root zone consists mainly of the 20 to 40 inches of moderately permeable soil over the bedrock. In places a few roots penetrate the upper part of the fractured bedrock layer. These soils have moderate available water capacity. Where slope permits, the soils are suited to early tillage and grazing in spring. Their capacity to supply nitrogen, potassium, and phosphorus is medium. Unlimed areas are strongly acid or very strongly acid. Depth to bedrock is one of the major limitations for many nonfarm uses.

Representative profile of Lordstown channery silt loam, sloping, in an idle field in the town of Fabius, Highland Park, 50 feet south of Arab Hill Road, 1,760 feet east of the intersection of Kenyon Hollow Road:

Ap—0 to 5 inches, dark-brown (10YR 3/3) channery silt loam; weak, fine and medium, granular structure; very friable; many roots; 20 percent coarse fragments, 2 percent larger than 2 inches in diameter; strongly acid; abrupt, smooth boundary.

B21—5 to 10 inches, brown (7.5YR 4/4) channery silt loam; weak, fine, and medium, granular structure; friable; many pores; common roots; 20 percent coarse fragments, 2 percent larger than 3 inches in diameter; strongly acid; clear. wavy boundary.

B22—10 to 15 inches, dark-brown (10YR 3/3) channery silt loam; weak, fine and medium, granular structure; friable; many pores; common roots; 25 percent coarse fragments, 5 to 10 percent larger than 3 inches in diameter; medium acid; clear, wavy boundary.

B3—15 to 22 inches, dark grayish-brown (10YR 4/2) channery silt loam; weak, fine, subangular blocky structure; friable; many pores; thin, patchy clay films in larger pores; few roots; 30 percent coarse fragments, 25 percent larger than 3 inches in diameter; strongly acid; clear, wavy boundary.

R—22 inches, fractured gray shale and siltstone bedrock interspersed with some brown (10YR 4/3) silty fines; few roots; gradual, wavy boundary to massive gray sandstone bedrock below depth of 39 inches; strongly acid.

The solum ranges from 20 to 36 inches in thickness. Depth to bedrock ranges from 20 to 40 inches. Content of coarse fragments averages 15 to 35 percent in the solum. These are mostly flat angular stone fragments and flagstones. Some subhorizons contain more than 35 percent coarse fragments, but the average is less than 35 percent.

The Ap horizon ranges from grayish brown (10YR 5/2) to very dark brown (10YR 3/3). The A1 horizon in undisturbed areas ranges from black (10YR 2/1) to very dark gray (10YR 3/1). A thin A2 horizon is commonly present. It ranges from 0 to 4 inches in thickness and from light gray (10YR 7/2) to white (10YR 8/1) in color. In unlimed areas reaction in the A horizon is strongly acid to very strongly acid.

The B horizon ranges from brown (7.5YR 4/4) to dark grayish brown (2.5Y 4/2). Texture of the fine-earth fraction of the B horizon ranges from loam to silt loam.

The C horizon, where present, is dark grayish brown (10YR 4/2) to olive (5Y 5/4). Texture of the fine-earth fraction of the C horizon is loam or silt loam and is 20 to 60 percent coarse fragments. Reaction in the C horizon ranges from very strongly acid to medium acid.

Lordstown soils are closely associated with the Arnot soils that are shallow over bedrock, the deep, moderately well drained Mardin soils, and the moderately shallow variant of Mardin soils. All formed in similar material.

Some of the Lordstown soils in Onondaga County have a darker colored B and C horizon than is defined in the range for the series, but this difference does not influence their usefulness or behavior.

Lordstown channery silt loam, sloping (LWC).—This soil is on upland hilltops at higher elevations in the county where relief is affected by the bedrock. Many areas are large, and a few are larger than 100 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Arnot soils where the depth to bedrock is less than 20 inches and areas of Mardin soils where the depth to bedrock is more than 40 inches. Also included are areas of the moderately shallow variant of Mardin and Volusia soils. In places these wetter inclusions delay farming.

This soil is suited to crops, pasture, and trees. Because it is at high elevations, climate limits the selection of crops and the methods of farming. Rooting depth ranges from 20 to 40 inches, and plant growth is generally better in the deeper areas. Flat stone fragments hinder tillage and harvesting in places. Runoff is moderate to rapid on the steeper and longer slopes, and these areas are subject to erosion if cultivated. Capability unit IIIe–3; woodland suitability group 3o1.

Lordstown-Arnot channery silt loams, moderately steep (LXD).—These soils are on the upper parts of hillsides on uplands where bedrock affects the relief. Slopes range from 15 to 25 percent. The complex is about 40 to 60 percent moderately deep Lordstown soils and 25 to 40 percent shallow Arnot soils. Bedrock outcrops are common. Areas are mostly long and narrow and are as large as 50 acres. Included in mapping are small areas of Mardin soils where depth to bedrock is more than 40 inches and areas where bedrock is at a depth of less than 10 inches.

These soils are suited to limited crops, pasture, and trees. The use of modern machinery is difficult and hazardous on these moderately steep slopes. The hazard of erosion is severe if the soils are left without protective cover. Tillage needs to be largely confined to renovation for hay or pasture. Crop response is spotty in places because of the variable depth to bedrock over short distances. Capability unit IVe–3; Lordstown soils in woodland suitability group 3r2 and Arnot soils in woodland suitability group 4d1.

Lyons Series

The Lyons series consists of deep, poorly drained, medium-textured soils that are high in content of lime. These soils formed in calcareous glacial till or in a combination of till and thin, relatively stone-free, surficial alluvial deposits. They are in flats or depressions on uplands where runoff is very slow or where water accumulates.

In a representative profile the surface layer is very dark gray silt loam 7 inches thick. Between depths of 7 and 22 inches, the upper part of the subsoil is mottled, grayish-brown silt loam that is friable to firm. Between depths of 22 and 34 inches, the lower part of the subsoil is mottled, grayish-brown gravelly loam that is friable. Between depths of 34 and 50 inches is a firm, gray, gravelly loam till substratum that is strongly calcareous.

Unless drained, Lyons soils have a prolonged high water table at or near the surface in spring and during wet periods. It is perched on the slowly permeable or very slowly permeable substratum. The subsoil is moderately permeable. These soils, in their natural state, generally cannot support farm machinery before the first of June. Rooting depth is restricted mainly to the upper 12 to 18 inches because of wetness. Available water capacity is high. The capacity of these soils to supply phosphorus and potassium is generally medium. The supply of nitrogen is high; but it is released slowly when the soils are cold and wet, so crops respond well to applications of nitrogen fertilizer. In unlimed areas reaction of the surface layer is medium acid to neutral. Prolonged wetness is the main limitation to farming. Prolonged wetness and the slowly permeable or very slowly

permeable substrata are the major limitations for many nonfarm uses.

Representative profile of Lyons silt loam, in a pasture in the town of Lafayette, 100 feet west of Webb Road, 1,300 feet north of Amidon Road, 3,700 feet north of U.S. Highway 20:

A1—0 to 7 inches, very dark gray (10YR 3/1) silt loam; common, medium, distinct, dark-brown and dark reddish-brown root mottles; moderate, medium, granular structure; friable; many roots; 5 percent coarse fragments; neutral; clear, wavy boundary.

B21g—7 to 11 inches, grayish-brown (10YR 5/2) silt loam; common, medium, distinct yellowish-brown mottles and dark-brown and dark reddish-brown root mottles; moderate, medium, subangular blocky structure parting to moderate, medium, granular; friable; common fine roots; 5 percent coarse fragments; neutral; clear, wavy boundary.

B22g—11 to 22 inches, grayish-brown (10YR 5/2) silt loam; common, fine and medium, distinct yellowish-brown and light-gray mottles; few fine, distinct, dark-brown and dark reddish-brown root mottles; weak, coarse, subangular blocky structure; firm, slightly sticky; few fine roots; common fine and medium pores; 10 percent coarse fragments; neutral; gradual, wavy boundary.

11B3g—22 to 34 inches, grayish-brown (10YR 5/2) gravelly loam; common, medium, distinct yellowish-brown and few, medium, faint gray mottles; weak, medium and coarse, subangular blocky structure; friable; few fine and medium pores; 15 percent coarse fragments; mildly alkaline (weakly calcareous); gradual, wavy boundary.

C—34 to 50 inches, grayish-brown (10YR 5/2) gravelly loam; weak, thick, platy structure; firm; 25 percent coarse fragments; moderately alkaline (strongly calcareous).

The solum ranges from 20 to 40 inches in thickness. Depth to carbonates ranges from 12 to 40 inches. Depth to bedrock is more than 40 inches and is generally more than 6 feet. Content of coarse fragments ranges from 5 to 30 percent between depths of 10 and 40 inches and from 20 to 60 percent below a depth of 40 inches. The upper 10 inches of soil generally formed in local alluvium and is the only part that either is generally free of coarse fragments or is less than 5 percent by volume.

The A1 and Ap horizons range from black (N 2/0) to dark grayish brown (10YR 3/2). In unlimed areas reaction in the A horizon ranges from medium acid to neutral.

The B horizon ranges from olive gray (5Y 4/2) to gray (5YR 6/1) and has higher chroma mottles ranging from few to many. Texture of the fine-earth fraction ranges from fine sandy loam to light clay loam. Reaction in the B horizon ranges from slightly acid to moderately alkaline (calcareous).

The C horizon ranges from dark gray (5Y 4/1) to pinkish-gray (5YR 6/2) with or without higher chroma mottles. Texture of the fine-earth fraction is fine sandy loam, loam, or silt loam that is platy, firm, and moderately alkaline (calcareous).

Lyons soils are closely associated with the somewhat poorly drained Kendaia, Appleton, and Darien soils. All formed in similar material.

Lyons silt loam (Ly).—This level or nearly level soil is in flats or depressions on uplands that receive runoff or seepage from adjacent higher lying soils. Most areas are smaller than 20 acres and only a few areas are larger than 30 acres.

Included with this soil in mapping are small spots of somewhat poorly drained Kendaia, Appleton, Darien, or Manheim soils on slight knolls or around the edges of the mapped area. These better drained soils make up as much as 20 percent of some areas, but they have little effect on use and management. Also included are small spots of very poorly drained Canandaigua soils or Palms muck in depressions or along drainageways generally near the center of larger mapped areas. These wetter soils make up as much as 15 percent of some areas, and they require extensive drainage for crops.

If undrained, this soil is suited to short-season hay crops, pasture, and trees. Only a few undrained areas are used for crops. If adequately drained, this soil is suited to most crops commonly grown in the county, especially annual short-season row crops. This soil responds readily to drainage if adequate outlets are available. Capability unit IVw–3; woodland suitability group 4w1.

Made Land, Chemical Waste

Made land, chemical waste (Ma) consists mainly of bed areas of chemical waste material. It includes both active beds on which waste is deposited and older beds on which vegetation is becoming established.

The waste material is residue from various chemical products. It is pumped as a slurry into diked beds where it is allowed to settle. The clear water or clear solution, which contains sodium chloride and calcium chloride, is then carefully drained off, and the material is consolidated by further drying. The waste beds are gradually built up to a predetermined height by diking with an impervious core material and coating the outside of the dike with gravel and soil material on which vegetation is established. The enclosed area is then filled by pumping in controlled amounts of slurry, which is allowed to settle, drain, and dry.

The fresh waste material is about 50 percent calcium carbonate, 11 percent calcium hydroxide, 11 percent calcium chloride, 9 percent sodium chloride, 5.5 percent silica, 4.5 percent calcium oxide, 4 percent magnesium oxide, 2.5 percent calcium sulfate, and 2 percent aluminum and iron oxides (*6*). Reaction (pH) is generally more than 10.

The residual material in the older beds, after draining and leaching, is about 68 percent calcium carbonate, 1 percent calcium chloride, 11 percent silicon dioxide, 12 percent calcium oxide, 7 percent magnesium oxide, and 2 percent calcium sulfate (*6*). Reaction (pH) is 8.0 to 8.5.

This material has a siltlike texture and has little or no structural development. It is moderately well drained and somewhat poorly drained on the higher terraces and somewhat poorly drained and poorly drained on lower terraces near lake level. These physical conditions are suitable for lime-tolerant plants that can further tolerate somewhat impeded drainage and reduced aeration (*6*). The material is practically devoid of nitrogen, phosphorus, and potassium.

Fertilizer test-plot results indicate phosphorus is most limiting, but the best plant growth is secured by using a complete fertilizer of a 1–2–1 ratio along with such added organic matter as sewage sludge.

Vegetation begins to grow on the beds after 20 to 25 years. This length of time is needed for toxic salts to leach from the top 1 to 2 feet of the beds.

The hazard of erosion and frost heaving on the exposed beds are major factors in preventing establishment of vegetation. After adequate vegetative cover is established, however, these hazards are eliminated or greatly reduced.

Present vegetation on the older beds consists of cottonwood and natural and European black alder trees and wild carrot and sweetclover forbs. All of these have roots at a depth of more than 1 foot. Many kinds of grass and such trees as aspen and white birch have roots at a depth of less than 1 foot.

These areas may have future potential for such open-space uses as parks and golf courses. Part of the older waste-bed area adjacent to the New York State Fair Ground has been developed into a large parking area, which is mainly used at the time of the State Fair. Onsite investigation of areas is necessary to determine use and management needs. Not assigned to a capability unit or woodland suitability group.

Madrid Series

The Madrid series consists of deep, well-drained, moderately coarse textured and medium-textured soils. These soils formed in loamy glacial till fairly high in content of sand. They are on upland till plains and drumlins.

In a representative profile the surface layer is brown to dark-brown fine sandy loam 9 inches thick. Between depths of 9 and 19 inches, the upper part of the subsoil is brown and reddish-brown, friable fine sandy loam. Between depths of 19 and 42 inches, the subsoil is firm, reddish-brown, slightly heavier fine sandy loam. At a depth of 42 inches, the till substratum is reddish-brown to weak-red, firm fine sandy loam. A few gravelly and cobbly fragments are scattered throughout the profile.

Normally the water table in Madrid soils is at a depth of more than 36 inches, but in places it is at a depth of about 36 inches for short periods in spring and during wet periods. It is perched on the moderately slowly permeable or slowly permeable substratum. Roots of deep-rooted plants penetrate readily, but the main rooting zone is in the upper 30 to 40 inches. This zone has moderate to high available water capacity. Plants begin to show signs of wilting after 10 to 15 rainless days. Madrid soils are early to warm up. Their capacity to supply phosphorus is medium, and to supply potassium and nitrogen, low to medium. Most areas need lime. Crops respond very well to fertilization. Madrid soils are among the best soils in the county for many crops, including vegetables. They have few limitations for many nonfarm uses.

Representative profile of Madrid fine sandy loam, 2 to 8 percent slopes, in a grass meadow in the town of Van Buren, 300 feet south of Conners Road, 1,350 feet east of the intersection of Kingdom Road:

Ap—0 to 9 inches, brown to dark-brown (7.5YR 4/2) fine sandy loam; weak, fine and medium, granular structure; very friable; many fine pores; many roots; 5 percent gravel; neutral; abrupt, wavy boundary.

B1—9 to 19 inches, brown (7.5YR 5/4) fine sandy loam, grading with increasing depth to reddish brown (5YR 5/4); weak, fine and medium, granular structure; friable; many fine pores; common roots; 5 percent gravel; neutral; clear, wavy boundary.

B&A'2—19 to 23 inches, reddish-brown (5YR 5/3) fine sandy loam; weak, fine and medium, subangular blocky structure; friable; surrounding areas of slightly darker, reddish-brown (5YR 4/3), slightly heavy fine sandy loam weak, medium and coarse, subangular blocky structure and 1/16- to 1/8-inch-thick coats of pinkish-gray (7.5YR 7/2) fine sandy loam on ped faces; firm; few fine pores; few roots; 5 percent gravel, few cobbles; medium acid; clear, wavy boundary.

B2t—23 to 42 inches, reddish-brown (2.5YR 4/4) fine sandy loam; weak to moderate, coarse, angular blocky structure; firm; thin patchy clay films on ped faces; many pores; nearly continuous clay linings in larger pores; few roots; many black nodules of rotted rock or roots; 5 percent coarse fragments; common, weathered or partly weathered gravel and cobbles; slightly acid; gradual, wavy boundary.

C—42 to 74 inches, reddish-brown (2.5YR 4/4) to weak-red (2.5YR 4/2) heavy fine sandy loam; weak, thick, platy structure with thin, patchy clay films on plate faces; firm; common pores; thin, discontinuous clay linings in larger pores; very few roots; some lenticular bodies of sandy clay loam as much as 4 inches thick and 2 to 3 feet long; 5 percent coarse fragments; common, weathered or partly weathered gravel and cobbles; common black nodules; neutral in upper part, moderately alkaline (calcareous) at a depth of 70 inches.

The solum ranges from 36 to 60 inches in thickness. Depth to carbonates ranges from 36 to 84 inches. Depth to bedrock is more than 40 inches and generally is more than 10 feet. Content of coarse fragments ranges from 5 to 25 percent in the solum below a depth of 10 inches. In places the upper 10 inches of the solum is stone free. Content of coarse fragments ranges from 5 to 35 percent in the C horizon.

The Ap horizon ranges from dark brown to very dark grayish brown. It has hues of 7.5YR to 2.5Y, values of 3 to 5, and chromas of 2 and 3. Texture of the fine-earth fraction ranges from fine sandy loam to loam. In undisturbed areas the A1 horizon ranges from 3 to 8 inches in thickness and is very dark brown and brown to dark grayish brown. It has hues of 7.5YR to 2.5Y, values of 2 to 4, and chromas of 2 and 3. The A2 horizon, where present, has hues of 5YR to 2.5Y, values of 4 to 6, and chromas of 3 and 4. Texture of the fine-earth fraction ranges from fine sandy loam to light loam. In unlimed areas reaction in the A horizons ranges from strongly acid to neutral.

The A horizon distinctly interfingers into the B horizon, resulting in A&B and B&A horizons. In this interfingering zone, washed sand grains that have values of 6 and 7 and chromas of 1 and 2 coat the B-horizon material.

The Bt horizon has hues of 2.5YR, value of 4 and 5, and chromas of 3 and 4. Texture of the fine-earth fraction ranges from fine sandy loam to light loam. Reaction in the B horizon ranges from medium acid to neutral.

The C horizon ranges from weak red to dark grayish brown in hues of 2.5YR to 2.5Y. Texture of the fine-earth fraction is fine sandy loam or loam. Reaction in the C horizon ranges from slightly acid to calcareous in the upper part and is always calcareous below a depth of 84 inches.

Madrid soils are closely associated with the moderately well drained Bombay and Hilton soils and the somewhat poorly drained Appleton soils. All formed in similar material.

Madrid fine sandy loam, 2 to 8 percent slopes (MdB).—This gently sloping or gently indulating soil is on till plains where it receives little or no runoff from adjacent higher lying soils. The slopes are convex in shape. Areas of this soil range from small to large in size, and some areas are larger than 100 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Hilton soils and Bombay soils in shallow depressions or drainageways. These wetter soils make up as much as 10 percent of some areas, and they delay tillage in spring. Also included are a few small areas of Howard soils in small outwash deposits.

This soil is suited to crops, pasture, and trees. It is suited to most crops commonly grown in the county, including vegetables. Crops respond to management

and fertilization. Runoff and hazard of erosion are moderate on the longer slopes if they are farmed intensively, so measures to control erosion are needed for best response. Capability unit IIe–1; woodland suitability group 2o1.

Madrid fine sandy loam, 8 to 15 percent slopes (MdC).—This sloping soil generally is below less sloping areas of Madrid fine sandy loam, from which it receives runoff. Most areas are small, and only a few are larger than 20 acres.

This soil has a profile similar to the one described as representative of the series, but a few cropped areas have a spotty appearance where the surface layer is lighter in color and lower in organic-matter content because of erosion.

Included with this soil in mapping are small areas of Hilton soils at the bases of the slopes or in depressions and drainageways. This wetter soil commonly has surficial deposits of eroded soil material. This deposited soil holds more water and is slow to dry out. These wetter spots delay tillage in spring. Also included are a few small areas of Howard or Palmyra soils on outwash deposits.

This soil is suited to crops, pasture, and trees. Runoff is rapid, and hazard of erosion is severe. If used for crops, this soil needs intensive measures to control runoff and erosion. Capability unit IIIe–2; woodland suitability group 2o1.

Madrid fine sandy loam, 8 to 15 percent slopes, eroded (MdC2).—This sloping soil generally is below less sloping areas of Madrid fine sandy loam, from which it receives a large amount of runoff. This soil has lost from 8 to 20 inches of the original material through erosion in most places. Consequently it holds less water and it is droughty. Most areas of this soil are small, and only a few are larger than 20 acres.

This soil has a profile similar to the one described as representative of the series, but the surface layer is lighter in color and lower in content or organic matter because of erosion. It also has a higher content of gravel and cobbles.

Included with this soil in mapping are small areas of Hilton soils at the bases of slopes or in depressions and drainageways. This wetter soil commonly has deposits of eroded soil material. This deposited soil holds more water and is slow to dry out, so these wetter spots delay tillage in spring.

This soil is suited to limited crops, pasture, and trees. Crop growth generally is variable, and the more severely eroded spots show up as bald areas in fields in many places. Runoff is rapid, and the hazard of further erosion is severe. If it is used for crops, this soils needs intensive measures to control runoff and erosion. This soil generally is better suited to long-term hay or pasture than to most other uses. Capability unit IVe–1; woodland suitability group 2o1.

Madrid fine sandy loam, rolling (MdCK).—This soil is on till plains where slopes are complex or side hills and closely spaced drainageways. Most areas of this soil are small, but a few are larger than 20 acres.

This soil has a profile similar to the one described as representative of the series, but depth to the till substratum is more variable in thickness from place to place.

Included with this soil in mapping are small areas of Hilton soil in depressions and drainageways. This wetter soil makes up as much as 15 percent of some areas, and it delays tillage and harvesting. Also included are small areas of Howard or Palmyra soils on small outwash deposits.

This soil is suited to limited crops, pasture, and trees. Because of the short, complex slopes and hazard of erosion, it is better suited to long-term hay crops than to most other uses. Areas that have been cropped intensively are moderately eroded to severely eroded. The hazard of erosion ranges from severe on the steeper slopes to moderate on the knolls. Eroded material has accumulated in most of the depressions. On many of the cropped fields, the severely eroded spots show up as bald areas. Contour measures to control erosion are difficult or impractical to establish because of the short, complex slopes. Capability unit IVe–1; woodland suitability group 2o1.

Madrid gravelly loam, 2 to 8 percent slopes (MgB).—This gently sloping soil is on smooth or undulating till plains. Slopes are distinctly complex, ranging from short to moderately long. Most areas of this soil are smaller than 30 acres, but a few areas are larger than 100 acres.

This soil has a profile similar to the one described as representative of the series, but it has a gravelly loam surface layer and is slightly more acid throughout the surface layer and subsoil.

Included with this soil in mapping are small areas of Bombay soils in shallow depressions and drainageways. These wetter soils make up as much as 15 percent of some areas, and they delay tillage in spring. Also included are small areas of Alton soils in small gravel deposits.

This soil is one of the best soils in the county for crops, pasture, and trees. It is well suited to most crops commonly grown in the county, including vegetables. In places gravel and cobbles hinder tillage harvesting of some crops. This soil can be tilled early in the season, and crops respond well to management and fertilization. Runoff is moderate on the longer slopes. The hazard of erosion is moderate. Measures to control runoff and erosion are needed in these areas. Random drainage of wet spots is also beneficial in some fields. Capability unit IIe–1; woodland suitability group 2o1.

Madrid gravelly loam, 8 to 15 percent slopes (MgC).—Many of the areas of this sloping soil that have been intensively cultivated are moderately eroded to severely eroded. Slopes are distinctly convex in shape and generally are short. Areas generally are long and narrow on the sides of low hills and drumlins or on the side slopes of moderately deep drainageways. Most areas of this soil are smaller than 20 acres.

This soil has a profile similar to the one described as representative of the series, but it has a gravelly loam surface layer and is more acid throughout the surface layer and subsoil, which are generally slightly thinner.

Included with this soil in mapping are small areas of Bombay soils in depressions or at the bases of the slopes adjacent to drainageways. Also included are small areas of Alton soils on small outwash deposits.

This soil is suited to crops, pasture, and trees. Most areas receive a large amount of runoff from adjacent higher, less sloping areas of Madrid soils. Runoff is rapid, and if the soil is intensively cropped, the hazard of erosion is severe. Most cultivated areas need intensive measures to control runoff and erosion. Capability unit IIIe–2; woodland suitability group 2o1.

Manheim Series

The Manheim series consists of deep, somewhat poorly drained, medium-textured soils that formed in glacial till. The till consists mostly of material derived from very dark gray to black shale and limestone. These soils are on upland till plains.

In a representative profile the surface layer is very dark brown silt loam 8 inches thick. Between depths of 8 and 13 inches, the upper part of the subsoil is dark-brown, friable silt loam that is mottled with dark grayish brown, grayish brown, and dark yellowish brown. Between depths of 13 and 22 inches, the subsoil is very dark brown, friable heavy loam. Between depths of 22 and 36 inches, the subsoil is very dark brown, friable light silty clay loam. Between depths of 36 and 42 inches, the lower part of the subsoil is friable, black gravelly heavy silt loam. The substratum, between depths of 42 and 60 inches, is very dark grayish-brown, friable gravelly silt loam.

Manheim soils have a seasonal high water table at a depth of 6 to 12 inches that persists for a long time in spring and during wet periods. Unless the soil is drained, rooting depth is mainly in the top 18 to 30 inches. Available water capacity of this zone is moderate to high, but more than enough moisture generally is available for plant growth during the growing season. The capacity of these soils to supply phosphorus is medium, and to supply potassium, high. The content of nitrogen is high to medium, but it is released slowly in spring when the soils are cold and wet, so plants respond to applications of fertilizer containing nitrogen. Some areas need lime for best crop response; others do not. Seasonal wetness is the main limitation to farming as well as to many nonfarm uses.

Representative profile of Manheim silt loam, 3 to 8 percent slopes, in an idle, formerly cultivated field in the town of Onondaga, 75 feet south of Howlett Hill Road, 900 feet east of Harris Road:

Ap—0 to 8 inches, very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) crushed, dark grayish brown (10YR 4/2) dry; moderate, fine and medium, granular structure; friable, slightly sticky; many fine roots; 10 percent coarse fragments; slightly acid; abrupt, smooth boundary.

B21—8 to 13 inches, dark-brown (10YR 4/3) silt loam; common, fine, faint dark grayish-brown and grayish-brown mottles and few, medium, distinct dark yellowish-brown mottles; moderate, fine, subangular blocky structure; friable; common fine roots; few coarse pores; very dark brown (10YR 2/2), thin, patchy clay films on ped faces; 10 percent coarse fragments; slightly acid; clear, wavy boundary.

B22t—13 to 22 inches, very dark brown (10YR 2/2) heavy loam, dark grayish brown (10YR 4/2) dry; moderate, medium, subangular blocky structure; friable, slightly sticky; common fine roots; few fine pores that have thin clay linings; thin clay films on ped faces; 10 percent coarse fragments; neutral; clear, wavy boundary.

B23t—22 to 36 inches, very dark brown (10YR 2/2) light silty clay loam; moderate, medium, subangular and angular blocky structure; friable, slightly sticky; common fine roots; few fine and medium pores that have thin clay linings; thin clay films on ped faces, thicker films in occasional indentations on ped faces; 10 percent coarse fragments, mainly semirounded limestone gravel and stone fragments, few fine shale chips; neutral; gradual, wavy boundary.

B3—36 to 42 inches, black (10YR 2/1) gravelly heavy silt loam; few very dark brown (10YR 2/2) rotted shale chips; weak, medium, subangular blocky structure; friable, slightly sticky; very few fine roots; few fine pores that have thin clay linings; 15 percent limestone gravel and fragments; 10 percent black shale chips; neutral; clear, wavy boundary.

C—42 to 60 inches, very dark grayish-brown (10YR 3/2) gravelly silt loam; very weak, thick, platy structure; friable; 20 percent limestone fragments; 10 percent shale fragments; moderately alkaline (calcareous).

The solum ranges from 25 to 45 inches in thickness and commonly corresponds to the depth to carbonates. Depth to bedrock is more than 40 inches. Content of coarse fragments ranges from 5 to 35 percent in the solum and from 10 to 50 percent in the C horizon. The major coarse fragments are limestone, and the secondary fragments are black and very dark gray shale chips.

The Ap and A1 horizons range from black (10YR 2/1) to very dark grayish brown (2.5 3/2). Reaction in the A horizon ranges from medium acid to neutral.

The B2t horizon is loam to light silty clay loam. The B3 horizon, where present, is similar in color and texture to the lower part of the B2t horizon. Reaction in the B horizon ranges from slightly acid to mildly alkaline, but the lower part is weakly calcareous in some places.

The C horizon ranges in color from very dark brown (10YR 2/2) to very dark grayish brown (2.5Y 3/2) and in texture from loam to very stony or very shaly silt loam. Reaction in the C horizon is neutral to moderately alkaline (calcareous) in the upper part and moderately alkaline (calcareous) below a depth of 45 inches. In some places black shale bedrock is at a depth of more than 40 inches.

Manheim soils are closely associated with the moderately well drained and well drained Mohawk soils and the poorly drained Lyons soils. All formed in similar material.

Manheim silt loam, 0 to 3 percent slopes (MhA).—This level or nearly level soil is mainly in long, narrow depressions on the till plains where it receives considerable runoff from adjacent higher lying soils. Most areas are smaller than 20 acres, and only a few are larger than 30 acres.

This soil has a profile similar to the one described as representative of the series, but in many places it has a thicker surface layer because of deposition of soil material from adjacent higher lying soils.

Included with this soil in mapping are small areas of Lyons soils in the lowest depressions and along drainageways. These wetter soils make up as much as 15 percent of some areas, and they delay tillage unless drained. Also included are small areas of Mohawk soils on slight rises and knolls.

Undrained, this soil is suited to short-season crops, pasture, and trees. If adequately drained, it is well suited to many crops commonly grown in the county, especially annual row crops. These drained areas can be used for nearly continuous row crops if they are managed so as to maintain good soil structure. Capability unit IIIw–2; woodland suitability group 3w1.

Manheim silt loam, 3 to 8 percent slopes (MhB).—This soil has gentle slopes that are mainly concave in shape and mainly in the 3- to 5-percent range. The areas generally are long and narrow on foot slopes adjacent to depressions that have a north-south axis.

These areas receive a large amount of runoff from adjacent higher lying, better drained soils. Most areas are smaller than 30 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Mohawk soils on small convex knolls. In some places these Mohawk soils make up as much as 25 percent of the mapped acreage, but have little significance for use and management. Also included are small areas of Lyons soils in the deeper depressions and along drainageways. These wetter soils delay tillage unless they are drained.

This soil is suited to short-season crops, hay, pasture, and trees. If adequately drained, it is well suited to most crops commonly grown in the county. If it is used intensively for row crops, the hazard of erosion is moderate, especially where runoff water from adjacent higher lying soils is allowed to concentrate. This soil, therefore, needs measures to control runoff and erosion in addition to drainage. Capability unit IIIw–2; woodland suitability group 3w1.

Manlius Series

The Manlius series consists of moderately deep, well-drained to excessively drained, medium-textured soils that formed in shaly till similar to the underlying shale bedrock. These soils are on bedrock-controlled landforms on uplands. They are mainly at elevations above 1,500 feet. A few areas where acid shales crop out are below 1,000 feet.

In a representative profile the surface layer is shaly silt loam 7 inches thick. It is dark grayish brown in the upper 4 inches and dark brown in the lower 3 inches. Between depths of 7 and 10 inches, the subsoil is friable, dark-brown shaly silt loam. Between depths of 10 and 19 inches, the subsoil is brown, very friable very shaly silt loam. The substratum, between depths of 19 and 23 inches, is a mass of shale fragments interspersed with coatings and deposits of dark grayish-brown silt loam. The substratum rests on olive-gray and very dark gray soft shale bedrock at a depth of 23 inches.

Normally the water table in Manlius soils is at a depth of more than 36 inches, but in a few places where it is perched above the bedrock, it is at a depth of about 36 inches. These soils are among the earliest in the county to dry out in spring. Most rooting is in the 20- to 40-inch zone above the bedrock. A few roots extend to greater depths along cracks in the rock. The soils are moderately permeable. Available water capacity ranges from low to moderate. The capacity of these soils to supply phosphorus is low to medium, and to supply potassium and nitrogen, low. Manlius soils are acid and need lime for best crop response. Low natural fertility and available water capacity are limitations to farming these soils. Depth to bedrock is a limitation for many nonfarm uses.

Representative profile of Manlius shaly silt loam, 2 to 6 percent slopes, in a formerly cultivated, idle area in the town of Pompey, 100 feet north of Number 1 West Road, 4,160 feet west of Pompey Center Road, and 3,500 feet east of Watervale Road on the east side of the shale pit:

Ap1—0 to 4 inches, dark grayish-brown (10YR 4/2) shaly silt loam; weak, medium and fine, granular structure; friable; many roots; 15 percent fine shale fragments; very strongly acid; clear, smooth boundary.

Ap2—4 to 7 inches, dark-brown (10YR 3/3) shaly silt loam; moderate, medium, granular structure; friable; many roots; 15 percent fine shale fragments; very strongly acid; clear, smooth boundary.

B21—7 to 10 inches, dark-brown (10YR 4/3) shaly silt loam; weak, medium, subangular blocky structure; friable; common roots; many pores; 20 percent shale fragments; very strongly acid; clear, wavy boundary.

B22—10 to 19 inches, brown (10YR 4/3) very shaly silt loam; weak, medium and fine, subangular blocky structure; very friable; common roots; many pores; 40 percent shale fragments; very strongly acid; gradual, wavy boundary.

C—19 to 23 inches, mass of shale fragments that have dark grayish-brown (10YR 4/2) silt loam deposits and films between shale fragments; very weak, fine, granular structure; very friable; few roots; many fine and medium pores in thicker silt deposits; brown (10YR 5/3) silt coats on vertically aligned shale; 90 percent shale fragments; shale is dark olive gray (5Y 3/2) to very dark gray (10YR 3/1) and has weathered edges of yellowish red (5YR 4/6); very strongly acid; gradual, wavy boundary.

R—23 inches, olive-gray (5Y 3/2) and very dark gray (10YR 3/1), soft shale bedrock that can be cut with pick but not spade; dark grayish-brown silt coats on vertical joints and horizontal faces of shale strata decrease with increasing depth. Some shale has weathered edges of dusky red (2.5YR 3/2) and yellowish red (5Y 4/6) in upper part. Shale very strongly acid if pulverized.

The solum ranges from 15 to 30 inches in thickness. Depth to bedrock ranges from 20 to 40 inches. In some places a C horizon is absent, and the solum rests on bedrock. Content of coarse fragments, mainly shale, ranges from 15 to 35 percent in the Ap horizon, generally increases with increasing depth, and makes up 35 to 60 percent of the lower part of the B horizon.

The A1 and Ap horizons have hues of 10YR to 2.5Y, values of 3 and 4, and chromas of 1 to 3. In unlimed areas reaction in the A horizon ranges from very strongly acid to medium acid.

The B horizon has hues of 10YR to 5Y, values of 4 to 6, ranges from silt loam to loam. Reaction in the B horizon is very strongly acid to medium acid.

The C horizon has hues of 10YR to 5Y, values of 3 to 5, and chromas of 2 to 4. Texture of the fine-earth fraction between the shale fragments is silt, silt loam, or loam. Reaction in the C horizon ranges from very strongly acid to medium acid. Content of shale in the C horizon ranges from 50 to 90 percent.

Manlius soils are closely associated with the Lordstown soils at higher elevations and Aurora soils at lower elevations. They formed in soft shale and are dryer and shalier than Lordstown soils. They are better drained and more acid than Aurora soils.

Manlius shaly silt loam, 2 to 6 percent slopes (MnB).—This gently sloping soil is on broad, convex hilltops. Areas range from 10 to 40 acres in size. It has the profile described as representative of the series. Included in mapping are small areas of somewhat poorly drained Volusia soils in shallow depressions where water accumulates. These wetter soils make up as much as 10 percent of some areas, and they delay tillage in spring unless drained.

This soil is suited to crops, pasture, and trees. Most areas are at about 1,300 feet elevation and are forested or reforested. Because of the elevation, cropped areas are better suited to short-season crops than to most other uses. The hazard of erosion is moderate. If this soil is used for row crops, measures are needed to control erosion and runoff. Capability unit IIIe–3; woodland suitability group 3o1.

Manlius shaly silt loam, 6 to 12 percent slopes (MnC).—Many of the larger areas of this sloping or rolling soil are on smooth hilltops where slopes are distinctly convex. Some of the smaller areas are rolling and have short, complex slopes between depressions and closely spaced drainageways. Erosion on this soil ranges from none to slight in forest and in unplowed pastures and ranges to severe in cultivated fields. Many of the severely eroded areas have numerous gullies that have cut into the shale bedrock. Areas range from small to large in size, and a few areas are larger than 50 acres.

This soil has a profile similar to the one described as representative of the series, but the depth to bedrock is more variable from place to place.

Included with this soil in mapping are small areas of Arnot and Farmington soils where the depth to bedrock is less than 20 inches. These shallow soils make up as much as 20 percent of some areas, especially those that have been severely eroded. They are very droughty and affect crop growth. Also included are bedrock outcrops and small areas of Lordstown soils where strata of harder sandstone rock are interbedded in the shale. A few small areas of Volusia soils are included in depressions and along drainageways. These wetter soils make up as much as 5 percent of some areas, and they delay tillage unless drained.

This soil is suited to crops, pasture, and trees. Runoff is rapid, and the hazard of erosion is severe. If this soil is used for crops, intensive measures to control erosion and runoff are needed. Most of this soil that is at elevations above 1,500 feet and that was cropped is now abandoned or has been reforested. Capability unit IIIe–3; woodland suitability group 3o1.

Manlius shaly silt loam, 12 to 18 percent slopes (MnD).—This moderately steep soil is commonly on side slopes that receive runoff from gently sloping or sloping Manlius soils. Many areas of this soil have smooth, convex slopes; other areas are cut by numerous closely spaced drainageways and have short, complex slopes. Areas of this soil range from small to large in size, and a few areas are larger than 50 acres.

This soil has a profile similar to the one described as representative of the series, but it is more variable in thickness to bedrock, and rock outcrops are common. Included in mapping are small areas of Arnot or Lordstown soils where hard strata of acid sandstone bedrock are interbedded in the soft shale. These soils make up as much as 20 percent of some areas, but they have little significance for use and management.

This soil is suited to hay, pasture, and trees. Runoff is very rapid. If this soil is used for hay and pasture, measures to control erosion and runoff are needed. Where this soil is severely eroded, vegetation generally is thin and sparse, especially on west-facing slopes. In these severely eroded areas, hay and pasture production generally is poor even if the soil has been limed and heavily fertilized. Tree growth on these eroded areas, where reforested, is also generally slow. Capability unit IVe–3; woodland suitability group 3r2.

Mardin Series

The Mardin series consists of deep, moderately well drained, medium-textured soils that formed in glacial till. The till is high in content of gray sandstone, siltstone, and shale. These soils are on uplands at elevations above 1,400 feet.

In a representative profile the surface layer is very dark grayish-brown channery silt loam 4 inches thick. Between depths of 4 and 12 inches, the upper part of the subsoil is friable, dark yellowish-brown channery silt loam. Between depths of 12 and 17 inches, the subsoil is firm, mottled, light olive-brown channery silt loam. Between depths of 17 and 21 inches is a leached layer of firm, mottled, grayish-brown very channery silt loam. Between depths of 21 and 58 inches, the lower part of the subsoil is a dense, firm and brittle fragipan of mottled, dark grayish-brown very channery silt loam. The substratum, between depths of 58 and 72 inches, is very firm, dark grayish-brown very channery silt loam that is weakly calcareous.

Mardin soils have a seasonal high water table at a depth of 15 to 24 inches. It is perched on the slowly permeable or very slowly permeable fragipan. Rooting depth is confined mainly to the 15 to 24 inches of soil above the fragipan. The available water capacity of this zone is moderate to high. The capacity of these soils to supply phosphorus, potassium, and nitrogen is generally medium. In unlimed areas reaction in the surface layer is strongly acid to medium acid. Seasonal wetness and the limited root zone above the pan are the main limitations to farming these soils. Seasonal wetness and slow permeability or very slow permeability of the fragipan and substratum are the major limitations for many nonfarm uses.

Representative profile of Mardin channery silt loam, 8 to 15 percent slopes, in a formerly cultivated, reforested area in the town of Fabius, Highland Park, 300 feet north of Arab Hill Road, 200 feet east of Kenyon Hollow Road:

Ap—0 to 4 inches, very dark grayish-brown (10YR 3/2) channery silt loam, dark brown (10YR 3/3) rubbed; weak, fine and medium, granular structure; friable; many fine roots; 20 percent angular stone fragments; strongly acid; abrupt, smooth boundary.

B21—4 to 12 inches, dark yellowish-brown (10YR 4/4) channery silt loam; weak, medium and fine, granular structure; friable; common fine roots; 20 percent angular stone fragments; strongly acid; gradual, wavy boundary.

B22—12 to 17 inches, light olive-brown (2.5Y 5/4) channery silt loam; many, medium, distinct dark yellowish-brown (10YR 4/4) and strong-brown (7.5YR 5/6) and few, fine, faint grayish-brown (2.5Y 5/2) mottles; weak, fine, subangular blocky structure; firm, slightly sticky; few fine roots; 25 percent angular stone fragments; strongly acid; clear, wavy boundary.

IIA'2—17 to 21 inches, grayish-brown (2.5Y 5/2) very channery silt loam; many, medium and coarse, prominent strong-brown (7.5YR 5/8) and medium, faint light-gray to gray (10YR 6/1) mottles; weak, thick, platy structure; firm, slightly sticky; many fine and medium pores; few fine roots; 40 percent shale and angular stone fragments; strongly acid; clear, wavy boundary.

IIB'x1—21 to 39 inches, dark grayish-brown (2.5Y 4/2) very channery silt loam; many, medium, distinct dark

yellowish-brown (10YR 4/4) and gray (5Y 5/1) mottles; moderate, very coarse (16 to 18 inches wide) prismatic structure parting to weak, very thick, platy; firm, brittle; prisms separated by 1/4- to 1/2-inch-wide, friable silt that has light-gray (5Y 6/1) centers and strong-brown (7.5YR 5/8) borders; few fine roots in silt between prisms; common fine and medium pores; 40 percent stone and shale fragments; medium acid; clear, wavy boundary.

IIB'x2—39 to 58 inches, dark grayish-brown (2.5Y 4/2) very channery silt loam; few, fine, faint light olive-brown (2.5Y 5/4) and yellowish-brown (10YR 5/4) mottles; weak, thick, platy structure; firm, brittle; few fine and medium pores; few, thin, patchy clay films on plate faces and in larger pores; 50 percent angular stone fragments; neutral; gradual, wavy boundary.

IIC—58 to 72 inches, dark grayish-brown (2.5Y 4/2) very channery silt loam; weak, platy structure; very firm; 50 percent angular stone fragments; moderately alkaline (weakly calcareous).

The solum ranges from 40 to 60 inches in thickness where depth to bedrock is more than 60 inches. Depth to the Bx horizon ranges from 15 to 24 inches. Depth to bedrock is more than 40 inches and commonly is more than 10 feet. Content of coarse fragments ranges from 10 to 30 percent in horizons above the Bx horizon and from 20 to 60 percent in the Bx and C horizons. The coarse fragments are small, flat, angular stone fragments, flagstones, gravel, stones, boulders, and shale fragments.

The Ap horizon has hues of 2.5Y to 10YR, values of 3 to 5, and chromas of 2 and 3. Undisturbed soils have an A1 horizon 2 to 5 inches thick that has hues of 2.5Y to 10YR, values of 2 to 4, and chromas of 1 to 3. In unlimed areas, reaction in the A horizon is strongly acid to medium acid.

The B2 horizon has hues of 2.5Y and 7.5YR, values of 4 and 5, and chromas of 4 to 6. The fine earth is loam or silt loam. In unlimed areas reaction is strongly acid to medium acid.

The A'2 horizon has hues of 10 YR to 2.5YR, values of 5 and 6, and chromas of 2 and 3. High-chroma mottles are present in places. The fine earth is loam or silt loam. Reaction ranges from strongly acid to medium acid.

The Bx horizon has hues of 10YR to 2.5Y, values of 4 and 5, and chromas of 2 to 4. Mottles range from few to many. The fine-earth fraction of the Bx horizon ranges from loam to silt loam. Consistence is firm or very firm and brittle. Reaction of the Bx horizon ranges from medium acid to neutral.

The C horizon is similar to the Bx horizon, but it has mottles that decrease in size and quantity with increasing depth. Reaction of the C horizon is mildly alkaline to moderately alkaline (calcareous).

Mardin soils are closely associated with the somewhat poorly drained Volusia soils and formed in similar material. They are also near the well-drained Lordstown soils and the Mardin soils, moderately shallow variant. Mardin soils are deeper over bedrock than Lordstown soils and Mardin soils, moderately shallow variant.

Mardin channery silt loam, 2 to 8 percent slopes (MoB).—This gently sloping soil is mainly on convex hilltops from which runoff is somewhat slow. A few areas on valley sides accumulate some runoff. Areas of this soil range from less than 10 acres to more than 50 acres in size, and a few areas are larger than 100 acres. Included in mapping are small areas of Volusia soils in shallow depressions and drainageways. These wetter soils make up as much as 15 percent of some areas, and they delay planting in spring.

This soil is suited to crops, pasture, and trees. Slight wetness in places delays planting briefly, and the shorter growing season limits crop selection to some extent. Stone fragments hinder tillage and harvesting in places. The hazard of erosion is slight to moderate if the soil is cultivated and not protected, particularly on the longer slopes. Capability unit IIe–4; woodland suitability group 3o1.

Mardin channery silt loam, 8 to 15 percent slopes (MoC).—Most areas of this sloping soil are on smooth, convex-shaped hillsides that accumulate some runoff from adjacent higher lying soils. A few areas are on rolling hilltops or on hillsides where slopes are short and complex. Areas are variable in size, ranging from less than 10 acres to more than 50 acres, but a few areas are larger than 100 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Volusia soils in depressions and drainageways. Also included are a few small areas of the moderately shallow variant of Mardin, Lordstown, and Manlius soils where bedrock is at a depth of less than 40 inches. Other inclusions are severely eroded areas that have lost from 6 to 12 inches of the original surface layer and have a browner surface layer that has lower organic-matter content and a larger amount of angular stone fragments on the surface. The depth to the fragipan is correspondingly shallower, and runoff generally is rapid; consequently, these severely eroded soils are very droughty.

This soil is suited to crops, pasture, and trees. The hazard of erosion is moderate to severe if it is cultivated and not protected. Slight wetness in places delays planting briefly. Cropped areas, especially those that have long slopes, need intensive measures to control erosion and runoff. Capability unit IIIe–5; woodland suitability group 3o1.

Mardin channery silt loam, 15 to 25 percent slopes (MoD).—This moderately steep or hilly soil is mainly in hillsides and valley sides where slopes are smooth to complex. The complex slopes generally have closely spaced drainageways. A few areas are on hilltops where slopes are short and complex. Most areas of this soil are smaller than 20 acres. A few are larger than 50 acres.

This soil has a profile similar to the one described as representative of the series, but it generally has fewer mottles in the upper part of the subsoil.

Included with this soil in mapping are areas of soils where erosion ranges from slight in unplowed, forested areas to severe on cropped or formerly cropped areas. Also included are small areas of Volusia soils around seep spots and in depressions and a few small areas of the moderately shallow variant of Mardin, Lordstown, and Manlius soils where the depth to bedrock is less than 40 inches.

This soil is suited to crops, pasture, and trees. If it is cropped, it is better suited to long-term hay crops than to most other uses. The steep slopes are hazardous to the use of machinery. Runoff is rapid and the hazard of erosion is severe if the soil is left unprotected. Capability unit IVe–6; woodland suitability group 3r2.

Mardin soils, steep (MPE).—These soils are on hill and valley sides. Slopes range from 25 to 45 percent. Common to many flagstones and boulders are on the surface in places. These soils have a profile similar to the one described as representative of the series, but the subsoil is less mottled, and they are better drained. Included in mapping are small areas of Lordstown or Manlius soils where the depth to bedrock is less than 40 inches.

These soils are suited to pasture or trees. Pasture is generally of low quality because the slopes are too steep for mowing and fertilization. Capability unit VIe-1; woodland suitability group 3r4.

Mardin Series, Moderately Shallow Variant

The Mardin series, moderately shallow variant, consists of moderately deep, moderately well drained, medium-textured soils that have a dense fragipan at a depth of 15 to 24 inches. These soils formed in thin till deposits derived mainly from local sandstone, siltstone, and shale. They are on uplands where the underlying bedrock affects the relief. Elevations are mainly more than 1,700 feet.

In a representative profile the surface layer is channery silt loam 7 inches thick. It is very dark brown in the top 3 inches and very dark grayish brown in the lower 4 inches. Between depths of 7 and 14 inches, the upper part of the subsoil is yellowish-brown to brown, friable channery silt loam. Between depths of 14 and 19 inches is a leached layer of mottled brown, friable channery silt loam. Between depths of 19 and 28 inches, the lower part of the subsoil is a firm, brittle fragipan of mottled, olive-brown channery silt loam. Gray sandstone bedrock is at a depth of 28 inches.

These soils have a seasonal high water table at a depth of 15 to 24 inches that is perched on the very slowly permeable or slowly permeable fragipan. Rooting depth is confined mainly to the upper 15 to 24 inches above the fragipan. This zone has moderate to high available water capacity. The capacity of these soils to supply nitrogen, phosphorus, and potassium is medium. In unlimed areas the reaction of the surface layer is strongly acid to medium acid. Seasonal wetness and the relatively shallow root zone above the fragipan are the principal limitations to farming these soils. Also, the length of the growing season at high elevations generally is a limitation. Seasonal wetness, slow permeability or very slow permeability of the fragipan, and depth to bedrock are limitations for many nonfarm uses.

Representative profile of Mardin channery silt loam, moderately shallow variant, 2 to 6 percent slopes, in a brushy, reforested area in the town of Fabius, 200 feet east of Highland Park Road, 400 feet north of the powerline, 9,000 feet south of State Route 80:

Ap1—0 to 3 inches, very dark brown (10YR 2/2) channery silt loam, very dark grayish brown (10YR 3/2) crushed; moderate, fine, granular structure; very friable; many roots; 20 percent coarse fragments; strongly acid; clear, wavy boundary.

Ap2—3 to 7 inches, very dark grayish-brown (10YR 3/2) channery silt loam, dark brown (10YR 3/3) crushed; moderate, medium, granular structure; friable; many roots; 20 percent coarse fragments; strongly acid; clear, wavy boundary.

B2—7 to 14 inches, yellowish-brown (10YR 5/4) channery silt loam fading to brown (10YR 5/3) at bottom; weak, medium, subangular blocky structure; friable; many roots; many pores; 20 percent coarse fragments; strongly acid; clear, wavy boundary.

A'2—14 to 19 inches, brown (10YR 5/3) channery silt loam; common, medium, distinct yellowish-brown (10YR 5/6) and light olive-brown (2.5Y 5/4) and few, fine, distinct light brownish-gray (2.5Y 6/2) mottles; weak, thin, platy structure; friable; grayish-brown (2.5Y 5/2) silt coats on plate faces; common roots; few fine pores; 25 percent coarse fragments; medium acid; clear, wavy boundary.

B'x—19 to 28 inches, olive-brown (2.5Y 4/4) channery silt loam; common, medium, distinct yellowish-brown (10YR 5/4) and grayish-brown (10YR 5/2) mottles; moderate, very coarse, prismatic structure parting to weak, medium and thick, platy; firm, brittle; prisms separated by 1/2- to 3/4-inch wide silt streaks that have centers of grayish brown (2.5Y 5/2) and borders of strong brown (7.5YR 5/6); few fine roots along prism faces; few fine and medium pores in prisms with patchy clay linings in larger pores; 30 percent coarse fragments; medium acid at top, slightly acid at bottom; abrupt, wavy boundary.

R—28 inches, gray sandstone bedrock that has horizontal strata 1/2 inch to 4 inches thick.

The solum ranges from 20 to 40 inches in thickness and corresponds to the depth to bedrock. Depth to the Bx horizon ranges from 15 to 24 inches. This horizon has a minimum thickness of 2 inches over the bedrock, and it is mainly more than 6 inches thick.

The Ap horizon ranges from very dark grayish brown (2.5Y 3/2) to brown (10YR 5/3). In unlimed areas reaction ranges from strongly acid to medium acid.

The B2 horizon is typically yellowish brown (10YR 5/4 or 5/6), but ranges from light olive brown (2.5Y 5/6) to dark brown (7.5YR 4/4). It is silt loam or loam that is 10 to 30 percent coarse fragments. Structure in the B2 horizon is weak, subangular blocky or granular. In unlimed areas reaction ranges from strongly acid to medium acid.

The A'2 horizon ranges from grayish brown (10YR 5/2) to light brownish yellow (2.5Y 6/4) with none to common, higher chroma mottles and few, low-chroma mottles in the matrix with chromas higher than 2. It is fine sandy loam to silt loam that is 10 to 30 percent coarse fragments. Structure is weak, platy or blocky, or the material is massive. Consistence of the A'2 horizon is friable or firm and brittle. Reaction is strongly acid or medium acid.

The Bx horizon ranges from dark grayish brown (10YR 4/2) to light olive brown (2.5Y 5/4), and mottles are few or common, faint or distinct. It is loam or silt loam that is 20 to 50 percent coarse fragments. Structure of the Bx horizon is weak or moderate, very coarse, prismatic, with tongues 1/8 to 1 inch wide separating prisms. The material in tongues is silt or very fine sand and is gray or grayish brown with distinct streaks or mottles of strong brown to yellowish brown. Structure is massive inside prisms or is weak, platy, or blocky. Consistence is firm or very firm and brittle. Reaction is medium acid to neutral.

Mardin soils, moderately shallow variant, are closely associated with the somewhat poorly drained Volusia soils, moderately shallow variant, and the well-drained Lordstown soils which formed in similar material. They are also associated with the deep Mardin soils, which formed in deep till.

Mardin channery silt loam, moderately shallow variant, 2 to 6 percent slopes (MrB).—This gently sloping soil is on convex hilltops that receive little or no runoff from adjacent higher lying soils. Elevations are mainly more than 1,700 feet. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of wetter Volusia soils, moderately shallow variant. Also included are areas of well-drained Lordstown soils.

This soil is suited to crops, pasture, and trees. Much of the acreage is reforested. Crop yields are mainly limited by the shallow rooting depth above the fragipan and the shorter growing season at the high elevations. Capability unit IIe-4; woodland suitability group 3o1.

Mardin channery silt loam, moderately shallow variant, 6 to 18 percent slopes (MrC).—This sloping soil is on the upper parts of hillsides that receive

runoff from adjacent higher lying soils. Elevations generally are more than 1,700 feet.

This soil has a profile similar to the one described as representative of the series, but the depth to the fragipan is more variable from place to place. Included in mapping are small areas of well-drained Lordstown soils.

This soil is suited to crops, pasture, and trees. Most of the acreage that has been cleared and used for crops is reforested. Crop suitability is limited by shallow rooting depth above the fragipan and by the shorter growing season at the high elevations. Capability unit IIIe–5; woodland suitability group 3o1.

Martisco Series

The Martisco series consists of very poorly drained, shallow muck deposits over white, gray, or pink, strongly calcareous silty marl. These soils formed in thin organic deposits in marshy depressions where water charged with lime precipitated the underlying marl. They are in marshy depressions on lake plains, outwash plains, and till plains. In some places they are also in depressions on flood plains.

In a representative profile the surface layer is black granular muck 13 inches thick. It is underlain by light brownish-gray, friable marl that extends to depths of more than 40 inches. Common white shell fragments are throughout the marl.

Unless drained, Martisco soils have a prolonged high water table at or near the surface 8 to 10 months of the year. Water generally is ponded for the wettest 6 months of the year. Rooting depth is limited to the mucky surface, and few or no roots penetrate the strongly calcareous marl. This root zone has moderate to high available water capacity. Martisco soils need drainage if used for crops or pasture. If adequately drained, the supply of nitrogen is high in these soils, because the muck oxidizes and releases nitrogen. The capacity to supply phosphorus and potassium is generally low. Martisco soils seldom need lime, and in most places, they contain too much lime, which is toxic to some plants. The principal limitations to farming are wetness, shallowness of the muck, low position that makes drainage outlets difficult to establish, and high lime content of the marl. Prolonged wetness and poor stability are major limitations for many nonfarm uses.

Representative profile of Martisco muck from an area of Martisco and Warners soils in the town of Manlius, 400 feet west of Pools Brook Road, 1,500 feet north of Kinderhook Road, in a stand of northern white-cedar:

O21—13 to 6 inches, black (5YR 2/1) decomposed organic material; moderate, medium, granular structure; friable; many roots; 20 percent silt; neutral; abrupt, smooth boundary.

O22—6 inches to 0, black (5YR 2/1) decomposed organic material; weak, coarse, subangular blocky structure parting to weak, coarse, granular; friable; common roots; 5 percent silt; neutral; abrupt, smooth boundary.

C—0 to 40 inches, light brownish-gray (10YR 6/2) marl; massive; friable; common white shell fragments.

The organic surface layer ranges from 8 to 16 inches in thickness. Depth to bedrock is more than 40 inches and generally is more than 10 feet.

The O2 horizon ranges from black (N 2/0 and 5YR 2/1) to very dark brown (10YR 2/2). Structure ranges from weak, fine, granular to moderate, coarse, subangular blocky. Consistence is friable or firm. Reaction of the O2 horizon ranges from slightly acid to moderately alkaline. Content of mineral material ranges from 0 to 60 percent of silt, very fine sand, or fine sand. The organic horizons are commonly continuous vertically, but in some places there are alternating thin strata of organic material and marl.

The C horizon ranges from gray (N 5/0) to white (10YR 8/2). The marl is silt or silt loam. Structure ranges from granular to subangular blocky, or the material is massive. Consistence is friable or firm. Reaction of the C horizon is moderately alkaline (very strongly calcareous). In some places a mineral IIC horizon ranging in texture from silty clay to fine sand is at a depth of more than 40 inches below the organic surface layer. It is massive or single grained. Consistence is loose to firm. In some places the IIC horizon is overlain by a 1- to 6-inch-thick layer of coprogenous earth.

Martisco soils are closely associated with Edwards and Warners soils. All formed in similar material. Martisco soils have thinner deposits of muck over marl than Edwards soils. They have a mucky surface layer instead of the mineral surface layer of the poorly drained and very poorly drained Warners soils.

Martisco and Warners soils (Ms).—This undifferentiated group consists of level Martisco muck and Warners soils. Areas consist of Martisco soils or Warners soils, and a few areas are made up of both soils. These Martisco and Warners soils have the profile described as representative of their respective series. These soils are in low, level areas on slackwater bottom lands and in depressions on lake plains, outwash plains, and till plains. Individual areas are irregular in shape and range from less than 10 acres to more than 50 acres in size. Many of the larger areas are near Cross Lake and along the slackwater bottom lands of the Seneca River and some of the major streams that flow from the limestone formations in the north-central part of the county.

Included with these soils in mapping are small areas of Edwards muck where the muck is more than 16 inches deep over the marl. Also included are small areas of Weaver soils on slightly higher knolls on flood plains or along the borders of streams. These inclusions make up as much as 15 percent of some areas, but they have little effect on use and management.

Most areas of these soils are undrained and are in swamp woods or low-quality pasture, or are idle. Only a few areas are drained and used for crops. The crops are mainly hay or such row crops as corn and snapbeans, which appear able to tolerate the high content of lime. A few areas, however, are used for such muck crops as lettuce and onions. Maintaining a drainage system, reducing the rate of subsidence of the muck, and controlling soil blowing are the main concerns of management on these soils if they are used for crops. Capability unit Vw–1; woodland suitability group 5w1.

Minoa Series

The Minoa series consists of deep, somewhat poorly drained, moderately coarse textured soils that formed in lacustrine or eolian deposits of fine sand and very fine sand. These soils are at intermediate elevations on the lake plains.

In a representative profile the surface layer is very dark grayish-brown fine sandy loam 10 inches thick. Between depths of 10 and 38 inches is a subsoil of

loamy very fine sand. The upper 4 inches is mottled, brown and is very friable. The next 8 inches is mottled, reddish brown and is firm in place, but it is very friable when removed. The lower 16 inches of the subsoil is mottled, grayish brown and is friable, but it also contains two thin 1- and 2-inch bands of mottled, dark-brown fine sandy loam that have firm consistence. The substratum, between depths of 38 and 60 inches, is slightly firm, mottled, light brownish-gray fine sand and very fine sand that has thin bands of brown silt.

In spring and during periods of wetness, Minoa soils have a seasonal high water table that fluctuates to within 6 to 12 inches of the surface through moderately permeable soil layers. If undrained, these soils are generally too wet to be plowed until the middle of May or early in June. Crops respond well to artificial drainage, but the sandy subsoil and substratum layers flow readily if they are saturated, and the sand plugs tile lines and ditches unless preventive measures are used. Unless drained, rooting depth is mainly in the upper 24 to 30 inches. This zone has a moderate to high available water capacity, but generally more than enough water is available during the growing season. The capacity of these soils to supply phosphorus is low to medium; to supply potassium, low; and to supply nitrogen, medium. Most areas of Minoa soils need lime. Wetness is one of the main limitations to farming. Wetness and poor stability are the main limitations for many nonfarm uses.

Representative profile of Minoa fine sandy loam, 0 to 2 percent slopes, in a formerly cultivated, idle field in the town of Manlius, 800 feet east of Fremont Road, 2,050 feet south of the New York State Thruway, 500 feet north of the private road, 900 feet north of Butternut Creek:

Ap—0 to 10 inches, very dark grayish-brown (10YR 3/2) fine sandy loam; weak, medium, granular structure; very friable; many roots; strongly acid; abrupt, smooth boundary.

B21—10 to 14 inches, brown (10YR 5/3) loamy very fine sand; few, fine, distinct dark yellowish-brown and few, fine, faint grayish-brown mottles; very weak, very fine, granular structure; very friable; common roots; many pores; strongly acid; clear, smooth boundary.

B22—14 to 22 inches, reddish-brown (5YR 4/3) loamy very fine sand; many, medium, distinct yellowish-red (5YR 4/6), reddish-gray (5YR 5/2), and dark yellowish-brown (10YR 4/4) mottles; weak, medium, platy structure parting to weak, very fine, subangular blocky; firm in place, very friable when removed; few fine roots; common fine and medium pores; medium acid; clear, smooth boundary.

B3—22 to 38 inches, grayish-brown (10YR 5/2) loamy very fine sand; many, medium, distinct dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6) mottles; very weak, medium, platy structure to massive; friable; few fine roots; few fine pores; 2 bands of lamellae, 1 inch and 2 inches thick, respectively, of dark-brown (10YR 4/3) fine sandy loam; common, fine, distinct grayish-brown and dark yellowish-brown mottles; massive; firm; few fine roots; few medium pores that have patchy clay linings; medium acid; clear, wavy boundary.

C—38 to 60 inches, light brownish-gray (10YR 6/2), weakly stratified very fine and fine sand that has thin bands, 1/4 to 1/2 inch thick, of brown (10YR 5/3) silt; common, medium, distinct yellowish-brown and dark yellowish-brown mottles that decrease in size and number with increasing depth; massive; slightly firm in place, very friable when removed; slightly acid at depth of 40 inches, neutral at depth of 50 inches.

The solum ranges from 26 to 40 inches in thickness. Depth to free carbonates is more than 40 inches and is as much as 72 inches in places. Depth to bedrock is more than 40 inches and generally is more than 10 feet. The solum is generally free of coarse fragments, but contains as much as 5 percent, by volume, in places.

Undisturbed soils have an A1 horizon 3 to 6 inches thick that is very dark grayish brown (10YR 3/2) to black (10YR 2/1). A thin A2 horizon, 1 to 4 inches thick, that has hues of 2.5Y to 5YR, value of 5, and chromas of 2 or 3 is present in places, but is generally destroyed by plowing. The Ap horizon ranges from very dark grayish brown (2.5Y 3/2) to dark reddish brown (5YR 3/2). In unlimed areas reaction ranges from strongly acid to neutral.

The B2 and B3 horizons have hues of 5YR to 2.5Y, values of 4 and 5, and chromas of 2 to 4. Where chroma of the matrix is more than 2, there are few to common, fine and medium mottles that have chroma of 2 or less. Chroma of 2 in the matrix is a result of inherited colors and is not a result of wetness. The B2 and B3 horizons are very fine sandy loam to loamy very fine sand. Reaction in the B horizon ranges from strongly acid to neutral. In places the B2 and B3 horizons contain thin bands or lamellae, but the aggregate total of these bands to a depth of 40 inches is less than 6 inches.

The C horizon is weakly stratified to prominently stratified very fine sand and fine sand, and has thin bands of silt and scattered thin bands of clay below a depth of 40 inches. In some places it contains gravel strata below a depth of 40 inches. Reaction in the C horizon ranges from medium acid to moderately alkaline (calcareous).

Minoa soils are closely associated with the moderately well drained Galen soils and the poorly drained and very poorly drained Lamson soils. All formed in similar material.

Minoa fine sandy loam, 0 to 2 percent slopes (MtA).—This level or nearly level soil is on moderately low parts of lake plains where it receives runoff from adjacent higher lying soils. The most extensive areas are in the town of Lysander. Most areas are smaller than 20 acres, and only a few areas are larger than 50 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Lamson soils in shallow depressions and along drainageways. These wetter soils make up as much as 10 percent of some areas, and they delay tillage unless drained. They are generally more difficult to drain because of a lack of outlets. Also included are a few small areas of Galen soils on slight rises and knolls, but these have little effect on use and management.

Undrained areas of this soil are suited to short-season crops, hay, pasture, and trees. Most undrained areas are in forest or are idle. If adequately drained, this soil is well suited to many crops commonly grown in the county, especially annual row crops. Crops on these drained areas respond well to management and fertilization. Runoff is slow, so water erosion is generally not a hazard, but soil blowing is a hazard on some of the more sandy areas if the surface is left unprotected. Capability unit IIIw–3; woodland suitability group 3w1.

Minoa fine sandy loam, 2 to 6 percent slopes (MtB).—This soil is in moderately low positions on the lake plains where it receives a large amount of runoff and seepage from adjacent higher upland till soils. Slopes are gentle, concave, and are mainly 3 to 4 percent, but a few areas are very gently undulating. Individual areas are irregular in shape and are

mainly less than 10 acres in size, but a few areas are larger than 30 acres.

This soil has a profile similar to the one described as representative of the series, but it is generally slightly better drained and has a lighter colored surface layer that is lower in content of organic matter.

Included with this soil in mapping are small areas of Galen soils on convex knolls. These moderately well drained soils make up as much as 20 percent of some areas, but they have little effect on use and management. Also included are a few small areas of Lamson soils in depressions and along narrow drainageways. These wetter soils make up as much as 10 percent of some areas, and they delay tillage unless they are drained.

Undrained areas of this soil are suited to short-season crops, hay, pasture, and trees. If adequately drained, the soil is suited to many crops commonly grown in the county, especially annual row crops. The hazard of erosion is moderate, especially where runoff water from higher areas concentrates. The hazard of soil blowing is moderate on the sandier areas if the surface is left unprotected. In addition to drainage, measures to control soil blowing and water erosion are needed. Crops respond well to management and fertilization. Capability unit IIIw–3; woodland suitability group 3w1.

Mohawk Series

The Mohawk series consists of deep, well drained to moderately well drained, medium-textured soils that have a high content of lime. These soils formed in glacial till high in content of soft, black to very dark grayish-brown shale and limestone. They are on convex-shaped uplands where they receive little or no runoff from adjacent higher lying soils.

In a representative profile the surface layer is very dark grayish-brown silt loam 8 inches thick. Between depths of 8 and 40 inches, the subsoil is silt loam. Between depths of 8 and 11 inches, it is brown; between 11 and 19 inches, it is dark grayish brown; and between 19 and 40 inches, it is very dark grayish brown. The subsoil is friable to a depth of 30 inches and firm below. The substratum, beginning at a depth of 40 inches, is firm, dark grayish-brown silt loam that contains many black shale fragments and extends to a depth of 60 inches or more.

Mohawk soils have a seasonal high water table at a depth of 15 to 25 inches that is perched on the slowly permeable or very slowly permeable substratum. This seasonal high water table, however, is at a depth of 36 inches or more in some of the better drained areas. The main rooting depth in Mohawk soils is in the top 30 to 36 inches, but a few roots extend into the firm, dense substratum. The available water capacity in this rooting zone is high. In a few areas stones and gravel in the surface layer hinder tillage and harvesting.

Mohawk soils are suited to most crops commonly grown in the county. Lime needs in most areas are none to slight. The supply of nitrogen is medium, and most plants respond to nitrogen fertilizer added early in spring. The capacity of these soils to supply potassium is high and to supply phosphorus, medium.

Representative profile of Mohawk silt loam, 2 to 8 percent slopes, in a cultivated area in the town of Onondaga, 1 mile south of Howlett Hill Road, 100 feet east of Cedarvale Road, 100 yards south of the large dairy barn near the crest of the broad hill trending northwest-southeast:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; strong, medium and fine, granular structure; friable; many roots; 5 percent coarse fragments; slightly acid; clear, smooth boundary.

B1—8 to 11 inches, brown (10YR 5/3) silt loam, pale brown (10YR 6/3) dry, moderate, fine, subangular blocky structure; friable; many, fine, tubular, vertical pores; many fine and common medium roots; dark-brown (10YR 4/3) coats on peds, peds have distinct pressure faces; many earthworm channels; 5 percent coarse fragments; slightly acid; gradual, wavy boundary.

B21—11 to 19 inches, dark grayish-brown (10YR 4/2) silt loam, strong, fine, subangular blocky structure; friable; very dark grayish-brown (10YR 3/2) and very dark gray (10YR 3/1) coats on peds; many fine roots penetrate peds; many fine pores have thin clay linings; 10 percent coarse fragments; neutral; diffuse boundary.

B22t—19 to 30 inches, very dark grayish-brown (10YR 3/2) shaly heavy silt loam; moderate, medium, subangular blocky structure parting under slight pressure to strong, fine, subangular blocky; friable; very dark gray (10YR 3/1) coats on peds, ped interiors dark brown (10YR 4/3) and dark grayish brown (10YR 4/2); common, black (10YR 2/1), soft shale fragments; common thin clay films; many, fine, vertical, tubular pores that have smooth interiors; common fine and few coarse roots; 20 percent coarse fragments; neutral; clear, wavy boundary.

B3—30 to 40 inches, very dark grayish-brown (10YR 3/2) shaly heavy silt loam; moderate, medium, angular blocky structure arranged in weak plates; firm; very dark gray (10YR 3/1) coats on peds; thin, patchy clay films; dark grayish-brown (10YR 4/2) interiors of peds; common, black (10YR 2/1), soft shale fragments; few coarse roots; 20 percent coarse fragments; mildly alkaline (calcareous); diffuse boundary.

C—40 to 60 inches, dark grayish-brown (10YR 4/2) shaly loam containing many black (10YR 2/1) shale fragments; weak, thick, platy structure; firm, the whole crushes to very dark grayish-brown (10YR 3/2) silt loam; 25 percent coarse fragments; coarse roots extend below depth of 45 inches; moderately alkaline (calcareous).

The solum ranges from 24 to 45 inches in thickness. Depth to carbonates ranges from 20 to 60 inches. Depth to bedrock is more than 40 inches and generally is more than 6 feet. Dark or very dark inherited colors associated with dark-colored shale dominate the entire profile and are not a result of wetness. Content of friable shale fragments, part of which disperse upon mechanical analysis, ranges from 5 to 15 percent in the upper horizons to 10 to 25 percent in the lower part of the B horizon in places. Content of hard gravel and stones ranges from 0 to 20 percent in the solum.

The Ap horizon is black (10YR 2/1) to very dark grayish brown (2.5Y 3/2). Reaction is medium acid to neutral.

The B horizon is dark grayish brown (2.5Y 4/2) to brown (10YR 5/3) in the upper part and very dark grayish brown (2.5Y 3/2) to brown (10YR 4/3) in the lower part. It is mostly loam or silt loam, but subhorizons in places are fine sandy loam or silty clay loam. The B horizon has moderate or strong, fine to coarse, subangular or angular blocky structure. Thin clay films range from 0 to 20 percent of ped faces in the upper part and from 10 to 40 percent in the lower part. Consistence in the B horizon is friable, very friable, or firm. Reaction is medium acid to mildly alkaline.

The C horizon ranges from very dark grayish brown (2.5Y

3/2) to dark grayish brown (10YR 4/2). It is massive or has platy structure. Reaction ranges from neutral to moderately alkaline. Content of coarse fragments ranges from 15 to 50 percent.

Mohawk soils are closely associated with the somewhat poorly drained Manheim soils and formed in similar material. They are near the well-drained Honeoye soils, the moderately well drained Lima soils, and the well-drained Palatine soils. They are darker in color than Honeoye and Lima soils. They are deeper to bedrock and have a finer texture than Palatine soils.

Mohawk silt loam, 2 to 8 percent slopes (MwB).—This gently sloping soil is on convex-shaped hilltops where slopes are mostly smooth, but a few are gently undulating. Most areas of this soil receive little or no runoff from adjacent higher lying soils. Individual areas are long and generally are narrow or moderately narrow and have a north and south axis. Areas are smaller than 10 acres to larger than 50 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of somewhat poorly drained Manheim soils in shallow depressions and along narrow drainageways. These wetter soils make up as much as 15 percent of some areas, and they delay tillage in spring unless they are drained. Also included are small areas of Palatine soils where bedrock is at a depth of less than 40 inches, but these soils have little effect on use and management. Other inclusions are small areas of Honeoye and Lima soils where the dark colors grade to lighter brown, but these inclusions also have little effect on use and management.

This soil is suited to crops, hay, pasture, and trees. If used intensively for row crops, measures are needed to control runoff and erosion, and other management practices are needed to maintain content of organic matter and surface soil structure. Capability unit IIe–1; woodland suitability group 2o1.

Mohawk silt loam, 8 to 15 percent slopes (MwC).—This sloping soil is on hillsides where slopes are short, convex, and generally smooth. Individual areas are long and narrow and have a north-south axis. Most areas are smaller than 20 acres, and only a few are larger than 30 acres. Erosion on this soil is variable, ranging from none to slight in forest and unplowed pastures to moderate and severe in cultivated areas. In the moderately eroded to severely eroded cultivated areas, the surface layer is slightly heavier and is generally lower in content of organic matter.

This soil has a profile similar to the one described as representative of the series, but it generally is thinner to the firm, glacial till substratum.

Included with this soil in mapping are small areas of Manheim soils in seep spots and wet spots on sidehills. These wetter soils make up as much as 5 percent of some areas, and they delay tillage unless they are drained. Also included are a few small areas of Palatine soils where the black shale bedrock is near the surface. These shallow soils make up as much as 5 percent of some areas, but they have little effect on use and management. Other inclusions are small areas of Honeoye soils where the blacker shale is intermixed with gray shale.

This soil is suited to crops, hay, pasture, and trees. If it is used for row crops, it needs intensive measures to control runoff and erosion. Where this soil is severely eroded, it needs extra nitrogen and practices to help improve soil structure and increase content of organic matter. Capability unit IIIe–2; woodland suitability group 2o1.

Mohawk silt loam, 15 to 25 percent slopes (MwD).—This moderately steep soil is on hillsides where slopes are convex, smooth, and generally short. Individual areas generally are long and narrow and have a north-south axis. Most areas range from 2 to 10 acres in size, but a few areas are larger than 30 acres. Where this soil has been cropped, it generally is moderately eroded or severely eroded. The severely eroded areas generally have a surface layer that is slightly heavier and lower in content of organic matter, and they have more stones and shale fragments on the surface.

This soil has a profile similar to the one described as representative of the series, but it generally is thinner to the firm glacial till substratum. Included in mapping are small areas of Palatine soils where black shale bedrock is at a depth of 20 to 40 inches. These moderately deep soils make up as much as 15 percent of some areas, but they have little effect on use and management.

This soil is suited to limited crops, hay, pasture, and trees. Runoff is rapid and the hazard of erosion is severe. The soil is generally better suited to long-term hay crops than to most other uses. It is droughty, especially where it has west-facing slopes and is severely eroded. Severely eroded areas generally appear as bald spots in fields. These areas need extra nitrogen and practices to improve soil structure and increase content of organic matter. Capability unit IVe–1; woodland suitability group 2r2.

Naumburg Series

The Naumburg series consists of somewhat poorly drained and poorly drained, coarse-textured soils that formed in sandy deltaic deposits on the lake plains. These soils are on moderately low, broad sand deltas from which water drains slowly or very slowly even though the soil is rapidly permeable.

In a representative profile the surface layer is very dark grayish-brown and very dark brown loamy fine sand 10 inches thick. Between depths of 10 and 15 inches is a leached subsurface layer of loose, pinkish-gray fine sand. Between depths of 15 and 16 inches, the upper part of the subsoil is very friable, dark reddish-brown loamy fine sand. Between depths of 16 and 26 inches, the lower part of the subsoil is brown to dark-brown, firm fine sand that has faint mottles and distinct, very firm, dark-brown iron nodules. The substratum, between depths of 26 and 50 inches, is loose, dark reddish-gray find sand.

In spring and during wet periods, Naumburg soils have a seasonal high water table that fluctuates to within 6 to 12 inches of the surface through rapidly permeable sandy material. In undrained areas rooting depth is limited by wetness mainly to the upper 2 feet of soil. This rooting zone has low available water capacity. The capacity of these soils to supply nitrogen is generally medium, and to supply phosphorus and potassium, low or very low. In unlimed areas

reaction of the surface layer is strongly acid. If the soils are adequately drained and are irrigated as needed, crops respond well to liming and fertilization. Naumburg soils are suitable for intensive truck farming under management that includes drainage, irrigation, heavy fertilization, and liming. They are subject to soil blowing if the surface is left dry and unprotected.

Representative profile of Naumburg loamy fine sand in an idle field in the town of Lysander, 25 feet south of Kellogg Road, 1,800 feet east of the intersection of Smokey Hollow Road:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) loamy fine sand; weak, medium and fine, granular structure; very friable; many fine roots; strongly acid; abrupt, smooth boundary.

A1—9 to 10 inches, very dark brown (10YR 2/2) loamy fine sand; weak, medium and fine, granular structure; very friable; common fine roots; very strongly acid; abrupt, wavy boundary.

A2—10 to 15 inches, pinkish-gray (7.5YR 6/2) fine sand; single grained; loose; few fine roots; strongly acid; abrupt, wavy boundary.

B21h—15 to 16 inches, dark reddish-brown (5YR 3/3) loamy fine sand; weak, medium and fine, granular structure; very friable; few fine roots; strongly acid; abrupt, wavy boundary.

B22ir—16 to 26 inches, brown to dark brown (7.5YR 4/4) fine sand; common, coarse, faint brown (10YR 5/3) mottles; single grained; firm, brittle; very firm, coarse to fine, dark-brown (7.5YR 3/2) iron nodules; few fine roots; strongly acid; gradual, wavy boundary.

IIC—26 to 50 inches, dark reddish-gray (5YR 4/2) fine sand; single grained; loose; strongly acid.

The solum ranges from 20 to 40 inches in thickness. Depth to bedrock is more than 40 inches and generally is more than 10 feet. The soil is free or nearly free of coarse fragments, except for small iron concretions. Reaction ranges from strongly acid to very strongly acid throughout.

The Ap horizon ranges from very dark gray (10YR 3/1) to grayish brown (10YR 5/2) and dark reddish brown (5YR 2/2). In undisturbed areas the A1 horizon ranges from black (10YR 2/1) to dark grayish brown (10YR 4/2) and dark reddish brown (5YR 2/2). The A2 horizon ranges from light grayish brown (10YR 6/2) to pinkish gray (5YR 7/2), and has none to common high-chroma mottles. The A horizon is loamy fine sand to sand.

The Bh horizon ranges from dark reddish brown (5YR 3/3) to dark brown (7.5YR 4/2). It is loamy fine sand to sand, and has none to common low- and high-chroma mottles. The Bir horizon ranges from reddish brown (5YR 5/4) to yellowish brown (10YR 5/6), and has few to many high- and low-chroma mottles. Iron concretions ranging from ¼ inch to 1 inch in diameter are few to common in the B horizon. The Bh horizon and upper part of the Bir horizon is 10 to 40 percent iron-cemented zones in places. The B horizon is loamy fine sand to sand.

The C horizon ranges from yellowish brown (10YR 5/4)) to dark reddish gray (5Y 4/2), and has few to common high- and low-chroma mottles in the upper part. It is sand to fine sand.

Naumburg soils are closely associated with the moderately well drained Croghan soils and the well-drained to excessively drained Colonie soils and formed in similar material. They are near the poorly drained and somewhat poorly drained Wareham soils, which lack the spodic horizons of the Naumburg soils.

Naumburg soils in Onondaga County are in a warmer climatic regime than defined in the range for the series, so the growing season is slightly longer than normal.

Naumburg loamy fine sand (Na).—This level or nearly level soil is on low sand deltas of the lake plains from which water drains slowly or very slowly. Individual areas are irregular in shape and range in size from a few acres to more than 50 acres.

Included with this soil in mapping are small areas of Croghan soils on slight rises and knolls. These better drained soils make up as much as 15 percent of some areas, but they have little effect on use and management. Also included are small areas of Lamson soils in depressions and along narrow drainageways. These wetter soils make up as much as 10 percent of some areas, and they require drainage for crops. Other inclusions are areas of similar Wareham soils that have little effect on use and management.

This soil is suited to crops, hay, pasture, and trees. Undrained areas are suited to short-season crops. With adequate drainage, irrigation, heavy fertilization, and liming, this soil is suited to many crops commonly grown in the county, especially annual row crops, including vegetables. Cropped areas are subject to soil blowing, especially if the surface is left bare and dry, so unprotected areas of Naumburg soils need such measures as windbreaks if they are used for crops. Capability unit IVw-1; woodland suitability group 4w1.

Niagara Series

The Niagara series consists of deep, somewhat poorly drained, medium-textured soils that are medium to high in content of lime. These soils formed in relatively stone-free glacial-lake deposits of silt and very fine sand and moderate amounts of clay. They are on moderately low lake plains from which runoff is slow or from which they receive runoff or seepage from adjacent higher lying soils.

In a representative profile the surface layer is very dark grayish-brown silt loam 9 inches thick. Between depths of 9 and 11 inches, the upper part of the subsoil is mottled, pale-brown, friable silt loam. Between depths of 11 and 23 inches, the subsoil is mottled, brown, friable very fine sandy loam. Between depths of 23 and 39 inches, the lower part of the subsoil is mottled, grayish-brown, friable heavy silt loam. The substratum, between depths of 39 and 50 inches, is distinctly mottled, brown, friable silt loam and very fine sandy loam that has thin layers of loamy very fine sand.

In spring and during wet periods, Niagara soils have a seasonal high water table at a depth of 6 to 12 inches that persists for a long time. It is perched on the moderately slowly permeable lower part of the subsoil and on the slowly permeable or moderately slowly permeable substratum. In undrained areas the rooting depth in Niagara soils is mainly in the upper 24 inches. Available water capacity of this zone is moderate to high. The capacity of these soils to supply phosphorus and potassium is medium, and to supply nitrogen, medium to high. Nitrogen, however, is released slowly in spring when the soils are cold and wet, so plants respond to applications of fertilizer containing nitrogen at this time.

Seasonal wetness is the main limitation to farming these soils. Wetness and poor stability are the major limitations for many nonfarm uses.

Representative profile of Niagara silt loam, 0 to 4 percent slopes, in a formerly cultivated, idle field in the town of Lysander, 100 feet west of Dinglehold Road, 1,080 feet north of Lamson Road:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt

loam, light brownish gray (10YR 6/2) dry; common, fine distinct yellowish-brown mottles; moderate, medium, granular structure; friable; many fine roots; slightly acid; abrupt, smooth boundary.

B1—9 to 11 inches, pale-brown (10YR 6/3) silt loam; common, fine, distinct yellowish-brown and dark yellowish-brown and few, fine, faint light brownish-gray mottles; very weak, medium, subangular blocky structure; friable; few fine roots; few fine pores; slightly acid; clear, smooth boundary.

B21—11 to 23 inches, brown (7.5YR 4/4) very fine sandy loam; common, medium, distinct strong-brown and light brownish-gray mottles; weak, medium, subangular blocky structure; friable; grayish-brown (10YR 5/3) ped faces; few fine roots; many pores; thin patchy clay linings in larger pores; neutral; clear, wavy boundary.

B22t—23 to 39 inches, grayish-brown (10YR 5/2) heavy silt loam; many coarse, distinct dark yellowish-brown (10YR 5/6) mottles; weak, very thick, platy structure parting to weak, medium, subangular blocky; friable, slightly sticky; few fine roots; many fine and medium pores that have clay linings; very thin clay films on ped faces; neutral; clear, wavy boundary.

C—39 to 50 inches, brown (7.5YR 5/2), weakly stratified silt loam and very fine sandy loam that has thin layers of loamy very fine sand; many coarse, distinct yellowish-brown (10YR 5/4, 5/6), dark yellowish-brown (10YR 4/4), dark-brown (7.5YR 4/4), and light brownish-gray (10YR 6/2) mottles in upper part, decreasing in size and number with increasing depth; weak, thick, platy structure; friable; few fine pores; mildly alkaline (weakly calcareous).

The solum ranges from 20 to 40 inches in thickness. Depth to carbonates ranges from 20 to 50 inches. Depth to bedrock is more than 40 inches and generally is more than 10 feet. Coarse fragments generally are absent, but make up as much as 5 percent of some profiles.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) to dark grayish brown (2.5Y 4/2). In undisturbed areas the A1 horizon ranges from 2 to 6 inches in thickness and is very dark brown (10YR 2/2) to very dark grayish brown (10YR 3/2). The A2 horizon, where present, ranges from pale brown (10YR 6/3) to reddish gray (7.5YR 5/2). It has common to many high-chroma mottles and few to common low-chroma mottles. The A2 horizon is fine sandy loam to silt loam, but it is mainly silt loam or very fine sandy loam. In unlimed areas reaction ranges from medium acid to neutral.

The upper part of the B horizon ranges from reddish brown (5YR 4/3) to pale brown (10YR 6/3) and has common to many high- and low-chroma mottles. The upper part of the B horizon is fine sandy loam to silt loam. The Bt horizon ranges from grayish brown (2.5Y 5.2) to dark reddish gray (5YR 4/2). It is silt loam or light silty clay loam. Thin clay films are present on ped faces and in pores. Reaction ranges from medium acid to mildly alkaline.

The C horizon ranges from grayish brown (2.5Y 5/2) to dark reddish gray (5YR 4/2). It is stratified layers of silt loam, very fine sandy loam, silt, fine and very fine sand, and clay, or mixtures of these, but silt and very fine sand are dominant. Reaction in the C horizon is neutral to moderately alkaline (calcareous) above a depth of 50 inches. It is moderately alkaline (calcareous) below a depth of 50 inches.

Niagara soils are closely associated with the moderately well drained Collamer and Williamson soils and the poorly drained and very poorly drained Canandaigua soils. All formed in similar material.

Niagara silt loam, 0 to 4 percent slopes (NgA).—This level to very gently sloping soil is on moderately low landforms of the lake plains. Individual areas are irregular in shape and range from less than 10 acres to more than 100 acres in size. The smaller areas generally are around the fringes of depressions, and they receive a large amount of runoff and seepage from adjacent higher soils. The large areas generally are on broad flats from which runoff water drains slowly.

Included with this soil in mapping are small areas of poorly drained and very poorly drained Canandaigua soils in depressions and along shallow drainageways. These wetter soils make up as much as 15 percent of some areas, and they delay tillage in spring unless they are drained. Also included are small areas of Collamer and Williamson soils on slight rises and knolls that make up as much as 10 percent of some areas, but they have little effect on use and management.

This soil is suited to crops, hay, pasture, and trees. Undrained areas of this soil are better suited to short-season crops or hay that can tolerate wetness than to most other uses. If adequately drained, this soil is well suited to many crops, especially annual row crops. Drainage is the main management need. If the soil is adequately drained and used intensively for row crops, management practices that maintain good soil structure and high content of organic matter are needed. Capability unit IIIw–3; woodland suitability group 3w1.

Odessa Series

The Odessa series consists of deep, somewhat poorly drained, moderately fine textured soils. These soils formed in lake-deposited material. They are on moderately low lake plains.

In a representative profile the surface layer is very dark grayish-brown to dark-brown silty clay loam 7 inches thick. Between depths of 7 and 17 inches, the upper part of the subsoil is firm, sticky, mottled, brown and reddish-brown silty clay loam. Between depths of 17 and 28 inches, the lower part of the subsoil is very firm, sticky and plastic, mottled, reddish-brown silty clay. The substratum, between depths of 28 and 60 inches, is reddish-brown, very firm and sticky silty clay that is strongly calcareous.

In spring and during wet periods, Odessa soils have a seasonal high water table at a depth of 6 to 12 inches that persists for a long time. It is perched on the very slowly permeable subsoil and substratum. In undrained areas most roots are confined to the top 12 to 24 inches. Available water capacity of this zone is moderate to high, but generally more than enough moisture is available during the growing season. The capacity of these soils to supply phosphorus is generally medium, and to supply potassium, high. The supply of nitrogen generally is high, but it is released slowly in spring when the soils are cold and wet, so plants respond to applications of fertilizer containing nitrogen at this time. In unlimed areas reaction of the surface layer is neutral or slightly acid, so in most places lime is not needed. The surface layer is slow to dry out after rains. If plowed when too wet or too dry, it becomes very cloddy and a satisfactory seedbed is difficult to prepare.

Seasonal wetness and the difficulty of maintaining good tilth are the major limitations to farming these soils. Wetness and poor stability are the major limitations for many nonfarm uses.

Representative profile of Odessa silty clay loam, 0 to 2 percent slopes, in a hayfield in the town of Marcellus, 2.5 miles south, 60 feet west of Bishop Hill Road, 600 feet south of Masters Road:

Ap1—0 to 4 inches, very dark grayish-brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate, fine and medium, subangular blocky structure; firm, slightly sticky; many fine and medium roots; neutral; clear, wavy boundary.

Ap2—4 to 7 inches, dark-brown (7.5YR 4/2) silty clay loam, moderate, fine and medium, subangular blocky and coarse granular structure; firm, slightly sticky; many fine and medium roots; neutral; abrupt, smooth boundary.

B&A—7 to 10 inches, brown (7.5YR 5/4) silty clay loam; many, medium, prominent pale-red (2.5YR 6/2), strong-brown (7.5YR 5/8), and yellowish-red (5YR 4/6) mottles; moderate, fine, prismatic structure parting to moderate, thin, platy; firm, slightly sticky; many fine roots; common fine and medium pores that have clay linings; pinkish-gray (7.5YR 6/2) silt films 1 to 2 millimeters thick on ped faces, with common, medium, distinct brown (10YR 5/3) mottles; neutral; clear, wavy boundary.

B21t—10 to 17 inches, reddish-brown (5YR 4/3) silty clay loam; common, fine, prominent pale greenish-gray and few, medium, faint reddish-brown mottles; strong, coarse, prismatic structure parting to strong, medium and coarse, angular blocky; firm, sticky; light brownish-gray (7.5YR 6/2) clay films with common, fine, prominent pale greenish-gray mottles on ped faces; few fine roots along ped faces; common fine and few medium pores that have clay linings; mildly alkaline; clear, wavy boundary.

B22t—17 to 28 inches, reddish-brown (5YR 4/3) silty clay; common, fine, faint reddish-brown and few, fine, distinct pinkish-gray mottles; strong very coarse, prismatic structure parting to moderate, medium and coarse, angular blocky; very firm, sticky and plastic; thin, continuous, reddish-brown (5YR 4/3) clay films on prisms and ped faces, few fine roots along ped faces; few fine pores that have clay linings; mildly alkaline (calcareous in lower 4 inches); gradual, wavy boundary.

C—28 to 60 inches, reddish-brown (5YR 5/3) silty clay; massive within strong, coarse, prismatic structure; very firm, sticky; few light greenish-gray (5GY 7/2) coatings on prism faces; few fine pores that have patchy clay linings; very few fine roots along prism face in upper part; moderately alkaline (strongly calcareous).

The solum ranges from 20 to 40 inches in thickness. Depth to carbonates ranges from 17 to 36 inches. Depth to bedrock is more than 40 inches and is generally more than 10 feet. Content of coarse fragments ranges from none to 5 percent.

The Ap horizon ranges from dark reddish brown (5YR 3/2) to grayish brown (10YR 5/2) and from pinkish gray (5YR 6/2) to light gray (10YR 7/2) when dry. In undisturbed areas the A1 horizon ranges from black (5YR 2/1) to very dark grayish brown (10YR 3/2). It is 2 to 4 inches thick. The A2 horizon, where present, ranges from pinkish gray (5YR 7/2) to grayish brown (10YR 5/2), and has common to many high-chroma mottles. In unlimed areas reaction of the A horizon ranges from slightly acid to neutral.

Silty material around peds in the B&A horizon ranges from 1 to 3 millimeters in thickness and is 10 to 30 percent, by volume, of the horizon. The Bt horizon ranges from dusky red (2.5YR 3/2) to brown (7.5YR 5/4) in ped interiors. Mottles are few to common and are generally faint, masked by the inherited red color. Silt coats are present in the upper part of the Bt horizon in places, especially on vertical faces of prisms and peds. Clay films on ped faces range from 10 to 40 percent and increase with increasing depth. The Bt horizon is heavy silty clay loam to clay. Reaction ranges from slightly acid to moderately alkaline (calcareous).

The C horizon is dusky red (2.5YR 3/2) to brown (7.5YR 5/4). It is silty clay, silty clay loam, or stratified clay that has thin bands or varves of silt and very fine sand.

Odessa soils are closely associated with the moderately well drained and well drained Schoharie soils and the poorly drained Lakemont soils and formed in similar material. They are similar to Rhinebeck soils but are redder.

Odessa silty clay loam, 0 to 2 percent slopes (OdA).—This level or nearly level soil is in moderately low positions on the lake plains where runoff is slow or where water accumulates. Individual areas are irregular in shape and most are less than 10 acres in size, but a few are larger than 20 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of poorly drained Lakemont soils in shallow depressions and along narrow drainageways. These poorly drained soils make up as much as 15 percent of some areas, and they require drainage for crops. Also included are small areas of moderately well drained Schohaire soils on slight convex knolls. These better drained soils make up as much as 10 percent of some areas, but they have little effect on use and management.

This soil is suited to crops, hay, pasture, and trees. Undrained areas are better suited to hay or short-season crops than to most other uses. If adequately drained, this soil is suited to many crops commonly grown in the county. The moderately heavy texture of the surface layer makes seedbed preparation difficult; consequently, measures to maintain good soil structure and a high content of organic matter are needed. Capability unit IIIw–4; woodland suitability group 3w1.

Odessa silty clay loam, 2 to 6 percent slopes (OdB).—This gently sloping or gently undulating soil is in moderately low positions on the lake plains and receives runoff from adjacent higher land. The gentle slopes are generally slightly concave in shape. Individual areas are irregular in shape and are mainly smaller than 10 acres. Only a few areas are larger than 20 acres. This soil is generally moderately eroded where it has been cropped.

This soil has a profile similar to the one described as representative of the series, but it commonly has a slightly lighter colored surface layer that is lower in content of organic matter.

Included with this soil in mapping are small areas of poorly drained Lakemont soils in narrow drainageways and depressions. These poorly drained soils make up as much as 15 percent of some areas, and they delay tillage unless they are drained. Also included are small areas of moderately well drained Schoharie soils on slight convex knolls. These better drained soils make up as much as 15 percent of some areas, but they have little effect on use and management.

This soil is better suited to hay and short-season crops than to most other uses. Most areas need diversions and drainage systems to divert runoff water from adjacent higher soils and to remove excess water from the included wet spots. Measures are also needed to control erosion. A cropping system that maintains good soil structure and a high content of organic matter is also needed. Capability unit IIIw–4; woodland suitability group 3w1.

Ontario Series

The Ontario series consists of deep, well-drained, medium-textured soils that formed in glacial till. The till consists mostly of material derived from red sandstone and limestone. These soils are on upland till plains and drumlins.

In a representative profile the surface layer is dark-brown loam 7 inches thick. Between depths of 7 and 14 inches is a subsurface layer of brown, very friable very fine sandy loam. Between depths of 14 and 28 inches, the upper part of the subsoil is dark-brown, firm gravelly loam that becomes slightly heavier textured with increasing depth. Between depths of 28 and 32 inches, the lower part of the subsoil is brown, firm gravelly loam that contains more sand that the layers above. The till substratum, between depths of 32 and 60 inches, is brown, very firm, dense gravelly loam that is calcareous.

The water table in Ontario soils is generally 3 feet or more below the surface. In places, however, it is seasonally at a depth of 30 inches where it is perched on the slowly permeable or very slowly permeable substratum. Ontario soils dry out fairly early in spring. Rooting depth is mainly in the top 30 to 40 inches over the dense till substratum. Available water capacity of this zone is moderate to high. The capacity of these soils to supply phosphorus, potassium, and nitrogen is generally medium. Crops respond well to applications of line and fertilizer. These soils are well suited to crops where they are not limited by slope and the hazard of erosion.

Representative profile of Ontario loam, 2 to 8 percent slopes, in a formerly cultivated, idle field in the town of Van Buren, 75 feet east of Canton Street, 1,900 feet south of new State Highway 48:

Ap—0 to 7 inches, dark-brown (10YR 3/3) loam, grayish brown (10YR 5/2) dry; moderate, fine and medium, granular structure; friable; many fine roots; 10 percent coarse fragments; neutral; abrupt, smooth boundary.

A2—7 to 14 inches, brown (7.5YR 5/4) very fine sandy loam, pinkish gray (7.5YR 7/2) dry; weak, medium, subangular blocky structure; very friable; many fine roots; many pores; 10 percent coarse fragments; common, washed, pinkish-gray (7.5YR 7/2) sand grains; neutral; clear, wavy boundary.

B&A—14 to 19 inches, dark-brown (7.5YR 4/4) gravelly loam; moderate, medium, subangular blocky structure; firm, slightly sticky; common fine roots; many pores; thin clay linings in larger pores; peds have 1- to 2-millimeter-thick coats of brown (7.5YR 5/4) very fine sandy loam, pinkish gray (7.5YR 7/2 dry; common, pinkish-gray (7.5YR 7/2), washed sand grains; 15 percent coarse fragments; neutral; gradual, wavy boundary.

B2t—19 to 28 inches, dark brown (7.5YR 4/4) heavy gravelly loam; strong, medium, subangular blocky structure; firm, slightly sticky; few fine roots; many pores that have continuous clay linings, coarse pores completely filled; brown, thin clay films on ped faces; 20 percent coarse fragments; neutral; clear, wavy boundary.

B3—28 to 32 inches, brown (7.5YR 5/2) gravelly loam; feels gritty; moderate, medium, subangular blocky structure; firm, slightly sticky; few fine roots; many pores that have 20 percent clay linings; patchy, brown clay films on ped faces; 25 percent coarse fragments; mildly alkaline; gradual, wavy boundary.

C—32 to 60 inches, brown (7.5YR 5/2) gravelly loam; feels gritty; moderate, medium and thick, overlapping lenslike platy structure; very firm; few pores; pinkish-gray lime coats on plate faces; 25 percent coarse fragments; moderately alkaline (calcareous).

The solum ranges from 30 to 48 inches in thickness. Depth to bedrock is more than 40 inches and generally is more than 10 feet. Depth to free carbonates is 28 to 48 inches. Content of stones and gravel ranges mainly from 10 to 30 percent in the solum and from 20 to 50 percent in the C horizon. In places the surface layer is less than 10 percent coarse fragments.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) to grayish brown (10YR 5/2) and brown (7.5YR 5/2). In undisturbed areas the A1 horizon ranges from very dark gray (10YR 3/1) to dark grayish brown (10YR 4/2) and dark brown (7.5YR 4/2). It is 3 to 6 inches thick. The A2 horizon extends to a depth of 15 to 21 inches as interfingering into the B&A horizon. It ranges from light brownish gray (10YR 6/2) to brown (7.5YR 5/4) moist, and from white (10YR 8/2) to pinkish gray (7.5YR 6/2) dry. The A2 horizon is loam or very fine sandy loam that is 10 to 25 percent gravel and stones. In unlimed areas reaction ranges from strongly acid to neutral.

The Bt horizon ranges from dark grayish brown (10YR 4/2) to reddish brown (5YR 5/4). It is loam to heavy loam that is 10 to 30 percent gravel and stones. Reaction of the Bt horizon ranges from medium acid to mildly alkaline.

The C horizon ranges from dark grayish brown (10YR 4/2) to reddish gray (5YR 5/2). It is loam to fine sandy loam that is 20 to 50 percent gravel and stones. Reaction of the C horizon ranges from mildly alkaline to moderately alkaline (calcareous).

Ontario soils are closely associated with the moderately well drained Hilton soils and the somewhat poorly drained Appleton soils and formed in similar material. They are also near the well-drained Madrid soils, but they have finer texture than Madrid soils.

Ontario loam, 2 to 8 percent slopes (OgB).—This gently sloping or gently undulating soil is on convex tops of till plains and drumlins that receive little or no runoff from adjacent higher soils. Individual areas are irregular in shape, but they tend to have a longer north-south axis. They range from less than 10 acres to more than 50 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of wetter Hilton and Appleton soils in shallow depressions and along narrow drainageways. These wetter soils make up as much as 15 percent of some areas, and they delay tillage in spring unless they are drained. Also included are small areas of similar but more sandy Madrid soils and more clayey Cazenovia soils. Other inclusions are small areas of moderately deep Camillus and Wassaic soils where soft silty shale or limestone bedrock is near the surface.

This soil is suited to crops, hay, pasture and trees. It is among the better soils in the county for most commonly grown crops, including vegetables. Crops respond very well to good management and heavy fertilization. Runoff is moderate, and erosion is a hazard, especially on the longer slopes if the soil is used intensively for row crops; consequently, such areas need measures to control runoff and erosion. Capability unit IIe–1; woodland suitability group 2o1.

Ontario gravelly loam, 8 to 15 percent slopes (OnC).—This sloping soil is on hillsides and convex tops of drumlins on uplands. Individual areas are generally long and narrow and have a general north-south axis. They generally are smaller than 20 acres, but a few are larger than 50 acres.

This soil has a profile similar to the one described as representative of the series, but it contains more gravel in the surface and subsurface layers.

Included with this soil in mapping are small areas of moderately well drained Hilton soils along foot slopes adjacent to drainageways and around fringes of depressions. These wetter soils make up as much as 15 percent of some areas, and in places they delay tillage in spring unless they are drained. Also included are areas of similar but more sandy Madrid soils and more clayey Cazenovia soils. Other inclusions are small areas of Camillus and Wassaic soils

where soft, silty shale or limestone bedrock is near the surface.

This soil is suited to crops, hay, pasture, or trees. It is suited to many crops commonly grown in the county, including vegetables. Runoff is moderately rapid or rapid, so the hazard of erosion is severe if the soil is cultivated and not protected. Management practices that maintain the content of organic matter and good soil structure are needed. Capability unit IIIe–2; woodland suitability group 2o1.

Ontario gravelly loam, 8 to 15 percent slopes, eroded (OnC2).—This sloping soil is on convex-shaped hillsides that receive a large amount of runoff from adjacent higher, more level Ontario soils. Individual areas are generally long and narrow and have a long, north-south axis. Areas generally range from less than 10 acres to 20 acres in size, and only a few areas are larger than 50 acres.

This soil has a profile similar to the one described as representative of the series, but it is thinner to the underlying substratum, and the surface layer has a higher content of gravel and heavier texture as a result of erosion.

Included with this soil in mapping are small areas of moderately well drained Hilton soils in shallow depressions and drainageways. They make up as much as 15 percent of some areas, and they delay tillage in spring unless they are drained. Also included are small areas of coarser Madrid soils and areas of heavier Cazenovia soils. Other inclusions are small areas of moderately deep Camillus and Wassaic soils where silty shale or limestone bedrock is near the surface.

This soil is suited to limited crops, hay, pasture, and trees. Because of the severe hazard of further erosion, intensive measures to control runoff and erosion, and management practices to improve soil structure and add organic matter are needed if the soil is used for row crops. This soil is generally better suited to long-term hay or pasture than to most other uses. Capability unit IVe–1; woodland suitability group 2o1.

Ontario gravelly loam, rolling (OnCK).—This soil is on rolling, upland till plains that have short, complex slopes that range mainly from 8 to 15 percent. A few small areas are on hillsides that are dissected by closely spaced drainageways. Individual areas are irregular in shape, and most are smaller than 10 acres in size. A few extensive rolling areas on the uplands are larger than 50 acres.

This soil has a profile similar to the one described as representative of the series, but it contains more gravel in the surface and subsurface layers, and it is generally more variable in the depth to the underlying glacial till substratum from place to place.

Included with this soil in mapping are small areas of Hilton soils around numerous depressions and along narrow drainageways. These wetter soils make up as much as 20 percent of some areas, but they have little effect on use and management. Also included are small areas of more sandy Madrid soils and more clayey Cazenovia soils.

This soil is suited to crops, hay, pasture, and trees. Because of the short, complex slopes and numerous wet spots, this soil is better suited to long-term hay than to most other uses. Because of the short, complex slopes, the intensive measures needed to control erosion on this soil if it is used for row crops are difficult to establish. Capability unit IVe–1; woodland suitability group 2o1.

Ontario and Madrid soils, 15 to 25 percent slopes (OpD).—This undifferentiated group consists of moderately steep and hilly Ontario and Madrid soils. Most areas are mainly Ontario soils, others mainly Madrid soils, and a few areas are made up of both soils. These soils have a profile similar to those described as representative of their respective series, but they vary from place to place, and in most places they have a gravelly surface layer. Many areas that have been cropped in the past are severely eroded. In these areas, the surface layer is lighter colored and contains less organic matter. These soils are on the sides of drumlins or hillsides adjacent to drainageways, or they are in hilly areas of uplands that have short, complex slopes. Individual areas are irregular in shape. Most areas are smaller than 20 acres, but a few are larger than 40 acres.

Included with the soils in mapping are small areas of Hilton soils on foot slopes adjacent to drainageways or around fringes of depressions in hilly areas. These wetter soils make up as much as 15 percent of some areas, but they have little effect on use and management. Also included are small areas of similar but more clayey Cazenovia soils. Other inclusions are areas of gravelly Howard and Palmyra soils on outwash deposits. These inclusions have little effect on use and management.

These soils are suited to limited crops, hay, pasture, or trees. Runoff is rapid, and the hazard of erosion is severe if the soils are left without protective cover. Complex slopes are common in many areas, and contouring generally is not feasible to control runoff and erosion. These soils are moderately steep, and the use of farm machinery is difficult and hazardous. Tillage needs to be largely confined to renovation of hay and pasture sods. Capability unit IVe–1; woodland suitability group 2r2.

Otisville Series

The Otisville series consists of deep, excessively drained, coarse-textured soils that formed in gravelly outwash material high in content of red and gray sandstone. These soils are on glacial outwash terraces, kames, and beaches.

In a representative profile the surface layer is dark-brown gravelly loamy fine sand 9 inches thick. Between depths of 9 and 14 inches, the upper part of the subsoil is loose, strong-brown gravelly loamy sand. Between depths of 14 and 33 inches, the lower part of the subsoil is very friable to loose, strong-brown very gravelly loamy sand that fades to brown. Between depths of 33 and 96 inches, the substratum is loose, pinkish-gray, weakly stratified very gravelly sand.

Otisville soils are very rapidly permeable throughout, and the water table is at a depth of more than 3 feet soon after the frost leaves the ground in spring. They are among the earliest soils in the county to dry out and warm up in spring. The main rooting depth is in the top 30 inches. This zone has low or very low

available water capacity. The capacity of these soils to supply nitrogen, phosphorus, and potassium is low or very low. Crops, however, respond well to fertilization along with irrigation. Consequently, Otisville soils are well suited to growing vegetables for market under intensive management. The main limitations to farming are very low natural fertility and low or very low available water capacity. Also, the soils are subject to soil blowing if the surface layer is left unprotected.

Representative profile of Otisville gravelly loamy fine sand, 0 to 8 percent slopes, in a formerly cultivated, idle field in the town of Lysander, Three Rivers State Game Management Area, 350 feet north of Kellogg Road, 1,200 feet west of Sixty Road, in the northern edge of the gravel pit:

Ap—0 to 9 inches, dark-brown (7.5YR 4/2) gravelly loamy fine sand; very weak, medium, granular structure; very friable, many fine roots; 20 percent gravel; very strongly acid; clear, smooth boundary.

B2—9 to 14 inches, strong-brown (7.5YR 5/8) gravelly loamy sand, fading to strong brown (7.5YR 5/6) with increasing depth; very weak, medium, granular structure to single grained; loose; common fine roots; many fine pores or voids between sand grains; 30 percent gravel; very strongly acid; clear, wavy boundary.

B3—14 to 33 inches, strong-brown (7.5YR 5/6) very gravelly loamy sand, fading with increasing depth to brown (7.5YR 5/4); weak, medium, granular structure; very friable to loose; few fine roots; many fine pores or voids between sand grains; 40 percent gravel; strongly acid; gradual, wavy boundary.

C—33 to 96 inches, pinkish-gray (5YR 6/2), weakly stratified very gravelly sand; single grained; loose; 45 percent gravel; strongly acid.

The solum ranges from 14 to 36 inches in thickness. Depth to bedrock is more than 40 inches and generally is more than 10 feet. Content of coarse fragments, mainly gravel and cobbles, ranges from 5 to 35 percent, by volume, to a depth of 10 inches, and from 15 to 50 percent between depths of 10 and 40 inches. Below a depth of 40 inches, content of coarse fragments ranges from 35 to 75 percent by volume.

The Ap horizon ranges from very dark grayish brown (2.5Y 3/2) to brown (7.5YR 5/2). In undisturbed areas the A1 horizon ranges from dark reddish brown (5YR 3/2) to dark grayish brown (2.5Y 4/2). It is 1 to 4 inches thick. In unlimed areas reaction is very strongly acid to strongly acid.

The B horizon ranges from strong brown (7.5YR 5/8) to yellowish red (5YR 4/8) in the upper part and from brown (7.5YR 5/4) to reddish brown (5YR 4/4) in the lower part because of the high content of reddish sandstone. The B horizon ranges from gravelly or very gravelly loamy fine sand to sand. Reaction is strongly acid or very strongly acid.

The C horizon is reddish-gray (5YR 5/2) to light-brown (7.5YR 6/4) very gravelly sand that has varying degrees of stratification. Reaction is medium acid to very strongly acid.

Otisville soils are closely associated with the Alton soils and Colonie soils on outwash plains and deltas. They have coarser textures than Alton soils. They contain more gravel than the gravel-free or nearly gravel-free Colonie soils.

Otisville gravelly loamy fine sand, 0 to 8 percent slopes (OtB).—This level to gently undulating or gently sloping soil is on the tops or faces of glacial outwash terraces. In a few places it is on gravelly beaches. Individual areas are irregular in shape and range in size from less than 10 acres to more than 50 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small sandy areas of Colonie soils. Also included are areas of Alton soils where the gravelly deposits are higher in content of silt and clay. These inclusions make up as much as 15 percent of some areas, but they have little effect on use and management.

This soil is suited to crops, hay, pasture, and trees. Under intensive fertilization, management, and irrigation, it is better suited to early vegetables and market-garden crops than to most other uses. Because of its low or very low available water capacity, it needs frequent, light irrigation. This soil is subject to soil blowing if it is left without protective cover. It is generally too droughty for good pasture in summer. Capability unit IIIs–1; woodland suitability group 4s1.

Otisville gravelly loamy fine sand, rolling (OtC).—This soil is on glacial outwash terraces, kames, and beaches. It has short, complex slopes that range mainly between 8 and 15 percent. Individual areas are irregular in shape and range in size from less than 10 acres to about 40 acres.

This soil has a profile similar to the one described as representative of the series, but the depth to stratified sand and gravel is generally more variable from place to place.

Included with this soil in mapping are small areas of sandy Colonie soils. These inclusions make up as much as 20 percent of some areas, but they have little effect on use and management.

This soil is suited to limited crops, hay, or trees. It is poorly suited to many crops or pasture because it is very droughty, and irrigation is generally not feasible because of the rolling topography. If used for hay, it is better suited to deep-rooted legumes than to most other crops. Capability unit IVs–1; woodland suitability group 4s1.

Ovid Series

The Ovid series consists of deep, somewhat poorly drained to moderately well drained, medium-textured soils that have a moderately fine textured subsoil. These soils formed in shaly glacial till containing reworked clayey lacustrine material in places. They are on uplands where runoff is slow or where they receive runoff from adjacent higher soils.

In a representative profile the surface layer is very dark grayish-brown heavy silt loam 9 inches thick. Between depths of 9 and 13 inches is a subsurface layer of mottled, brown, friable silt loam. Between depths of 13 and 30 inches, the subsoil is firm silty clay loam that is mottled, reddish brown in the upper part and mottled, brown below a depth of 20 inches. The till substratum, between depths of 30 and 76 inches, is reddish-brown, firm silty clay loam that feels gritty and is strongly calcareous.

Ovid soils have a seasonal high water table at a depth of 6 to 12 inches that persists for a relatively long time in spring and during wet periods. It is perched on the slowly permeable subsoil and the very slowly permeable or slowly permeable substratum. Unless the soil is drained, the main rooting depth is in the upper 18 to 30 inches. This zone has a moderate to high available water capacity, but generally more than enough moisture is available for plants. The capacity of these soils to supply phosphorus is medium, and to supply potassium, high. The supply of nitrogen is me-

dium to high, but it is released slowly in spring when the soils are cold and wet, so plants respond to applications of fertilizer containing nitrogen at that time. Lime needs are none to slight.

The main limitations to farming these soils are seasonal wetness and the difficulty in maintaining good tilth. The soils tend to clod if plowed when too wet or too dry. Seasonal wetness is the main limitation for many nonfarm uses.

Representative profile of Ovid silt loam, 0 to 3 percent slopes, in a hayfield in the town of Pompey, 100 feet west of Pompey Center Road, 1,700 feet south of Broadfield Road:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) heavy silt loam, dark brown (10YR 3/3) crushed; weak, medium, granular structure; friable; many roots; 2 percent coarse fragments; neutral; abrupt, smooth boundary.

A2—9 to 13 inches, brown (7.5YR 5/2) silt loam; common, fine and medium, distinct reddish-brown, strong-brown, brown, and dark yellowish-brown mottles; weak, fine and medium, subangular blocky structure; friable; dark grayish-brown (10YR 4/2) organic staining on 50 percent of vertical ped faces; common fine roots; common fine and medium pores; 2 percent coarse fragments; neutral; clear, wavy boundary.

B21t—13 to 20 inches, reddish-brown (5YR 4/3) silty clay loam; many, medium, distinct brown (7.5YR 4/4) and gray (10YR 6/1) mottles; moderate, medium, prismatic structure parting to moderate, medium and coarse, subangular blocky; firm, slightly sticky; prism faces have thin (less than 1 millimeter thick) brown (5YR 5/2) silt coats; thin clay films on 40 percent of block faces; few fine roots along ped faces; common fine pores that have clay linings; 5 percent coarse fragments; neutral; gradual, wavy boundary.

B3—20 to 30 inches, brown (7.5YR 4/4) silty clay loam; common, fine and medium, distinct strong-brown and gray mottles; weak, very thick, platy structure parting to moderate, fine, subangular blocky; firm, slightly sticky; thin, continuous, gray (5Y 6/1) clay films on vertical ped faces; thin clay films on 50 percent of horizontal block faces; few fine and medium pores that have clay linings; 10 percent coarse fragments; mildly alkaline (weakly calcareous in lower part); gradual, wavy boundary.

C—30 to 76 inches, reddish-brown (5YR 4/4) silty clay loam; feels gritty; moderate, medium and thick, platy structure; firm; few pores; 10 percent gravel; moderately alkaline (strongly calcareous).

The solum ranges from 20 to 40 inches in thickness. Depth to carbonates ranges from 18 to 40 inches. Depth to bedrock is more than 40 inches and generally is more than 10 feet. Content of coarse fragments ranges from 1 to 25 percent in the solum and typically increases with increasing depth. In the C horizon content of coarse fragments ranges from 10 to 65 percent.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) to brown (7.5YR 4/2). In undisturbed areas the A1 horizon ranges from very dark gray (10YR 3/1) to very dark brown (10YR 2/2) and dark reddish brown (5YR 2/2). It is 2 to 6 inches thick. The A2 horizon, where not destroyed by plowing, ranges from reddish gray (5YR 5/2) to brown (10YR 5/3). It has common to many high-chroma mottles and few to many low-chroma mottles where base color has a chroma higher than 2. The A2 horizon ranges from very fine sandy loam to light silty clay loam. In unlimed areas reaction ranges from medium acid to neutral.

The Bt horizon ranges from brown (7.5YR 5/4) to reddish brown (2.5YR 4/3). It has few to many distinct and faint mottles of higher and lower chroma and faces of peds that have chromas of 1 or 2. The Bt horizon ranges from silty clay loam to clay loam. Reaction ranges from medium acid to mildly alkaline, and it may be weakly calcareous in the lower part.

The C horizon is similar to the B horizon in color and texture above a depth of 40 inches, and the texture ranges to fine sandy loam below a depth of 40 inches in places.

Ovid soils are closely associated with the moderately well drained and well drained Cazenovia soils and the poorly drained Lyons soils. All formed in similar material.

Ovid silt loam, 0 to 3 percent slopes (OvA).—This level or nearly level soil is on glacial till plains where runoff is slow or where it receives some runoff and seepage from adjacent higher soils. Individual areas are irregular in shape and generally less than 20 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Lyons soils in shallow depressions and along narrow drainageways. These wetter soils make up as much as 15 percent of some areas, and they delay tillage in spring unless they are drained. Also included are small areas of Cazenovia soils on small convex knolls. These better drained soils make up as much as 10 percent of some areas, but they have little effect on use and management.

This soil is suited to crops, hay, pasture, and trees. It needs drainage for most crops commonly grown in the county. Undrained areas are suited to short-season crops or hay crops that tolerate wetness. This soil tends to clod if worked when too wet or too dry. Management practices that maintain good soil structure and a high content of organic matter are needed on this soil if it is used for row crops. Capability unit IIIw–2; woodland suitability group 3w1.

Ovid silt loam, 3 to 8 percent slopes (OvB).—This gently sloping soil is in slightly concave positions on till plains where it receives a large amount of runoff and seepage water from adjacent higher soils. In places where it has been intensively cropped, it is moderately eroded, and the surface layer is lower in content of organic matter. Individual areas are irregular in shape. Most areas are smaller than 20 acres, but a few areas are larger than 30 acres.

This soil has a profile similar to the one described as representative of the series, but it is generally slightly better drained and has a slightly lighter colored surface layer.

Included with this soil in mapping are small areas of poorly drained Lyons soils in shallow depressions and along narrow drainageways. These wetter soils make up as much as 10 percent of some areas, and they delay tillage unless they are drained. Also included are small areas of moderately well drained Cazenovia soils on gentle, convex knolls. These better drained soils make up as much as 10 percent of some areas, but they have little effect on use and management.

This soil is suited to crops, hay, pasture, and trees. It needs drainage for most crops commonly grown in the county. Undrained areas are suited only to short-season crops or to hay that tolerates wetness. If adequately drained and used for row crops, this soil needs moderate erosion-control measures in most places, especially on the longer slopes. It tends to clod if plowed when too wet or too dry; consequently, a cropping system is needed that maintains good soil structure and increases the content of organic matter. Capability unit IIIw–2; woodland suitability group 3w1.

Palatine Series

The Palatine series consists of moderately deep, well-drained and somewhat excessively drained, medium-textured soils. These soils formed in thin deposits of till or partly in residuum derived mainly from the underlying dark-colored shale bedrock. They are on uplands where relief is affected by the underlying bedrock.

In a representative profile the surface layer is very dark brown shaly silt loam 9 inches thick. Between depths of 9 and 20 inches is a subsoil of very dark grayish-brown, very friable very shaly silt loam. The substratum, between depths of 20 and 28 inches, is dark-brown, loose extremely shaly silt loam. At a depth of 28 inches, it merges with the very dark grayish-brown to black, soft shale bedrock.

The water table in Palatine soils is generally at a depth of more than 3 feet. The soils are moderately permeable and dry out rapidly after frost leaves the ground in spring. Rooting depth is mainly in the 20- to 40-inch zone above the bedrock. The available water capacity in this zone is low to moderate. The capacity of these soils to supply nitrogen, phosphorus, and potassium is medium. Plants generally respond well to fertilization if adequate moisture is available. In unlimed areas reaction of the surface layer is medium acid to neutral, and in places the soil needs moderate amounts of lime. In other areas lime needs are none to slight.

The main limitations to farming these soils are variable rooting depth and available water capacity because the soils are affected from place to place by the depth to bedrock. Depth to bedrock is the main limitation to many nonfarm uses.

Representative profile of Palatine shaly silt loam, 6 to 12 percent slopes, in a cultivated area in the town of Manlius, 500 feet east of Palmer Road, 800 feet north of State Route 173, 1,500 feet west of the Madison County line:

Ap—0 to 9 inches, very dark brown (10YR 2/2) shaly silt loam, light grayish brown (10YR 6/2) dry; weak, fine, granular structure; very friable; many fine roots; 30 percent fine and very fine, very dark grayish-brown and black shale fragments; medium acid; abrupt, smooth boundary.

B—9 to 20 inches, very dark grayish-brown (10YR 3/2) very shaly silt loam, brown (10YR 5/3) dry; weak, medium, subangular blocky structure; very friable; many fine roots; many pores; 40 percent fine and medium shale fragments, interiors very dark grayish brown (10YR 3/2) or black (10YR 2/1); slightly acid; clear, wavy boundary.

C—20 to 28 inches, dark-brown (10YR 3/3) extremely shaly silt loam; single grained; loose; common fine roots; 75 percent shale fragments that have silt coats as much as 3 millimeters thick; interior of shale is very dark grayish brown to black; neutral; clear, wavy boundary.

R—28 to 60 inches, very dark grayish-brown (10YR 3/2) to black (N 2/0) shale bedrock that has weathered structural faces of yellowish red (5YR 4/6); very fissile, ranging from 1 millimeter to 15 millimeters thick, can be cut with spade; reaction of shale is neutral.

The solum ranges from 15 to 30 inches in thickness. Depth to bedrock ranges from 20 to 40 inches. Content of shale fragments ranges from 5 to 50 percent in the upper 10 inches of soil and from 35 to 80 percent between a depth of 10 inches and the shale bedrock. Reaction of the shale bedrock ranges from neutral to moderately alkaline (calcareous).

The Ap horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2) moist, and from light brownish gray (10YR 6/2) to dark grayish brown (10YR 4/2) dry. In undisturbed areas the A1 horizon is black or very dark gray. Reaction ranges from medium acid to neutral.

The B horizon ranges from black (10YR 2/1) to brown (10YR 4/3) moist, and from very dark grayish brown (2.5Y 3/2) to pale brown (10YR 6/3) dry. It is very shaly silt loam to heavy silt loam. Reaction of the B horizon ranges from medium acid to mildly alkaline.

The C horizon, where present, is similar to the B horizon in color, but it has a higher content of shale. Reaction of the C horizon ranges from neutral to moderately alkaline (calcareous). The shale bedrock ranges from black to very dark brown. It is generally soft, but in some places there are thin beds of harder shale or limestone.

Palatine soils are closely associated with the deep, well drained and moderately well drained Mohawk soils, the moderately deep Wassaic soils, which have fewer coarse fragments, and the shallower Benson soils.

Palatine shaly silt loam, 2 to 6 percent slopes (PaB).—This gently sloping soil is on bedrock-controlled landforms of uplands. Slopes generally are smooth, but in a few areas of closely spaced drainageways, slopes are complex. Individual areas are irregular in shape and are generally smaller than 20 acres, but a few areas are larger than 40 acres.

This soil has a profile similar to the one described as representative of the series, but it is generally slightly thicker in most areas.

Included with this soil in mapping are small areas of Mohawk soils where the bedrock is at a depth of more than 40 inches and small areas of a soil similar to Palatine soil where the depth to shale bedrock is less than 20 inches. These inclusions make up as much as 15 percent of some areas, but they have little effect on use and management. Also included are a few small areas of lighter colored Wassaic and Benson soils where the underlying bedrock is limestone.

This soil is suited to crops, hay, pasture, and trees. It can be tilled early in the season and is especially well suited to early crops and small grains. Runoff is moderate, especially on the longer slopes, and measures to control erosion generally are needed on these areas if they are used for row crops. Capability unit IIe–1; woodland suitability group 2o1.

Palatine shaly silt loam, 6 to 12 percent slopes (PaC).—This sloping soil is on bedrock-controlled landforms of uplands. Individual areas are irregular in shape and generally are smaller than 10 acres, but a few areas are larger than 30 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Mohawk soils where the bedrock is at a depth of more than 40 inches and a soil similar to Palatine soil that is less than 20 inches deep over shale bedrock. These inclusions make up as much as 15 percent of some areas, but they have little effect on use and management. Also included are small areas of lighter colored Wassaic and Benson soils where limestone is the underlying bedrock. Other inclusions are small areas of severely eroded Palatine soils that are thinner over shale bedrock, have lower available water capacity, and are lower in content of organic matter in the surface layer than is typical for the Palatine series.

This soil is suited to crops, hay, pasture, and trees. Most areas are suited to crops commonly grown in the county, especially early crops or small grains and

short-season crops. Runoff is rapid, especially on the longer slopes, and the hazard of erosion is severe if the soil is cultivated and not protected. Capability unit IIIe–1; woodland suitability group 2o1.

Palms Series

The Palms series consists of 16 to 50 inches of well-decomposed muck underlain by loamy mineral matter. These soils formed mainly in herbaceous material that accumulated in basins formerly occupied by shallow ponds and lakes. Most areas are in boggy depressions on the lake plains and till plains. Drainage in these soils is very poor.

In a representative profile the surface layer is black, granular muck 8 inches thick. Between depths of 8 and 24 inches is friable and slightly plastic, black muck subsurface material. The substratum, between depths of 24 and 50 inches, is gray, sticky, slightly plastic, light clay loam mineral material.

Palms muck has water on or near the surface about 8 to 10 months of the year unless it is artificially drained. Undrained areas are either in swamp woods or cattail marshes. The swamp woods consist mainly of soft maple, alder, and northern white-cedar. If adequately drained, the soils are used for such vegetables as onions and lettuce. Available water capacity is high. The supply of nitrogen is high. The capacity of these soils to supply phosphorus and potassium is low. Crops respond very well to fertilization. Lime needs in most areas are none to slight. Where the drained muck is thinner than 20 inches because of subsidence, oxidation, soil blowing, or a combination of these factors, it is either abandoned or is used for such annual row crops as corn and beans. Many of the abandoned areas where the drainage system has failed are too wet for trees and have reverted to cattail marshes.

Wetness is the major limitation to farming these soils. Wetness and very poor stability are the main limitations for most nonfarm uses.

Representative profile of Palms muck, drained, in an idle, formerly cultivated area in the town of Cicero, 2,600 feet east of Thompson Road, 2,400 feet north of Island Road:

Oa1—0 to 8 inches, black (10YR 2/1) broken face, rubbed and pressed, sapric material; strong, medium, granular structure; friable; common fine pores; appears to be from herbaceous material; about 10 percent mineral content; about 5 percent wood fragments; slightly acid; clear, smooth boundary.

Oa2—8 to 14 inches, black (10YR 2/1) broken face and rubbed, very dark brown (10YR 2/2) pressed, sapric material; about 25 percent fibers, about 2 percent rubbed; moderate, medium, platy structure; friable, nonsticky, slightly plastic; few dark-brown (7.5YR 3/2) leaf remains on plate faces; herbaceous fibers; 5 percent mineral matter; 5 percent wood fragments; slightly acid; clear, smooth boundary.

Oa3—14 to 24 inches, black (10YR 2/1) broken face, black (5Y 2/1) rubbed and pressed, sapric material; about 10 percent fibers, 2 percent rubbed; massive; slightly plastic; herbaceous fibers; 5 percent mineral matter; slightly acid; abrupt, smooth boundary.

IICg—24 to 50 inches, gray (5Y 5/1) light clay loam; massive; sticky, slightly plastic; slightly acid at top, moderately alkaline (calcareous) at depth of 50 inches.

Thickness of the organic material or muck over the mineral IIC horizon ranges from 16 to 50 inches. The depth to bedrock is more than 40 inches and generally is more than 10 feet. The organic fiber is derived mainly from herbaceous plants, but in some places wood fiber is also present along with fragments of wood 1/8 inch to 6 inches in diameter, but these make up less than 15 percent of the material, by volume. Color of the organic material (muck) ranges from black (10YR 2/1 to 5YR 2/1) to dark brown (7.5YR 3/2). The organic material is mainly sapric, but in places it includes thin layers of hemic material as much as 6 inches thick. The muck ranges from granular to massive. Consistence is friable to slightly sticky or plastic. Reaction ranges from medium acid to mildly alkaline.

The IIC horizon ranges from gray to light gray in 5YR to 5Y hues and has higher-chroma mottles in places. It is fine sandy loam to light clay loam. Reaction of the IIC horizon ranges from slightly acid to moderately alkaline (calcareous).

Palms muck soils are closely associated with the deep Carlisle muck soils, Edwards muck soils, Canandaigua soils, and Lamson soils. They are shallower than Carlisle muck soils and have less than 50 inches of organic material over loamy mineral material. They resemble Edwards muck soils, which formed in organic material over marl. They have thicker muck deposits than the poorly drained and very poorly drained Canandaigua and Lamson soils, which formed in mineral material.

Palms muck (Pb).—This level or nearly level muck soil is in low areas on lake plains or in depressions on till plains from which water drains very slowly or is impounded for long periods of time. Individual areas are irregular in shape and range from less than 10 acres to more than 50 acres in size. Many are beltlike areas 100 to 200 feet wide that surround areas of deeper Carlisle muck.

Included with this soil in mapping are small areas of Carlisle muck where the muck is more than 50 inches deep. They are generally in the centers of the larger areas of Palms muck. They make up as much as 15 percent of some areas, but they have little effect on use and management.

Undrained areas of this soil are suited to trees or wildlife habitat. If adequately drained, this soil is suited to crops, hay, and pasture. Most of the drained areas are used for vegetable crops, but a few areas are used for such annual row crops as corn and beans. Only a few areas are used for hay or pasture because the economic return from such uses generally does not justify the expense of maintaining drainage systems. Maintaining the drainage system is the main management need. Drainage needs to be managed so that water levels are maintained high enough to reduce the rate of subsidence. Large exposed areas need windbreaks to reduce soil blowing. A complete fertilizer is generally needed for most crops. Lime needs are none to slight in most places. Crops generally respond well to management and fertilization. Capability unit IVw–5; woodland suitability group 5w1.

Palmyra Series

The Palmyra series consists of deep, well-drained to excessively drained, medium-textured soils that have a high content of gravel. These soils formed in gravelly and sandy glacial outwash material derived mainly from limestone, sandstone, and shale. They are on glacial outwash terraces and kames mainly along larger valleys at elevations below 1,500 feet.

In a representative profile the surface layer is very dark grayish-brown gravelly loam 9 inches thick. Between depths of 9 and 19 inches is a subsurface

layer of brown, friable gravelly loam. Between depths of 19 and 31 inches, the subsoil is friable gravelly heavy loam that is brown to a depth of 25 inches and dark grayish brown from 25 to 31 inches. The substratum, between depths of 31 and 60 inches, is mixed gray and brown, loose, stratified gravel and sand that is calcareous.

The water table in Palmyra soils is generally at a depth of more than 3 feet, but in places it fluctuates to within 3 feet of the surface in spring and during wet periods. Permeability of the solum is moderate or moderately rapid and that of the substratum, rapid or very rapid. Palmyra soils are among the earliest in the county to be ready for tillage in spring. Deep-rooted crops extend their roots far into the substratum, but the main rooting depth is in the top 30 inches. This zone has moderate to high available water capacity. The capacity of these soils to supply phosphorus is generally medium, and to supply potassium and nitrogen, medium to low. In unlimed areas the reaction of the surface layer is medium acid to neutral, so many areas of Palmyra soils need lime, but some do not. Crops respond very well to applications of fertilizer and lime in combination with other good management practices. Where slopes are not a limitation, Palmyra soils are well suited to farming as well as to many nonfarm uses.

Representative profile of Palmyra gravelly loam, 0 to 3 percent slopes, in a cultivated area in the town of Onondaga, 1,500 feet west of Abbey Road, 1,200 feet north of Cedarvale Road, 2,100 feet northwest of the intersection of Abbey and Cedarvale Roads in the west edge of the gravel pit:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) gravelly loam; light brownish gray (10YR 6/2) dry; moderate, medium, granular structure; friable; many roots; 25 percent gravel; neutral; abrupt, smooth boundary.

A2—9 to 14 inches, brown (7.5YR 5/2) gravelly loam; pinkish gray (7.5YR 7/2) dry; weak, medium, granular structure; friable; many roots; many pores; 25 percent gravel; neutral; clear, irregular boundary.

A&B—14 to 19 inches, brown (7.5YR 5/2) gravelly loam; weak, medium, granular structure; friable; common roots; many pores; material makes up about 75 percent of matrix and surrounds small bodies of slightly darker brown (7.5YR 5/4) gravelly heavy loam, 1/4- to 1/2-inch in diameter, that has thin, light-gray (10YR 7/2) silt or very fine sand coatings; common fine and medium pores; discontinuous clay linings in larger pores; 25 percent gravel; neutral; clear, irregular boundary.

B21t—19 to 25 inches, brown (10YR 4/3) gravelly heavy loam; dark yellowish brown (10YR 4/4) crushed; moderate, medium and coarse, subangular blocky structure; friable to firm, slightly sticky; common roots; many pores; continuous clay linings in larger pores; common clay bridges between sand grains; thin, discontinuous clay films on ped faces and gravel; 30 percent gravel; neutral; gradual, irregular boundary.

B22t—25 to 31 inches, dark grayish-brown (10YR 4/2) gravelly heavy loam; dark brown (10YR 4/3) crushed; moderate, medium and coarse, subangular blocky structure; friable; slightly sticky; common fine roots; many pores that have clay linings; thin, discontinuous clay films on ped faces and gravel; 30 percent gravel; cone-shaped tongues of B horizon extend 12 to 18 inches into C horizon at 2- to 5-foot intervals; mildly alkaline (calcareous around limestone gravel); clear, irregular boundary.

IIC—31 to 60 inches, grayish-brown (10YR 5/2), dark grayish-brown (10YR 4/2), very dark grayish-brown (10YR 3/2), and gray (N 5/0), stratified gravel and sand; single grained; loose; 60 percent gravel; moderately alkaline (calcareous).

The solum ranges from 15 to 45 inches in thickness within single profiles because of tonguing of the B horizon into the C horizon, but the average solum thickness ranges from 18 to 24 inches. Depth to carbonates is the same as solum thickness or as much as 4 inches less where B3 horizons are present. Depth to bedrock is more than 40 inches, and is generally more than 10 feet. Content of coarse fragments, mainly gravel and cobbles, ranges from 15 to 30 percent in the A horizon, from 20 to 35 percent in the Bt horizon, and from 35 to 75 percent in the C horizon.

The Ap horizon ranges from grayish brown (10YR 5/2) to very dark grayish brown (10YR 3/2) and dark reddish brown (5YR 3/2). In undisturbed areas the A1 horizon ranges from very dark brown (10YR 2/2) to dark reddish gray (5YR 4/2). It is gravelly loam or gravelly silt loam. The A2 horizon is absent or destroyed by deep plowing in places, but if present it is as much as 12 inches thick over the deepest tongues. The A2 horizon ranges from grayish brown (10YR 5/2) to light reddish brown (5YR 6/4). It is gravelly sandy loam to gravelly silt loam. In unlimed areas reaction ranges from medium acid to neutral.

An A&B horizon is generally present below the A2 or Ap horizon. The A material of the A&B horizon is similar to the material in the overlying A2 horizon. The Bt-like material in the A&B horizon ranges from 10 to 40 percent, by volume, and is slightly darker, slightly firmer, and slightly heavier in texture. The Bt horizon below the A&B horizon ranges from 7 to 15 inches in thickness between tongues, and from 15 to 30 inches in thickness within tongues. The Bt horizon ranges from very dark grayish brown (10YR 3/2) to reddish brown (2.5YR 5/4). It is gravelly heavy fine sandy loam to gravelly clay loam. Reaction of the Bt horizon ranges from slightly acid to mildly alkaline, but the lower few inches is calcareous in places, especially adjacent to limestone gravel.

The C horizon is gravel, cobbles, and sand that is variably stratified but is channery in places. The sand and gravel is cemented with secondary lime below a depth of 6 to 8 feet in places. Gravel or cobbles are dominantly limestone and red and gray sandstone, but gray, black, and red shale are also present in places.

Palmyra soils are closely associated with the moderately well drained Phelps soils, the somewhat poorly drained and poorly drained Fredon soils, and the very poorly drained Halsey soils. All formed in similar material.

Palmyra gravelly loam, 0 to 3 percent slopes (PgA).—This level or nearly level soil is on the tops of glacial outwash terraces in the major valleys. Individual areas are irregular in shape and range in size from less than 10 acres to several hundred acres. The largest and most extensive areas are in the Tully Valley. This soil has the profile described as representative of the series. Included in mapping are small areas of moderately well drained Phelps soils in shallow depressions. These slightly wetter soils make up as much as 15 percent of some areas, but they have little effect on use and management.

This soil is suited to crops, hay, pasture, and trees. It is well suited to most crops commonly grown in the county, especially deep-rooted crops. Gravel and cobbles on the surface hinder tillage and harvesting of some crops. Capability unit I–1; woodland suitability group 2o1.

Palmyra gravelly loam, 3 to 8 percent slopes (PgB).—This gently sloping or undulating soil is on glacial outwash terraces and kames. Slopes are generally short and slightly convex in shape. Individual areas are irregular in shape and range from less than 5 acres to more than 50 acres in size.

This soil has a profile similar to the one described as representative of the series, but it is generally

slightly thinner to the underlying sand and gravel substratum.

Included with this soil in mapping are small areas of Phelps soils in shallow depressions and along narrow drainageways. These moderately well drained soils make up as much as 10 percent of some areas, but they have little effect on use and management. Also included are small areas that have a cobbly surface layer where the majority of the stones average 3 to 5 inches in diameter. These stones commonly interfere with tillage and harvesting. Other inclusions are areas of similar Howard soils, sandy Arkport soils, and heavier textured Schoharie soils.

This soil is suited to crops, hay, pasture, and trees. Most of the acreage is cleared and is used for crops. It is suited to most crops commonly grown in the county. Runoff is moderate, especially on the longer slopes when the ground is frozen. The hazard of erosion is slight to moderate if the soil is cultivated and not protected. On undulating areas that have short, complex slopes where contouring is not feasible, a cropping system that maintains good soil structure and content of organic matter is needed to control erosion. Capability unit IIe–2; woodland suitability group 2o1.

Palmyra gravelly loam, rolling (PgC).—This soil is commonly in kamy areas of glacial outwash. It generally has short, complex slopes, but a few small areas have simple, smooth slopes. Individual areas are irregular in shape and range in size from less than 5 acres to more than 50 acres.

This soil has a profile similar to the one described as representative of the series, but it is generally more variable in depth to the underlying sand and gravel substratum. In some places it is moderately eroded to severely eroded and has a lighter colored surface layer that is lower in content of organic matter and contains a higher percentage of gravel.

Included with this soil in mapping are small areas of Phelps soils in depression. These wetter soils make up as much as 15 percent of some areas, but they have little effect on use and management. Also included are areas of similar Howard soils, sandy Arkport soils, and heavier textured Schoharie soils. These inclusions make up as much as 15 percent of some areas, but they have little effect on use and management.

This soil is suited to limited crops, hay, pasture, and trees. Runoff is moderate to rapid, especially when the ground is frozen, and the hazard of erosion is severe if the soil is used for row crops. Because of the short, complex slopes, such erosion-control measures as contour tillage and terracing are extremely difficult to establish. This soil, therefore, is generally better suited to long-term, deep-rooted hay crops than to most other uses. Capability unit IVe–10; woodland suitability group 2o1.

Palmyra and Howard soils, hilly (PHD).—This undifferentiated group consists of individual areas of mostly Palmyra soils, Howard soils, or both. These soils have profiles similar to those described as representative of their respective series, but they vary from place to place in texture of the surface layer and in depth to the underlying sand and gravel. These soils are in kamy outwash areas that have short, complex slopes, on terrace fronts, and on moderately steep sides of drainageway dissections. Slopes range mainly between 15 and 25 percent. Areas are irregular in shape and range in size from less than 10 acres to more than 40 acres.

Included with these soils in mapping are small areas of Phelps soils in deeper depressions and along drainageways. These wetter soils make up as much as 20 percent of some areas, but they have little effect on use and management. Also included are areas of sandy Arkport soils and heavier textured Schoharie soils. These soils make up as much as 10 percent of some areas, but they have little effect on use and management.

These soils are suited to hay, pasture, and trees. Runoff is rapid, and the hazard of erosion is severe if the soils are left without protective cover. The soils are droughty, so they are generally better suited to long-term, deep-rooted hay crops that can withstand droughty conditions than they are to shallow-rooted crops. Pasture sods are generally adequate in spring and fall, but they suffer from lack of moisture in midsummer. Slopes are so steep that the use of farm machinery is difficult and hazardous. Capability unit IVe–10; woodland suitability group 2r4.

Palmyra and Howard soils, steep (PHE).—This undifferentiated group consists of Palmyra and Howard soils in areas that are either mostly Palmyra soils, mostly Howard soils, or made up of both. These soils have a profile similar to those described as representative of their respective series, but they vary from place to place in the content of sand and gravel in the solum and in the depth to the underlying stratified sand and gravel. These soils are in kamy outwash areas that have short, complex slopes and on steep terrace fronts. Slopes range mainly between 25 and 35 percent. Kamy areas of these soils are irregular in shape and range in size from less than 10 acres to more than 50 acres. Areas on terrace fronts are long and narrow and range in size from less than 10 acres to about 30 acres.

Included with these soils in mapping are areas of similar but coarser textured Alton and Otisville soils. Also included are areas of sandy Arkport and Colonie soils and areas of heavier textured Dunkirk and Schoharie soils. These inclusions have little effect on use and management. Other inclusions are areas of wetter soils around springs and seeps, generally at the base of slopes.

These soils generally are better suited to trees than to most other uses. In places they are used for native pasture. The soils are too droughty for good growth of pasture grasses in midsummer. Runoff is very rapid, and the hazard of erosion is severe if the soils are left without protective cover. Capability unit VIe–1; woodland suitability group 2r5.

Palmyra and Howard soils, very steep (PHF).—This undifferentiated group consists of Palmyra and Howard soils in areas that are mostly Palmyra soils, mostly Howard soils, or are made up of both. These soils have a profile similar to those described as representative of their respective series, but they vary from place to place in the content of sand and gravel in the solum and in the depth to the stratified sand and gravel substratum. These soils are on kamy

outwash areas that have short, complex slopes and on valley sides or very steep terrace faces. Slopes are more than 35 percent. Individual areas are irregular in shape or long and narrow. They are generally smaller than 30 acres.

Included with these soils in mapping are areas of similar but coarser textured Alton and Otisville soils. Also included are areas of sandy Colonie and Arkport soils and areas of heavier textured Dunkirk and Schoharie soils. These inclusions have little or no effect on use and management.

These soils are too steep for cultivation or pasture renovation and management. They are also very droughty. The soils are suited to trees and some recreational uses. Runoff is very rapid, and the hazard of erosion is severe if the soils are left without protective cover. Capability unit VIIe–1; woodland suitability group 2r5.

Phelps Series

The Phelps series consists of deep, moderately well drained, medium-textured soils. These soils formed in gravelly glacial outwash deposits derived mainly from sandstone, shale, and moderate to high amounts of limestone. They are mainly on areas of glacial outwash terraces in the larger valleys where internal drainage and runoff are slow.

In a representative profile the surface layer is very dark grayish-brown gravelly loam 10 inches thick. Between depths of 10 and 12 inches is a thin subsurface layer of friable, reddish-brown gravelly loam. Between depths of 12 and 23 inches, the upper part of the subsoil is friable, brown gravelly heavy loam that is mottled. Between depths of 23 and 28 inches, the lower part of the subsoil is mottled, dark-brown gravelly heavy loam. The substratum, between depths of 28 and 50 inches, is stratified, grayish-brown and reddish-gray, loose gravel and sand that is calcareous.

Phelps soils have a seasonal high water table that fluctuates to within 15 to 24 inches of the surface in spring and during wet periods. In most places they have a moderately permeable surface layer and subsoil and moderately rapidly permeable or rapidly permeable substratum. The water table, therefore, has only a moderate effect on time of tillage after rains. Rooting depth is mainly in the upper 24 inches, but a few roots extend below this depth as the water table recedes. Available water capacity of this zone is moderate to high. The capacity of these soils to supply phosphorus, potassium, and nitrogen is generally medium. In unlimed areas the reaction of the surface layer ranges from medium acid to neutral. Crops respond well to applications of lime and fertilizer.

Slight seasonal wetness is one of the main limitations to farm use and to many nonfarm uses of these soils.

Representative profile of Phelps gravelly loam, 0 to 3 percent slopes, in a cultivated field in the town of Elbridge, 100 feet east of Lynch Road:

Ap—0 to 10 inches, very dark grayish-brown (10YR 3/2) gravelly loam, grayish brown (10YR 5/2) dry; moderate, medium, granular structure; friable; many roots; 20 percent gravel; neutral; abrupt, smooth boundary.

A2—10 to 12 inches, reddish-brown (5YR 5/3) gravelly loam; pinkish gray (7.5YR 7/2) dry; weak, medium, granular structure; friable; common roots; 20 percent gravel; neutral; clear, wavy boundary.

B&A—12 to 16 inches, brown (7.5YR 4/2) gravelly heavy loam; common, medium, distinct strong-brown and yellowish-brown mottles; moderate, coarse, subangular blocky structure; friable, slightly sticky; 1- to 4-millimeters-thick reddish-brown (5YR 5/3) silt or fine sand coats on ped faces, pinkish gray (7.5YR 7/2) dry; common roots; common pores that have thin patchy clay linings; 25 percent gravel; neutral; clear, wavy boundary.

B2t—16 to 23 inches, brown (7.5YR 4/2) gravelly heavy loam; common, medium, distinct pinkish-gray, strong-brown, and yellowish-brown mottles; moderate, coarse, subangular blocky structure; friable, slightly sticky; few roots; many pores; thin clay linings in larger pores; thin patchy clay films on ped faces and gravel; 25 percent gravel; neutral; clear, wavy boundary.

B3—23 to 28 inches, dark-brown (7.5YR 3/2) gravelly heavy loam; common, medium, distinct yellowish-brown mottles; weak, coarse, subangular blocky structure; friable, slightly sticky; few roots; many pores that have clay linings; 30 percent gravel; mildly alkaline (weakly calcareous around limestone gravel); clear, wavy boundary that has tongues 2 to 5 feet wide and 8 to 18 inches deep extending into C horizon.

IIC—28 to 50 inches, grayish-brown (10YR 5/2) to reddish-gray (5YR 5/2), stratified very gravelly sand; 50 percent gravel; single grained; loose; moderately alkaline (calcareous).

The solum ranges from 24 to 36 inches in thickness. Depth to carbonates ranges from 18 to 40 inches. The thicker solum is generally associated with the medium-lime and low-lime Howard and Alton soils. Bedrock is at a depth of more than 40 inches and is generally more than 10 feet. Content of gravel and stones ranges from 15 to 35 percent in the solum and from 35 to 70 percent in the C horizon. Thin layers, as much as 6 inches thick, that are free or nearly free of coarse fragments are present in places.

The Ap horizon ranges from very dark grayish brown to dark brown, but dry colors are 2 to 3 values higher. In undisturbed areas the A1 horizon ranges from very dark brown to very dark grayish brown. It is 3 to 6 inches thick. The A2 horizon has been destroyed by deep plowing in places, especially in the higher lime soils that have a thinner solum, but it extends to a depth of 20 inches where the solum is lower in content of lime. The A2 horizon ranges from grayish brown (10YR 5/2) to light reddish brown (5YR 6/3) and has values of 5 and 6 and chromas of 2 and 3. The A horizon ranges from sandy loam to silt loam in the fine-earth fraction. In unlimed areas reaction in the A horizon is medium acid to neutral.

The A&B and B&A horizons range from 2 to 6 inches in thickness, with B-like material ranging from 15 to 80 percent by volume. The Bt horizon ranges from dark brown (10YR 3/3) to yellowish brown (10YR 5/4), reddish brown (5YR 4/3), and olive brown (2.5Y 4/4), and has values of 3 to 5 and chromas of 2 to 4. Both high- and low-chroma mottles are present in the Bt horizon below a depth of 10 inches. The fine-earth fraction ranges from heavy sandy loam to light clay loam. Reaction of the B horizon ranges from medium acid to mildly alkaline.

The C horizon is stratified gravel, sand and gravel, or sand. Thin layers of silt are present below a depth of 40 inches in places.

Phelps soils are closely associated with the well-drained to excessively drained Palmyra soils, the somewhat poorly drained and poorly drained Fredon soils, and the very poorly drained Halsey soils. All formed in similar material.

Phelps gravelly loam, 0 to 3 percent slopes (PpA).—This level or nearly level soil is on moderately low landforms on glacial outwash terraces. Individual areas are irregular in shape, and most areas range in size from less than 5 acres to about 20 acres. Only a few areas are larger than 30 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas

of poorly drained Fredon soils in shallow depressions or along narrow drainageways. They make up as much as 15 percent of some areas, and they delay tillage in spring unless they are drained. Also included are small areas of Palmyra and Howard soils on slightly convex knolls. These better drained soils make up as much as 15 percent of some areas, but they have little effect on use and management.

This soil is suited to crops, hay, pasture, and trees. Most areas have been cleared and are used for crops. The main concern of management on this soil is drainage of the included wetter spots in order to facilitate early tillage and plowing. Capability unit IIw–3; woodland suitability group 2o1.

Phelps gravelly loam, 3 to 8 percent slopes (PpB).—This gently sloping soil is on slightly concave moderately low glacial outwash terraces where it receives seepage from adjacent higher soils. Slopes range from 3 to 5 percent. Individual areas are irregular in shape and are mostly less than 20 acres in size. Only a few areas are larger than 30 acres.

This soil has a profile similar to the one described as representative of the series, but it generally is slightly better drained and has a slightly lighter colored surface layer that is lower in content of organic matter.

Included with this soil in mapping are small areas of Fredon soils in shallow depressions and at the bases of slopes where prolonged seepage takes place or springs crop out. These wetter soils make up as much as 15 percent of some areas, and they need drainage for tilling and harvesting. Also included are small areas of Palmyra and Howard soils on slight rises and knolls. These better drained soils make up as much as 15 percent of some areas, but they have little effect on use and management.

This soil is suited to crops, hay, pasture, and trees. Most areas have been cleared and are used for crops. Runoff is slow to moderate, so the hazard of erosion is generally slight except where water concentrates. Random drainage of the included wet spots is generally needed for early plowing and havesting. Capability unit IIe–6; woodland suitability group 2o1.

Rhinebeck Series

The Rhinebeck series consists of deep, somewhat poorly drained, medium-textured soils that have a fine textured or moderately fine textured subsoil. These soils formed in lacustrine deposits of calcareous clay and silt. They are on lake plains from which runoff is slow or where they receive runoff from adjacent higher areas.

In a representative profile the surface layer is very dark gray silt loam 8 inches thick. Between depths of 8 and 36 inches is a firm, silty clay subsoil that is dark yellowish brown and mottled to a depth of 20 inches and olive brown and mottled from 20 to 36 inches. The substratum, between depths of 36 and 50 inches, is mottled, olive-brown, firm silty clay loam that is calcareous.

Rhinebeck soils have a seasonal high water table at a depth of 6 to 12 inches that persists for a relatively long time in spring and during wet periods. It is perched on the slowly permeable subsoil and substratum. Rooting depth is mainly in the top 18 to 24 inches, but a few roots extend below this depth. Available water capacity of this zone is moderate to high, but generally more than enough water is available for plants. The capacity of these soils to supply phosphorus is generally medium, and to supply potassium, high. The supply of nitrogen is medium to high, but it is released slowly in spring when the soils are cold and wet, so plants respond to nitrogen fertilization at this time. In unlimed areas reaction of the surface layer is neutral or slightly acid, so little or no lime is needed for good plant response.

Wetness and the difficulty of maintaining good tilth are limitations to farming these soils. If plowed when too wet, they clod and puddle readily. Wetness and poor stability are the main limitations for many nonfarm uses.

Representative profile of Rhinebeck silt loam in an idle field in the town of Clay, 100 feet north of Orangeport Road, 3,400 feet west of the intersection of Bear Spring Road, 4,600 feet east of Caughdenoy Road:

Ap—0 to 8 inches, very dark gray (10YR 3/1) heavy silt loam, gray (10YR 6/1) dry; moderate, medium and coarse, subangular blocky structure parting to moderate, medium and coarse, granular; friable, slightly sticky; many fine roots; many fine pores; neutral; clear, wavy boundary.

B&A—8 to 11 inches, dark yellowish-brown (10YR 4/4) silty clay; few, medium, distinct yellowish-brown and light brownish-gray mottles; moderate, medium and coarse, blocky structure; firm, sticky; 1- to 2-millimeters-thick, light grayish-brown (10YR 6/2) silt coats on ped faces; many, fine and medium, distinct yellowish-brown (10YR 5/6) mottles; common fine roots; few fine pores; neutral; clear, wavy boundary.

B21t—11 to 20 inches, dark yellowish-brown (10YR 4/4) silty clay; common, fine, distinct yellowish-brown mottles; strong, medium, prismatic structure parting to strong, coarse, subangular blocky; firm, sticky; common fine roots along prism and block faces; few fine pores; continuous grayish-brown (10YR 5/2) clay films on ped faces; thin clay lining in larger pores; neutral; clear, wavy boundary.

B22t—20 to 36 inches, olive-brown (2.5Y 4/4) silty clay; common, fine, distinct yellowish-brown mottles; strong, medium, prismatic structure parting to moderate, coarse, subangular blocky; firm, sticky; few fine roots along ped faces; few fine pores; continuous gray (10YR 5/1) clay films on ped faces that have common, medium, distinct yellowish-brown mottles; clay lining in larger pores; mildly alkaline; clear, smooth boundary.

C—36 to 50 inches, olive-brown (2.5Y 4/4) silty clay loam; many, medium, distinct gray (10YR 5/1) and faint dark grayish-brown (2.5Y 4/2) mottles that decrease in size and number with increasing depth; weak, medium, platy structure; firm, sticky; few fine pores; calcareous.

Thickness of the solum ranges from 20 to 40 inches and corresponds to the depth to carbonates. Depth to bedrock is more than 40 inches and generally is more than 10 feet.

The Ap horizon ranges from very dark gray (10YR 3/1) to dark grayish brown (2.5Y 4/2). In undisturbed areas the A1 horizon ranges from very dark brown (10YR 2/2) to very dark gray (10YR 3/1). It is 3 to 5 inches thick. The A2 horizon, where not destroyed by deep plowing, ranges from grayish brown (2.5Y 5/2) to light gray (10YR 6/1) and has common to many high-chroma mottles. It is silt loam. The A2 horizon generally interfingers into the upper part of the Bt horizon as silt films on ped faces. Reaction of the A horizon ranges from slightly acid to neutral.

The Bt matrix has hues of 10YR to 2.5Y, values of 3 to 5, and chromas of 2 to 4, and has few to many mottles of both high and low chromas. Ped exteriors are 4 to 6 in value, and 1

or 2 in chroma, and have common to many high-chroma mottles. The B horizon ranges from silty clay loam to clay. Structure is generally moderate to strong, and continuous clay films are on ped faces. Reaction of the B horizon ranges from neutral to mildly alkaline.

The C horizon ranges from dark gray (10YR 4/1) to olive (5Y 5/4). It has common to many mottles in the upper part, decreasing in size and number with increasing depth. The C horizon is weakly stratified and ranges from silty clay to fine sand.

Rhinebeck soils are closely associated with the very poorly drained Fonda soils and formed in similar material. They are similar to Odessa soils but are grayer.

Rhinebeck silt loam (Rh).—This level or nearly level soil is on lake plains from which runoff is slow or where it receives runoff from adjacent higher areas. Slopes are mainly between 0 and 4 percent. Individual areas are irregular in shape and range in size from less than 10 acres to more than 50 acres.

Included with this soil in mapping are small areas of Fonda soils in shallow depressions and along drainageways. These wetter soils make up as much as 15 percent of some areas, and they delay tillage unless they are drained. Also included are small areas of Collamer soils on slight, convex knolls or rises. These better drained soils make up as much as 10 percent of some areas, but they have little effect on use and management.

Undrained areas of this soil are generally better suited to hay, pasture, and trees than to most other uses. If drained, the soil can be used for row crops. Because of the slow and very slow permeability, response to drainage is generally only fair unless such special measures as land shaping are taken to facilitate the removal of water. Some areas of this soil adjacent to streams are subject to flooding. Capability unit IIIw–4; woodland suitability group 3w1.

Rock Outcrop

Rock outcrop consists of areas where more than 90 percent of the surface is exposed bedrock or patches of soil that are too thin over bedrock for use in farming. In Onondaga County, Rock outcrop is mapped as one of the major parts of soil associations with soils of the Aurora, Benson, Farmington, and Wassaic series.

Where Rock outcrop is mapped with Aurora and Farmington soils, it is mainly shale and sandstone and some thin, bedded limestone. When mapped with Benson and Wassaic soils, it is mainly hard, massive limestone.

Saprists and Fluvaquents, Ponded

Saprists and Fluvaquents, ponded (SA), popularly termed fresh water marsh, consists of areas that are permanently under water a few inches to 3 feet deep. These areas support a growth of sedges and cattails. They are mostly in the northern half of the county. The largest area is in Peat Swamp in the town of Clay. Many areas, mainly those along the barge canal, have resulted from the building of dams, locks, and dikes.

This soil material is highly variable. It generally consists of silt, clay, or sand sediment, or muck and peat. Detailed examination was not made at the time of field mapping because of the water depth.

Areas are best suited to wetland wildlife habitat. Many muskrats are trapped annually in some areas. In places cattail flags are harvested for caulking material. Standing water and unstable soil material are the main limitations for most other uses. Capability unit VIIIw–1; not assigned to a woodland suitability group.

Schoharie Series

The Schoharie series consists of deep, moderately well drained to well drained, medium-textured and moderately fine textured soils that have a moderately fine textured or fine textured subsoil. These soils formed in lacustrine deposits of calcareous, reddish-brown silt and clay. They are on lake plains.

In a representative profile the surface layer is dark-brown heavy silt loam 6 inches thick. Between depths of 6 and 12 inches, the upper part of the subsoil is reddish-brown, firm silty clay loam. Between depths of 12 and 26 inches, the lower part of the subsoil is reddish-brown, firm silty clay. The substratum, between depths of 26 and 55 inches, consists of a layer of calcareous, reddish-brown, firm silty clay and thin layers of silt.

Schoharie soils have a seasonal high water table at a depth of 18 to 36 inches that is perched on the slowly permeable or very slowly permeable subsoil and substratum. Schoharie soils are slow to dry out. If plowed when too wet, they clod and puddle readily. Root growth is mostly in the upper 24 to 30 inches of soil, but a few roots extend below this depth in places. The available water capacity of this zone is moderate to high. The capacity of these soils to supply nitrogen and phosphorus is generally medium, and to supply potassium, high. In unlimed areas the reaction of the surface layer is slightly acid to neutral, so lime needs are none to slight.

The hazard of erosion, difficulty of maintaining good tilth, and seasonal wetness in places are limitations to farming these soils. Seasonal wetness and poor stability are limitations for many nonfarm uses.

Representative profile of Schoharie silt loam, rolling, in a formerly cultivated, brushy pasture in the town of Marcellus, 75 feet west of State Route 174, 1,500 feet north of U.S. Highway 20:

Ap—0 to 6 inches, dark-brown (7.5YR 4/2) heavy silt loam; weak, fine, subangular blocky structure; friable, slightly sticky; many fine roots; few fine shale chips; neutral; abrupt, smooth boundary.

B21—6 to 12 inches, reddish-brown (5YR 5/3) silty clay loam; moderate, coarse, prismatic structure parting to moderate, medium and coarse, subangular blocky; firm, sticky; few fine roots; common fine and medium pores that have thin clay linings; brown (7.5YR 4/2) silt coats, 1 to 2 millimeters thick, on prism faces; few fine shale chips; neutral; clear, wavy boundary.

B22t—12 to 26 inches, reddish-brown (5YR 4/3) silty clay; strong, coarse, prismatic structure parting to moderate, medium and coarse, angular blocky; firm, sticky; few fine roots along prism faces; few fine pores that have clay linings; reddish-brown (5YR 5/3), continuous clay films on ped faces, films most prominent on prism faces; few fine shale chips; neutral; clear, wavy boundary.

C—26 to 55 inches, reddish-brown (5YR 4/3) silty clay; strong, coarse, prismatic structure parting to moderate, very thick (2 to 6 inches), platy or varved strata separated by 1- to 2-millimeters-thick layers of silt; very firm, sticky; few fine roots along prism faces; very few fine pores; thin, weak-red (2.5YR 5/2) clay films on prism faces in upper part that become discontinuous or patchy with increasing depth; moderately alkaline (calcareous).

The solum ranges from 22 to 36 inches in thickness. The depth to carbonates is 20 to 36 inches. Depth to bedrock is more than 40 inches and generally is more than 10 feet.

The Ap horizon ranges from dark brown (7.5YR 4/2) to brown (7.5YR 5/2) and is generally free of coarse fragments, but it is as much as 3 percent coarse fragments in places. The Ap horizon is silt loam or silty clay loam. In unlimed areas reaction ranges from slightly acid to neutral.

The upper part of the B horizon ranges from light reddish brown (5YR 6/3) to reddish brown (5YR 4/3). It is heavy silt loam to silty clay loam. The B22t horizon has values of 3 to 4 and hues of 5YR or 2.5YR. It is silty clay loam to silty clay. Reaction ranges from neutral to mildly alkaline.

The C horizon ranges from reddish brown (5YR 4/3) and (5YR 5/3) to weak red (2.5YR 5/2). It is silty clay that has very fine sand or silt layers between varves.

Schoharie soils are closely associated with the somewhat poorly drained Odessa soils and the poorly drained Lakemont soils and formed in similar material. They are also near the well-drained Dunkirk soils but have finer texture.

Schoharie silt loam, 2 to 6 percent slopes (ScB).—This gently sloping to gently undulating soil is on smooth lake plains in lower valley positions. Slopes are convex and generally short to medium in length. Individual areas are irregular in shape and generally less than 10 acres in size. Only a few areas are larger than 20 acres.

This soil has a profile similar to the one described as representative of the series, but the surface layer is generally thicker and coarser in texture.

Included with this soil in mapping are small areas of Odessa soils in shallow depressions and drainageways. Also included are small areas of Howard and Herkimer soils on alluvial fans.

This soil is suited to crops, pasture, and trees. Erosion control is needed on the longer slopes, especially if the soil is used intensively for row crops. This soil is slightly wet at times, and it clods readily if cultivated when wet. Capability unit IIe–8; woodland suitability group 2o1.

Schoharie silt loam, rolling (ScC).—This soil, in most places, is on dissected lake plains where slopes are short and complex. A few areas, however, have smooth, simple slopes. Individual areas range from 5 to 50 acres in size and are variable in shape. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of somewhat poorly drained Odessa soils in drainageways or shallow depressions and poorly drained Lakemont soils in seeps or wet spots. Also included are small areas of Cazenovia soils where glacial till protrudes above the lake plains.

This soil is suited to crops, hay, pasture, and trees. If the soil is cropped, conservation measures are needed to control runoff and erosion. A cropping system that maintains good soil structure, tilth, and content of organic matter is needed on this soil. This soil clods readily if plowed when too wet. Runoff is rapid, and the hazard of erosion is severe. Capability unit IVe–8; woodland suitability group 2r1.

Schoharie silty clay loam, hilly (SdD).—Most areas of this soil are on moderately steep sides of drainageways that have short, complex, convex-shaped slopes. Slopes are mainly between 12 and 20 percent. Most of the areas that have been cleared and used for crops are severely eroded.

This soil has a profile similar to the one described as representative of the series, but it has a lighter colored, heavier textured surface layer.

Included with this soil in mapping are small, narrow areas of somewhat poorly drained Odessa soils along the drainageways. Also included are areas of poorly drained Lakemont soils in seep spots.

This soil is suited to crops, hay, pasture, and trees. Because of complex slopes, cropped areas are better suited to long-term hay than to most other uses. Runoff is rapid, and the hazard of erosion is severe. This soil is difficult to till, especially where eroded, and it clods readily if plowed when too wet. It is poorly suited to crops even under good management. Capability unit IVe–8; woodland suitability group 2r1.

Schoharie soils, steep (SEE).—These soils are on short, narrow, simple and complex side slopes of deep drainageways or on steep, higher valley sides. Slopes range mainly between 20 and 30 percent. Many areas are severely eroded.

These soils have a profile similar to the one described as representative of the series, but they are better drained, shallower to the substratum, and generally have a heavier textured surface layer.

Included with these soils in mapping are narrow areas of steep Aurora, Cazenovia, or Honeoye soils on uplands. Also included are areas of more silty Dunkirk soils and gravelly Howard and Palmyra soils.

These soils are better suited to pasture or trees than to most other uses. Some of the smoother areas are suited to hay. Tillage and mowing are difficult and hazardous because of the steep, complex slopes. Runoff is rapid or very rapid, and the hazard of erosion is severe. Capability unit VIe–1; woodland suitability group 2r3.

Teel Series

The Teel series consists of deep, moderately well drained and somewhat poorly drained, medium-textured soils. These soils formed in recent alluvial deposits of silt and very fine sand that contain moderate to high amounts of lime. They are nearly level soils on flood plains of the larger streams in the county.

In a representative profile the surface layer is dark-brown silt loam 10 inches thick. Between depths of 10 and 21 inches, the upper part of the subsoil is friable, dark-brown silt loam that is faintly mottled. Between depths of 21 and 28 inches the lower part of the subsoil is dark grayish brown and mottled. The substratum, between depths of 28 and 60 inches, consists of thick layers of mottled, dark yellowish-brown, friable silt loam and thin layers of light brownish-gray silty clay loam.

Teel soils are commonly flooded in spring, but they are rarely flooded during the growing season. The height of the water table is governed by the water level of the adjacent streams and is at a depth of 12 to

24 inches for long periods of time. Rooting depth is mainly in the upper 24 to 30 inches of soil. Permeability of this zone is moderate, and the available water capacity is high. The capacity of these soils to supply phosphorus and potassium is generally medium, and to supply nitrogen, medium to high. In unlimed areas reaction of the surface layer is neutral to slightly acid, so lime needs are none to slight.

Seasonal wetness and the hazard of flooding are the main limitations. These soils are generally an excellent source of topsoil.

Representative profile of Teel silt loam in a cultivated area in the town of Onondaga, 150 feet east of the dug channel of Onondaga Creek, 2,500 feet west of U.S. Highway 11, 550 feet north of the Onondaga Indian Reservation line:

Ap—0 to 10 inches, dark-brown (10YR 3/3) silt loam; brown (10YR 4/3) rubbed; moderate, medium and fine, subangular blocky structure parting to weak, medium, granular; friable; many roots; neutral; abrupt, smooth boundary.

B21—10 to 21 inches, dark-brown (10YR 4/3) silt loam; common, fine, faint gray (10YR 5/1) mottles; weak, medium and coarse, subangular blocky structure; friable; common roots; many fine pores; neutral; clear, wavy boundary.

B22—21 to 28 inches, dark grayish-brown (10YR 4/2) silt loam; common, medium, faint yellowish-brown (10YR 5/6) mottles; weak, medium and coarse, subangular blocky structure; friable, firmer than horizon above; few fine roots; many pores lined with light brownish-gray (10YR 6/2) silt coatings; mildly alkaline; abrupt, wavy boundary.

C—28 to 60 inches, dark yellowish-brown (10YR 3/4) silt loam that has thin layers of light brownish-gray (10YR 6/2) silty clay loam; common, medium, faint brownish-yellow (10YR 6/8) and yellowish-brown (10YR 5/8) mottles; very weak, coarse, subangular blocky structure; friable; few fine roots; common fine and medium pores, nearly continuous clay linings in medium pores; mildly alkaline.

The solum ranges from 24 to 40 inches in thickness. Depth to bedrock is more than 40 inches. The solum is mostly silt loam, but it ranges to fine sandy loam. The C horizon is mainly silt loam to fine sandy loam. Layers of silty clay sediment are present in places. Coarse fragments are not common in the solum, but they make up as much as 5 percent, by volume, in places. Layers of gravel are common in the C horizon in shallower profiles. Reaction is slightly acid to mildly alkaline in the solum and neutral to moderately alkaline (calcareous) in the C horizon. Depth to low-chroma mottles or a horizon that has matrix chroma of 2 or less and high-chroma mottles ranges from 10 to 24 inches.

The Ap horizon ranges from dark grayish brown (10YR 4/2) to dark brown (10YR 3/3). Dry values are 6 or 7. The Ap horizon is slightly acid to mildly alkaline.

The B horizon ranges from brown (10YR 5/3) to dark yellowish brown (10YR 3/4), dark grayish brown (2.5Y 4/2), and dark brown (7.5YR 4/4). Chromas of 2 in the B horizon are inherited and do not indicate wetness. Structure is weak or moderate, medium or coarse, subangular blocky. The B horizon has moderately coarse prisms in places.

The C horizon ranges from light brownish gray (10YR 6/2) to dark brown (10YR 4/3) or brown (7.5YR 5/4). Mottles are many or common. Consistence is friable or firm. Buried surface layers are present in places.

Teel soils are closely associated with the well-drained Hamlin soils and the poorly drained and very poorly drained Wayland soils and formed in similar material. They are also near the well-drained, shaly Herkimer soils and the well-drained and somewhat excessively drained, gravelly Howard soils on fans.

Teel silt loam (Te).—This level or nearly level soil is on flood plains mainly along the larger streams in the county. Individual areas are irregular in shape and range in size from less than 5 acres to more than 100 acres.

Included with this soil in mapping are small areas of Teel soils at slightly higher elevations that have a slightly lighter colored surface layer and a browner subsoil and are subject to flooding only once in 5 to 10 years. Also included are small areas of Wayland soils in shallow depressions and remnants of old oxbows or stream channels that have been partly filled by deposition from floods. These wetter soils make up as much as 10 percent of some areas, and they need drainage for crops. Other inclusions are small areas of Hamlin soils on slightly higher areas adjacent to streams. These better drained soils make up as much as 15 percent of some areas, but they have little effect on use and management.

This soil is suited to crops, hay, pasture, and trees. It is generally better suited to annual crops or to perennial crops that can tolerate flooding and inundation early in spring than to most other uses. In some places the surface layer is subject to scouring by rapidly flowing flood water if it is left without protective cover. In many places streambanks are subject to cutting during floods or periods of higher water. Capability unit IIw–2; woodland suitability group 2o2.

Urban Land

Urban land (Ub) consists of areas so altered or obscured by urban works that identification of the soils is not feasible. Buildings or pavement cover more than 50 percent of such areas. Urban land includes the downtown business district of the city of Syracuse and the larger shopping complexes and industrial parks with their buildings and large, paved parking lots in both the city and its suburbs. Not assigned to a capability unit or woodland suitability group.

Varick Series

The Varick series consists of moderately deep, poorly drained, medium-textured soils. These soils formed in thin till deposits or partly in residuum derived mainly from the underlying gray shale bedrock. They are on uplands where bedrock affects the relief. They commonly receive large amounts of runoff or seepage from adjacent higher, better drained soils.

In a representative profile the surface layer is very dark gray silt loam 8 inches thick. Between depths of 8 and 15 inches is a subsurface layer of mottled, grayish-brown, friable silt loam. Between depths of 15 and 30 inches, the subsoil is mottled, dark grayish-brown, firm silty clay loam. The substratum, between depths of 30 and 34 inches, is mottled, grayish-brown, firm shaly silt loam. Dark-gray, brittle shale bedrock is at a depth of 34 inches.

Varick soils have a prolonged high water table at a depth of 6 inches or less in places. It is perched on the slowly permeable or very slowly permeable subsoil and substratum. Rooting depth is limited by wetness mainly to the upper 18 inches. The available water capacity of this zone is moderate. More than enough

moisture is generally available for plant growth. The capacity of these soils to supply phosphorus is medium, and to supply potassium, medium to high. The supply of nitrogen is high, but it is released slowly in spring when the soils are cold and wet, so plants respond to applications of fertilizer containing nitrogen at this time. In unlimed areas reaction of the surface layer is medium acid to neutral, so lime is needed in places for best crop response.

Prolonged wetness, difficulty of establishing adequate drainage because of depth of bedrock, and slow permeability or very slow permeability are limitations to farm and nonfarm uses of these soils.

Representative profile of Varick silt loam in a forested area in the town of Skaneateles, 1,100 feet west of Rickard Road, 3,200 feet north of Coon Hill Road:

A1—0 to 8 inches, very dark gray (10YR 3/1) silt loam, very dark grayish brown (10YR 3/2) crushed; moderate, medium and coarse, granular structure; friable; many roots; 5 percent coarse fragments, dominantly shale and sandstone; neutral; clear, wavy boundary.

A2g—8 to 15 inches, grayish-brown (2.5Y 5/2) silt loam; feels gritty; common, medium, distinct dark yellowish-brown, yellowish-brown, and gray mottles; moderate, medium and coarse, subangular blocky structure; friable, slightly sticky; common roots; common pores; 5 percent shale and sandstone fragments; neutral; clear, wavy boundary.

B2tg—15 to 30 inches, dark grayish-brown (2.5Y 4/2) light silty clay loam; few, medium, distinct dark yellowish-brown and gray mottles; moderate, medium and coarse, blocky structure; firm, sticky; few fine roots; common pores that have continuous clay linings; grayish-brown (2.5Y 5/2), continuous, thin clay films on ped faces; 10 percent shale fragments; neutral; clear, wavy boundary.

Cg—30 to 34 inches, grayish-brown (2.5Y 5/2) shaly heavy silt loam; common, medium, distinct dark yellowish-brown and yellowish-brown mottles; weak, medium and thick, platy structure; firm, slightly sticky; few medium pores that have patchy clay linings; 25 percent shale fragments; mildly alkaline; abrupt, wavy boundary.

R—34 inches, dark-gray (2.5Y 4/1), brittle shale bedrock that cannot be cut with spade; upper 12 inches weathered and somewhat broken; mildly alkaline (weakly calcareous.)

The solum ranges from 20 to 36 inches in thickness. Depth to bedrock ranges from 20 to 40 inches. The C horizon is generally absent where depth to bedrock is between 20 and 24 inches, but it is generally present and ranges to as much as 6 inches in thickness where the depth to bedrock is 24 to 40 inches. Content of coarse fragments, mainly shale, ranges from 2 to 35 percent in the solum and from 15 to 50 percent in the C horizon, or in a thin 2- to 4-inch zone just above the rock in the Bt horizon if the C horizon is absent.

The A1 and Ap horizons range from black (10YR 2/1) to dark brown (7.5YR 3/2). In unlimed areas reaction is medium acid to neutral. An A2g horizon is present in places and it is as much as 8 inches thick, generally where the depth to bedrock is more than 30 inches. Hues range from 10YR to 5Y, values are 4 and 5, and chromas are 1 and 2. Both high- and low-chroma mottles in the A2g horizon range from few to common. The fine earth ranges from loam to silty clay loam in the A horizon, and reaction is medium acid to neutral.

The Btg horizon ranges from olive gray (5Y 4/2) to gray (5YR 5/1). Values are 4 and 5 and chromas are 1 and 2, and high-chroma mottles range from few to many. The fine earth ranges from loam to silty clay loam. Structure in the Btg horizon is moderate to strong, medium and coarse, blocky. It has distinct clay films or coats that have chroma of 0, 1, or 2 on ped faces and in pores. Reaction ranges from medium acid to mildly alkaline.

The C horizon, where present, has color, texture, and consistence similar to that of the Btg horizon. The content of shale fragments is higher. Reaction ranges from mildly alkaline to moderately alkaline (calcareous). Structure in the C horizon is weak to moderate, thin to thick, platy, or the material is massive.

Varick soils are closely associated with the somewhat poorly drained Angola soils and the moderately well drained Aurora soils and formed in similar material. They are also near the somewhat poorly drained Darien soils and the poorly drained Lyons soils, which formed in deep till.

Varick silt loam (Va).—This level to very gently sloping soil is on moderately low, bedrock-controlled landforms of the uplands where it receives runoff from adjacent higher, better drained soils. Slopes range from 0 to 4 percent. Individual areas are irregular in shape, and most are smaller than 20 acres. Only a few areas are larger than 30 acres.

Included with this soil in mapping are small areas of Lyons soils where the bedrock is at a depth of more than 40 inches. These deeper soils make up as much as 20 percent of some areas, but they have little effect on use and management. Also included are small areas of somewhat poorly drained Angola soils on slight rises and knolls. These soils make up as much as 15 percent of some areas, but they have little effect on use and management.

This soil is suited to crops, hay, pasture, and trees. Undrained areas are suited to grass and legume hay or pasture that can tolerate wetness. If adequately drained, the soil is well suited to many crops commonly grown in the county, especially annual row crops. This soil clods readily if it is plowed when too wet. The hazard of erosion is moderate on the longer, very gentle slopes, especially where runoff water from adjacent higher land concentrates. Capability unit IVw–4; woodland suitability group 4w1.

Volusia Series

The Volusia series consists of deep, somewhat poorly drained, medium-textured soils that have a dense fragipan as the subsoil. These soils formed in glacial till derived mainly from sandstone, siltstone, and shale. They are on uplands at elevations of more than 1,400 feet.

In a representative profile the surface layer is very dark grayish-brown channery silt loam 7 inches thick. Between depths of 7 and 15 inches is a subsurface layer of mottled, brown, friable channery silt loam. Between depths of 15 and 46 inches, the subsoil is a dense, very firm, and brittle fragipan of mottled, dark grayish-brown channery silt loam. The substratum, between depths of 46 and 53 inches, is firm, dark grayish-brown very channery silt loam that is mottled.

Volusia soils have a seasonal high water table at a depth of 6 to 12 inches. It is perched on the very slowly permeable fragipan. Rooting depth is limited mainly to soil above the fragipan. The available water capacity of this zone is low to moderate. Generally more than enough moisture is available for plant growth, but during long dry periods plants suffer from lack of water. The capacity of these soils to supply phosphorus and potassium is medium. The supply of nitrogen is medium to high. It is slowly available when the soils are cold and wet, so plants respond to applications of nitrogen fertilizer. In unlimed areas the reaction of the surface layer is medium acid to slightly acid.

Seasonal wetness and shallow rooting depth are The main limitations to farming these soils. Seasonal wetness and the very slowly permeable fragipan and substratum are the major limitations for many nonfarm uses.

Representative profile of Volusia channery silt loam, 0 to 8 percent slopes, in a formerly cultivated, idle field in the town of Fabius, 300 feet east of the truck trail, which is a continuation of Rowley Hill Road, 5,500 feet north of the Cortland County line:

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) channery silt loam, dark brown (10YR 3/3) rubbed; moderate, medium, granular structure; friable; many roots; 20 percent coarse fragments; medium acid; clear, wavy boundary.

A2—7 to 15 inches, brown (10YR 5/3) channery silt loam; many, medium, distinct gray (10YR 5/1) and yellowish-brown (10YR 5/4) mottles, larger mottles have strong-brown (7.5YR 5/6) centers; weak, medium and coarse, subangular blocky structure; friable; common fine roots; common medium pores; 20 percent coarse fragments; medium acid; clear, wavy boundary.

Bx1—15 to 24 inches, dark grayish-brown (2.5Y 4/2) channery silt loam; many, coarse, distinct yellowish-brown and gray mottles; strong, very coarse prisms as much as 10 to 20 inches across parting to weak, medium, platy structure; prisms separated by tongues of friable silt, 1/2 inch to 1/4 inch wide, with grayish-brown (2.5Y 5/2) centers and strong-brown (7.5YR 5/6) edges; prisms very firm and brittle; few fine roots in silt along prism faces; few medium pores that have thin patchy clay linings; 25 percent coarse fragments; medium acid; gradual, wavy boundary.

Bx2—24 to 46 inches, dark grayish-brown (2.5Y 4/2) channery silt loam; common, coarse, distinct yellowish-brown and gray mottles; very coarse prisms, 12 to 18 inches wide, parting to weak, thick, platy structure; grayish-brown (2.5YR 5/2) silt films, 1 to 4 millimeters thick, on prism faces; very firm, brittle; few medium pores that have thin patchy clay films; 30 percent coarse fragments; neutral; gradual, wavy boundary.

C—46 to 53 inches, dark grayish-brown (2.5Y 4/2) very channery silt loam; few, medium, distinct light olive-brown and yellowish-brown mottles in upper part becoming fewer and smaller with increasing depth; massive; firm; few fine and medium pores; 50 percent coarse fragments; mildly to moderately alkaline (weakly calcareous).

The solum ranges from 40 to 60 inches in thickness. Depth to bedrock is more than 40 inches. Depth to calcareous material is more than 40 inches. Depth to the fragipan ranges from 10 to 16 inches. Content of coarse fragments ranges from 10 to 30 percent in the upper horizons and from 30 to 60 percent in the C horizon.

The A1 and Ap horizons range from very dark gray to dark brown. They have hues of 10YR and 2.5Y, values of 3 and 4, and chromas of 1 to 3. The A2 horizon ranges from pale brown to olive gray and has common to many mottles. Reaction of the A horizon ranges from strongly acid to slightly acid.

The Bx horizon ranges from dark grayish brown to olive. It has hues of 10YR to 5Y, values of 4 and 5, and chromas of 2 to 4. The fine earth ranges from silt loam to loam. Reaction ranges from medium acid to mildly alkaline.

The C horizon is dark grayish brown, grayish brown, or olive brown. It has platy structure or is massive. Consistence of the C horizon is firm or very firm. The fine earth is loam or silt loam. Reaction of the C horizon ranges from mildly alkaline to moderately alkaline.

Volusia soils are closely associated with the moderately well drained Mardin soils and formed in similar material. They are also near Volusia soils, moderately shallow variant, and Appleton soils. Volusia soils are deeper to bedrock than Volusia soils, moderately shallow variant. They have a fragipan, are more acid, and have less clay in the B horizon than Appleton soils.

Volusia channery silt loam, 0 to 8 percent slopes (VoB).—The level or nearly level areas of this soil are mainly on broad hilltops from which water drains slowly. The gently sloping areas are on hillsides that receive runoff and seepage from adjacent higher soils. Most areas are smaller than 30 acres in size, but a few areas are larger than 50 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small spots of a similar but poorly drained soil on flat areas, shallow depressions, and drainageways. This included soil makes up as much as 20 percent of some mapped areas, and it further delays tillage in spring unless it is drained. Also included are small areas of better drained Mardin soils on slight convex knolls and areas of the moderately shallow variant of Volusia soils where bedrock is at a depth of 20 to 40 inches.

This soil is suited to crops, pasture, and trees. Undrained areas are better suited to hay crops consisting of water-tolerant grasses and legumes than to most other crops. In addition to seasonal wetness, erosion is a hazard on the more sloping areas if the soil is cultivated and left unprotected. Angular stone fragments hinder tillage and harvesting. Capability unit IIIw–5; woodland suitability group 3w2.

Volusia channery silt loam, 8 to 15 percent slopes (VoC).—This sloping soil is commonly on concave footslope areas of hillsides. Individual areas are long and narrow and generally are smaller than 20 acres.

This soil has a profile similar to the one described as representative of the series, but the surface layer is lighter colored in many places.

Included with this soil in mapping are small areas of better drained Mardin soils on slight convex rises. Also included are areas of a similar but poorly drained soil below seep spots.

This soil is suited to crops, hay, pasture, and trees. Unless this soil is drained, seasonal wetness delays planting and limits the choice of crops. The hazard of erosion is moderate to severe if the soil is cultivated and left unprotected. Angular stone fragments hinder tillage and harvesting. Capability unit IIIe–8; woodland suitability group 3w2.

Volusia Series, Moderately Shallow Variant

The Volusia series, moderately shallow variant, consists of moderately deep, somewhat poorly drained, medium-textured soils on uplands. These soils formed in glacial till that consists mainly of gray sandstone and shale and some limestone. They are on uplands where relief is influenced by the underlying bedrock. Elevations are generally about 1,500 feet.

In a representative profile the surface layer is dark grayish-brown channery silt loam 9 inches thick. Between depths of 9 and 10 inches is a subsurface layer of pale-brown, friable channery silt loam. Between depths of 10 and 14 inches is friable, grayish-brown channery silt loam that has common yellowish-brown and brown mottles. Between depths of 14 and 26 inches, the subsoil is a very firm and brittle fragipan that is mottled, dark grayish-brown channery silt loam. It rests on dark grayish-brown sandstone bedrock at a depth of 26 inches.

Depth to the seasonal water table is 6 to 12 inches. It is perched above the fragipan. Rooting depth is

limited to soil above the fragipan, and is also affected by seasonal wetness. Because soil above the pan has low to moderate available water capacity, plants are damaged by too much water during wet summers and by too little water during dry summers. These soils are acid and need lime. They are medium to high in content of organic matter and nitrogen. Wetness, however, reduces the decomposition of organic matter and the release of nitrogen during spring and wet summers, so plants need additional nitrogen during these periods. The capacity of these soils to supply phosphorus and potassium is medium. The use of complete fertilizer is beneficial for most crops. Drainage to remove excess water is also beneficial for most crops.

Representative profile of Volusia channery silt loam, moderately shallow variant, 0 to 6 percent slopes, in a formerly cultivated, idle field in the town of Pompey, 2,400 feet east of Pompey Center Road, 1,800 feet northwest East Hill Road at Old Steep Hill Road:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) channery silt loam, dark brown (10YR 4/3) crushed; moderate, fine, granular structure; friable, slightly sticky; many fine roots; 15 percent coarse fragments; medium acid; abrupt, smooth boundary.

A21—9 to 10 inches, pale-brown (10YR 6/3) channery silt loam; common, medium, distinct yellowish-brown, dark yellowish-brown, and brown mottles; weak, fine, subangular blocky structure; friable; common fine roots; common fine pores; 15 percent coarse fragments; strongly acid; clear, discontinuous boundary; horizon destroyed by deep plowing in places.

A22—10 to 14 inches, grayish-brown (10YR 5/2) channery silt loam; common, medium, distinct yellowish-brown, dark yellowish-brown, and brown mottles; weak, thick, platy structure parting to weak, very fine, subangular blocky; friable; common fine roots; few fine pores; 20 percent coarse fragments; strongly acid; abrupt, wavy boundary.

Bx1—14 to 26 inches, dark grayish-brown (10YR 4/2) channery silt loam; few, fine and medium, distinct dark yellowish-brown and yellowish-brown mottles; strong, very coarse, prismatic structure; very firm, brittle; prisms separated by 1/4- to 1/2-inch wide silt wedges that have grayish-brown (2.5Y 5/2) centers with many, coarse, prominent brown (7.5YR 4/4), dark reddish-brown (5YR 3/4), and yellowish-brown (10YR 5/6) mottled edges; wedges have weak, thin, platy structure; few fine roots in silty wedges; common fine and medium pores in wedges and prisms; thin, patchy clay linings in larger pores in prisms; 25 percent coarse fragments; medium acid; abrupt, smooth boundary.

R—26 inches, dark grayish-brown (10YR 4/2), fine-grained sandstone bedrock, grayish-brown silt coats on joints and horizontal faces of rock in upper 12 inches.

Solum thickness ranges from 20 to 40 inches and corresponds to the depth to bedrock. Depth to the fragipan ranges from 10 to 16 inches. Content of coarse fragments ranges from 15 to 35 percent, by volume, in the solum.

The Ap horizon ranges from very dark grayish-brown (10YR 3/2) to brown (10YR 5/3). In unlimed areas reaction is strongly acid to medium acid. In undisturbed areas the A1 horizon ranges from very dark gray (10YR 3/1) to dark brown (10YR 4/3). It is 3 to 6 inches thick. The A2 horizon ranges from pale brown (10YR 6/3) to dark grayish brown (2.5Y 4/2) and has common to many, fine and medium, higher-chroma mottles. The A horizon ranges from silt loam to loam. Reaction ranges from strongly acid to medium acid.

The Bx horizon ranges from dark grayish brown (10YR 4/2) to olive brown (2.5Y 4/4). It is silt loam or loam. Consistence is firm or very firm and brittle. Structure of the Bx horizon is weak, platy, or the material is massive within coarse or very coarse prisms. Reaction ranges from medium acid to neutral. Gray sandstone and shale bedrock is at a depth of 20 to 40 inches.

Volusia soils, moderately shallow variant, are closely associated with the moderately well drained Mardin soils, moderately shallow variant, and the well-drained Lordstown soils and formed in similar material. They are also near the deep, somewhat poorly drained Volusia soils and the moderately well drained Mardin soils, which formed in deep till.

Volusia channery silt loam, moderately shallow variant, 0 to 6 percent slopes (VuB).—This level to gently sloping soil is either on the broad tops of hills where it receives little or no runoff from adjacent higher soils, but from which water drains slowly, or it is on side hills where it receives runoff and seepage from adjacent higher soils. Most areas are smaller than 30 acres in size, and only a few areas are larger than 50 acres.

Included with this soil in mapping are small areas of the moderately shallow variant of Mardin soils on slight convex knolls and areas of deep Volusia soils where the depth to bedrock is more than 40 inches. These inclusions make up as much as 20 percent of some areas, but they have little effect on use and management. Also included are small wet areas of similar but poorly drained soils.

This soil is suited to crops, pasture, and trees. Undrained areas are better suited to hay crops consisting of water-tolerant grasses and legumes than to most other uses. If adequately drained, this soil is suited to short-season crops. Drainage is difficult to establish because of the moderately shallow depth to bedrock. Angular stone fragments hinder tillage and harvesting in places. Capability unit IIIw–5; woodland suitability group 3w2.

Wampsville Series

The Wampsville series consists of deep, well-drained, medium-textured soils that have a moderately fine textured subsoil. These soils formed in glacial outwash and moraine deposits that are high in content of red and olive-gray clay shale. They are level to rolling on glacial outwash terraces and moraines.

In a representative profile the surface layer is dark reddish-gray gravelly silt loam 8 inches thick. Between depths of 8 and 13 inches is a subsurface layer of reddish-brown, friable gravelly silt loam. Between depths of 13 and 36 inches, the subsoil is firm gravelly silty clay loam. It is reddish brown between depths of 13 and 21 inches and weak red between depths of 21 and 36 inches. Between depths of 36 and 40 inches, the underlying calcareous substratum is dark reddish-gray, friable very gravelly sandy loam. Below this, and extending to a depth of 72 inches, is stratified sand and gravel that is grayish-brown to weak red and contains many red and greenish-gray shale fragments.

In most areas the water table in Wampsville soils is at a depth of more than 3 feet, but in a few places it fluctuates to within 3 feet of the surface in spring and during wet periods. Permeability is moderate in the solum and moderate to rapid in the substratum. Rooting depth is mainly in the upper 30 inches of soil.

This zone has high available water capacity. The capacity of these soils to supply nitrogen and phosphorus is generally medium, and to supply potassium, high. In unlimed areas reaction of the surface layer is medium acid to neutral, so lime needs vary from place to place. Crops respond well to applications of fertilizer.

Other than the hazard of erosion on sloping areas, there are few limitations to farm and many nonfarm uses of Wampsville soils.

Wampsville gravelly silt loam, 3 to 8 percent slopes, in a hayfield in the town of Van Buren, 700 feet north of Tappon Road at a point 400 feet east of Crego Road, 2,500 feet east of new State Route 48:

Ap—0 to 8 inches, dark reddish-gray (5YR 4/2) gravelly silt loam; moderate, medium, granular structure; friable; many roots; 20 percent gravel and few cobbles; slightly acid; abrupt, smooth boundary.

A2—8 to 13 inches, reddish-brown (5YR 5/3) gravelly silt loam; weak, medium, granular structure; friable; many roots; common pores; 20 percent gravel; slightly acid; clear, wavy boundary.

B21t—13 to 21 inches, reddish-brown (5YR 5/4) gravelly silty clay loam; moderate, medium, subangular blocky structure; firm, slightly sticky; common roots; many pores that have thin clay linings; reddish-brown (5YR 5/3) silt coatings, 2 to 4 millimeters thick, on ped faces in upper 3 inches; clay films on ped faces in lower part; 25 percent gravel; some partly weathered clay shale fragments; slightly acid; clear, wavy boundary.

B22t—21 to 32 inches, weak-red (2.5YR 4/2) gravelly silty clay loam; moderate, medium, subangular blocky structure; firm, sticky; common roots; many pores; weak-red (2.5Y 5.3) clay films on ped faces and in larger pores; 30 percent gravel and partly weathered, reddish and greenish clay shale fragments; slightly acid; gradual, irregular boundary.

B3—32 to 36 inches, weak-red (2.5YR 4/2) gravelly silty clay loam; weak, medium and coarse, subangular blocky structure; firm, sticky; few roots; many pores; weak-red (2.5Y 5/2) clay films on ped faces and in pores; 30 percent gravel and reddish and greenish clay shale chips; mildly alkaline (slightly calcareous); gradual, irregular boundary.

IIC1—36 to 40 inches, dark reddish-gray (5YR 4/2) very gravelly sandy loam; massive; friable, slightly sticky; few fine roots; thin clay films on gravel; clay bridges between sand grains; 40 percent gravel, red and green shale chips; moderately alkaline (calcareous); clear, irregular boundary.

IIC2—40 to 72 inches, stratified sand and gravel, sand grains range from grayish brown (10YR 5/2) to weak red (2.5YR 5/2); numerous red and greenish-gray shale fragments; moderately alkaline (calcareous).

The solum ranges from 20 to 40 inches in thickness. Depth to carbonates ranges from 24 to 48 inches. Depth to bedrock is more than 40 inches and generally is more than 6 feet. Content of coarse fragments, mainly gravel and shale, ranges from 10 to 35 percent, by volume, in the solum and from 35 to 70 percent in the C horizon.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) to dark reddish gray (5YR 4/2). In undisturbed areas the A1 horizon ranges from very dark brown (10YR 2/2) to dark reddish gray (5YR 4/2). It is 3 to 6 inches thick. The A2 horizon generally is present, but it has been destroyed by deep plowing in places. The A2 horizon material, in the form of silt coats 1 to 4 millimeters thick, is on upper vertical ped faces of the Bt horizon to a depth of 1 to 4 inches. The A2 horizon ranges from brown (7.5YR 5/4) to weak red (2.5YR 5/2) when moist and from pinkish gray (7.5YR 7/2) or pink (5YR 7/2) to pale red (2.5YR 6/2) when dry. The fine earth in the A2 horizon ranges from loam to light silty clay loam, with silt loam dominant. In unlimed areas reaction of the A horizon ranges from neutral to medium acid.

The Bt horizon ranges from weak red (2.5YR 4/2) to brown (7.5YR 5/4). The fine earth ranges from sandy clay loam to silty clay loam. The Bt horizon generally contains common to many partly weathered clay shale fragments. Structure ranges from moderate to strong, medium and coarse, blocky with distinct clay films. Consistence of the Bt horizon is firm to friable when moist and slightly sticky to plastic when wet. Reaction ranges from slightly acid to mildly alkaline and is weakly calcareous in the lower part in places.

The C horizon ranges from dusky red (2.5YR 3/2) to grayish brown (10YR 5/2) and is weakly stratified to strongly stratified. It ranges from sand and gravel to very gravelly silty clay loam. Reaction is generally moderately alkaline (calcareous), but it is neutral to mildly alkaline in places above a depth of 60 inches.

Wampsville soils are closely associated with the moderately well drained Phelps soils and formed in similar material. They are also near Lairdsville and Palmyra soils. Wampsville soils have coarser textures and are deeper to bedrock than Lairdsville soils. They have finer textures than Palmyra soils.

Wampsville gravelly silt loam, 0 to 3 percent slopes (WaA).—This level or nearly level soil is on the flat tops of glacial outwash terraces or morainic deposits. Individual areas are irregular in shape and range in size from less than 10 acres to more than 100 acres.

Included with this soil in mapping are small areas of Phelps soils in shallow depressions and along narrow drainageways. These moderately well drained soils make up as much as 5 percent of some areas, but they have little effect on use and management. Also included are small areas of Lairdsville soils where the clay shale bedrock is at or near the surface.

This soil is suited to crops, hay, pasture, and trees. It is well suited to most crops commonly grown in the county. Management concerns are few. The main concern of management is maintaining good surface soil structure and a high content of organic matter. Runoff is generally slow, and erosion is not a hazard. Capability unit I–1; woodland suitability group 2o1.

Wampsville gravelly silt loam, 3 to 8 percent slopes (WaB).—This gently sloping or gently undulating soil is in areas of glacial outwash terraces or moraines or their side slopes. Where this soil has been intensively cropped, it is silghtly eroded to moderately eroded. Individual areas are generally irregular in shape, but some are long and narrow. They range in size from less than 10 acres to more than 100 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Phelps soils in depressions or along narrow drainageways. These wetter soils make up as much as 10 percent of some areas, and they delay tillage in spring unless they are drained. Also included are small areas of Lairdsville soils where the clay shale bedrock is at or near the surface.

This soil is suited to crops, hay, pasture, and trees. Most areas have been cleared and are used for crops. The soil is well suited to most crops commonly grown in the county. Runoff is moderate, and erosion is a hazard if the soil is cultivated and left unprotected. Management practices that maintain good soil structure and a high content of organic matter are also helpful. Capability unit IIe–2; woodland suitability group 2o1.

Wampsville gravelly silt loam, rolling (WaC).—This soil mainly is on rolling areas of glacial outwash terrances and kames or moraines that have short, complex slopes. A few terrace faces have short,

smooth slopes of limited acreage. Individual areas are usually irregular in shape, but a few are long and narrow. They range in size from less than 10 acres to about 20 acres, and only a few areas are larger than 30 acres. Slopes range from 8 to 15 percent.

This soil has a profile similar to the one described as representative of the series, but the depth to the underlying stratified substratum is generally more variable from place to place, and in some places it is severely eroded and has the more clayey subsoil material mixed into the surface layer.

Included with this soil in mapping are small areas of Lairdsville soils where the clay shale bedrock is at or near the surface. These slightly heavier soils make up as much as 10 percent of some areas, and they are more difficult to till and are more erodible where runoff is rapid. Also included are small areas of Phelps soils in the deeper depressions and along narrow drainageways. These soils make up as much as 10 percent of some areas, but they have little effect on use and management.

This soil is suited to limited crops, hay, pasture, and trees. Because of the short, complex slopes, most areas of this soil are better suited to long-term hay crops than to most other uses. If used for row crops, the soil needs intensive erosion-control measures to control runoff and erosion. Such measures generally are difficult to establish because of the short, complex slopes. Capability unit IVe–10; woodland suitability group 2o1.

Wareham Series

The Wareham series consists of deep, poorly drained and somewhat poorly drained, coarse-textured soils. These soils formed in sands that were deposited in glacial lakes. They are in depressions on the lake plains where runoff and internal drainage are slow.

In a representative profile the surface layer is very dark gray loamy fine sand 8 inches thick. Between depths of 8 and 16 inches, the upper part of the substratum is mottled, light brownish-gray, very friable loamy fine sand. Between depths of 16 and 24 inches, the substratum is mottled, pale-brown, very friable loamy sand. Between depths of 24 and 50 inches, the lower part of the substratum is light brownish-gray, loose sand that has a few distinct mottles in the top few inches.

Wareham soils have a prolonged high water table at a depth of 12 inches or less in spring and during wet periods. It fluctuates through the very rapidly permeable sandy layer of the profile. Rooting depth is limited by the water table mainly to the upper 18 inches of soil. The available water capacity of this zone is low or very low, but generally more than enough moisture is available for plant growth. The capacity of these soils to supply phosphorus and potassium is low. The supply of nitrogen is generally high, but it is released slowly in spring when the soils are cold and wet. In unlimed areas reaction of the surface layer is strongly acid.

Prolonged wetness, low natural fertility, and strong acidity are major limitations to farming these soils. Also, the sandy substratum material flows readily when it is saturated and clogs tile lines and ditches unless preventive measures are taken. Prolonged wetness and poor stability are limitations for many nonfarm uses of these soils.

Representative profile of Wareham loamy fine sand in an idle, formerly cultivated area in the town of Lysander, 200 feet east of Sixty Road, 1,460 feet south of Potter Road in the Three Rivers State Game Management Area:

Ap—0 to 8 inches, very dark gray (10YR 3/1) loamy fine sand; weak, fine, granular structure; very friable; many roots; strongly acid; clear, smooth boundary.

C1—8 to 16 inches, light brownish-gray (2.5Y 6/2) loamy fine sand; few, medium, distinct yellowish-brown mottles; single grained; very friable; common roots; strongly acid; gradual; smooth boundary.

C2—16 to 24 inches, pale-brown (10YR 6/3) loamy sand; common, medium, distinct yellowish-brown and strong-brown mottles; single grained; very friable; few roots; strongly acid; gradual, wavy boundary.

IIC3—24 to 50 inches, light brownish-gray (10YR 6/2) weakly stratified sand that has thin bands of fine sand, gradually changing to light gray (10YR 7/1) with increasing depth; few, fine, distinct yellowish-brown mottles in upper part; single grained; loose; few fine roots in upper part; strongly acid.

The A horizon ranges from 4 to 10 inches in thickness and is directly related to the thickness of the A1 horizon or to the depth of plowing. Depth to bedrock is more than 40 inches and generally is more than 10 feet. The profile is generally free of coarse fragments, but in places content of gravel is as much as 5 percent to a depth of 40 inches, and it is as much as 75 percent below a depth of 40 inches.

The A1 horizon ranges from black (N 2/0) to very dark grayish brown (10YR 3/2). The Ap horizon ranges from very dark gray (N 3/0) to dark grayish brown (2.5Y 3/2) and very dark brown (10YR 2/2). In unlimed areas reaction is very strongly acid to medium acid.

The C horizon, to a depth of 20 inches, ranges from pinkish gray (7.5YR 6/2) to olive (5Y 5/3), but mainly has hues of 10YR and 2.5Y. Values are 5 and 6, and chromas are 2 and 3. The C horizon is loamy fine sand to sand. It is loose to very friable. High-chroma mottles range from few to many. Below a depth of 20 inches, the C horizon is weakly stratified to moderately stratified sand, fine sand, and loamy sand and has hues of 10YR to 2.5Y, value of 4 to 7, and chroma of 1 to 3. High-chroma mottles are few to common in the C horizon and decrease in number with increasing depth. Reaction ranges from strongly to medium acid.

Wareham soils are closely associated with the moderately well drained Croghan soils and the somewhat poorly drained and poorly drained Naumburg soils. All formed in similar material.

Wareham loamy fine sand (Wb).—This level or nearly level soil is in low depressions on lake plains. Areas are generally ponded during the wettest part of the year, and water drains from them slowly. Individual areas are irregular in shape and are generally smaller than 30 acres.

Included with this soil in mapping are small areas of similar but very poorly drained, black, mucky, sandy soils in the deepest depressions along narrow drainageways. These very wet soils make up as much as 10 percent of some areas, and they delay tillage unless they are drained or they need more intensive drainage measures to remove the excess water. Also included are small areas of Palms muck in the centers of the largest areas. These shallow muck areas also need more intensive drainage measures if the soil is to be used for crops. Other inclusions are small areas of Croghan and Naumburg soils on slight rises or knolls, but these better drained soils have little effect on use and management.

This soil is suited to crops, hay, pasture, and trees. Undrained areas are better suited to short-season hay crops, pasture, or trees than to most other uses. If adequately drained, limed, and fertilized, the soil is suitable for annual row crops, especially vegetables. Most areas however, have not been cropped and are idle or in trees. Capability unit IVw–1; woodland suitability group 4w1.

Warners Series

The Warners series consists of poorly drained and very poorly drained, medium-textured soils that are underlain by strongly calcareous marl. These soils formed in alluvial deposits along streams containing water charged with lime that is precipitated out in the form of marl. They are on flood plains of streams.

In a representative profile the surface layer is very dark brown silt loam 12 inches thick. Between depths of 12 and 30 inches is an upper substratum layer of friable, light-gray fine marl that contains many fine white shells and is strongly calcareous. Between depths of 30 and 75 inches, the substratum is friable gray silt loam that is high in content of carbonates and contains some white shell fragments.

Warners soils have a prolonged high water table at or near the surface during spring and in wet periods, the depth of which is governed by the level of water in the adjacent streams. Rooting depth is limited by the prolonged high water table and by the depth of soil above the marl. Few roots penetrate into the marl. The available water capacity of this zone above the marl is low to moderate, but seepage water or water from the adjacent stream is so prevalent that plants are seldom damaged by drought. Most plants are damaged by too much water. The capacity of these soils to supply phosphorus is generally low, and to supply potassium, medium to low. The supply of nitrogen is high, but wetness in spring generally prevents the release of nitrogen, so plants need additional nitrogen at that time. In unlimed areas reaction of the surface layer is neutral or calcareous. Lime is not needed on these soils.

The main limitations of farming are prolonged wetness and frequent flooding during the growing season. The soils need artificial drainage for most crops. Low position in relation to the streams in most places makes the soils extremely difficult to drain artificially. Warners soils along the Seneca River and Cross Lake are kept uniformly wet by the high water levels of the canal system, so artificial drainage systems here are dependent on river levels. Selection of crops is also limited to plants that can tolerate a high content of lime.

Representative profile of Warners silt loam from an area of Martisco and Warners soils, formerly cleared and now in forest in the town of Elbridge, 75 feet east of the Seneca River near the Cayuga County boundary and 2,000 feet south of the bridge on Jordan Road over the river:

A1—0 to 12 inches, very dark brown (10YR 2/2) silt loam; weak, coarse, subangular blocky structure; friable; few wedge-shaped fingers, 1/4 inch wide at tops, extend 6 inches to IIC1 horizon, many fine roots; many fine and medium pores; mildly alkaline; abrupt, irregular boundary.

IIC1—12 to 30 inches, light-gray (10YR 7/1) fine marl; common, large, distinct light yellowish-brown (10YR 6/4) mottles that have yellowish-brown (10YR 5/4) centers; massive; friable; few fine roots; 25 percent fine shells; 10 percent fibrous content, rubbed reduces to none; moderately alkaline (strongly calcareous), gradual, smooth boundary.

IIIC2—30 to 75 inches, gray (10YR 6/1) silt loam that is high in carbonates; common, large, prominent olive (5Y 5/3) mottles; massive; friable; 2 percent fiber content; 5 percent shells; few pores of all sizes; moderately alkaline (very strongly calcareous).

Thickness of the solum and depth to marl or silt deposits rich in carbonates range from 10 to 30 inches. Depth to bedrock is more than 60 inches. Coarse fragments are absent except for small shells and hardened carbonate particles.

The A1 or Ap horizon is high in organic matter and is black (10YR 2/1) or very dark brown (10YR 2/2). It is light loam to heavy silt loam, and is very friable to friable. Reaction of the A horizon is mildly alkaline to moderately alkaline (calcareous).

The C1 mineral horizon, where present above the marl, ranges from grayish brown (2.5Y 5/2) to very dark gray (10YR 3/1) with or without high-chroma mottles. It is 0 to 20 inches thick. The C1 horizon ranges from loam to light silty clay loam and is dominantly silt loam. It is granular or massive, friable, and is moderately alkaline (calcareous).

The IIC horizon is light-gray (10YR 7/1 or 10YR 6/1) marl or silt or silt loam that is saturated with carbonates and shells and is 2 to 15 percent fiber.

The IIIC2 horizon, where present, ranges within gray colors (10YR 6/1, 6/0 to 5/1). The marl contains enough other fine minerals to give silt loam texture that is friable to firm and massive. Reaction of the IIIC horizon is moderately alkaline (strongly calcareous or very strongly calcareous). The IVC horizon, where present, ranges from dark gray (5Y 4/1) to gray (5Y 5/1). It is heavy silt loam to silty clay that is impregnated with carbonates. It is massive and slightly plastic.

In Onondaga County, Warners soils are mapped only in an undifferentiated group with Martisco soils.

Warners soils are closely associated with the very poorly drained, mucky Martisco soils and the moderately well drained Weaver soils. All formed in similar material.

Wassaic Series

The Wassaic series consists of moderately deep, well drained and moderately well drained, medium-textured soils. These soils formed in thin till deposits derived mainly from sandstone, shale, and moderate to high amounts of limestone. They are on uplands where the underlying bedrock affects the relief. Rock outcrops are common in places.

In a representative profile the surface layer is dark-brown silt loam 9 inches thick. Between depths of 9 and 11 inches is a subsurface layer of brown, friable silt loam. Between depths of 11 and 15 inches, the upper part of the subsoil is brown, friable heavy silt loam. Between depths of 15 and 23 inches, the lower part of the subsoil is brown channery heavy silt loam that is friable, The underlying till substratum, between depths of 23 and 35 inches, is friable, brown channery loam that is calcareous. Limestone bedrock is at a depth of 35 inches.

The water table in Wassaic soils generally is below the bedrock surface. In places, however, it is at a depth of 18 to 40 inches where it is perched on the bedrock or till substratum in spring and during wet periods. Rooting depth is mainly in the 20 to 40 inches of soil above the bedrock. Available water capacity of this zone is moderate. The capacity of these soils to supply phosphorus and nitrogen is generally medium,

and to supply potassium, medium to high. In unlimed areas reaction of the surface layer is medium acid to neutral. Crops respond well to applications of fertilizer and to lime where needed.

In places slope and the hazard of erosion are limitations to farming these soils. In other places rock outcrops are common and are also a limitation. Depth to bedrock and slope in places are limitations for many nonfarm uses.

Representative profile of Wassaic silt loam, 0 to 8 percent slopes, in a formerly cultivated pasture in the town of Onondaga, 75 feet west of the intersection of Corporal Welch and Perry Roads:

Ap—0 to 9 inches, dark brown (7.5YR 4/2) silt loam; moderate, medium and coarse, granular structure; friable; many fine roots; 10 percent small, angular limestone fragments; neutral; abrupt, smooth boundary.

A2—9 to 11 inches, brown (7.5YR 5/2) silt loam, pinkish gray (7.5YR 7/2) dry; moderate, fine and medium, subangular blocky structure; friable; many fine roots; many medium and coarse pores; many worm channels that have dark-brown (7.5YR 4/2) worm casts; 10 percent small, angular limestone fragments; neutral; abrupt, wavy boundary.

B&A—11 to 15 inches, brown (7.5YR 4/4) heavy silt loam; moderate; medium and coarse, subangular blocky structure; friable, slightly sticky; common fine roots; many medium and coarse pores that have discontinuous clay linings; many worm channels that have dark-brown (7.5YR 4/2) worm casts; fingers of 1- to 2-millimeters-thick, brown (7.5YR 5/2) silt coats, pinkish gray (7.5YR 7/2) dry, extend from A2 horizon along vertical ped faces; 10 percent angular limestone fragments; neutral; clear, wavy boundary.

B2t—15 to 23 inches, brown (7.5YR 4/4) channery heavy silt loam; moderate, medium and coarse, subangular blocky structure; friable, slightly sticky; common fine roots; many medium and coarse pores that have thin, discontinuous clay linings; many worm channels; thin patchy clay films on ped faces; 15 percent angular limestone fragments and some flagstones and boulders; neutral; clear, wavy boundary.

C—23 to 35 inches, brown (10YR 5/3) channery loam; weak, fine, subangular blocky structure; friable, few fine roots; many medium and coarse pores that have discontinuous clay linings; common worm channels; 25 percent angular limestone fragments, flagstones, flat stones, and boulders; moderately alkaline (calcareous); abrupt, wavy boundary.

R—35 inches, gray limestone bedrock that has fine earth similar to C horizon in 2- to 4-inch-wide vertical cracks and joints that are 18 inches to 60 inches apart.

The solum ranges from 20 to 36 inches in thickness. Depth to bedrock ranges from 20 to 40 inches. Content of coarse fragments ranges from 2 to 35 percent, by volume, in the solum and in the C horizon above the bedrock, and includes gravelly to stony classes.

In undisturbed areas the A1 horizon ranges from 3 to 5 inches thick. The A1 and Ap horizons range from brown (7.5YR 5/2) to very dark grayish brown (10YR 3/2). The A2 horizon is thin or absent, where destroyed by deep plowing. It ranges from reddish gray (5YR 5/2) to light yellowish brown (2.5YR 6/4) when moist. A2-like material interfingers to a depth of 2 to 6 inches into the upper part of the B horizon as 1- to 3-millimeters-thick coats on vertical ped faces. The A2 horizon ranges from fine sandy loam to silt loam. In unlimed areas reaction of the A horizon is medium acid to neutral.

The Bt horizon ranges from reddish brown (5YR 5/3) to olive brown (2.5Y 4/4) with or without mottles of higher chroma. It is loam to silty clay loam. Structure of the Bt horizon is moderate, medium, or coarse, blocky. Consistence is friable to firm. Reaction of the Bt horizon is medium acid to mildly alkaline. Pores are common to many and have discontinuous or continuous clay linings. Clay films on peds faces are patchy or continuous.

A C horizon is present in places. It ranges from reddish brown (5YR 5/3) to dark grayish brown (2.5Y 4/2). It is fine sandy loam to light silty clay loam. It has weak, blocky or platy structure, is friable to firm, and is mildly alkaline to moderately alkaline (calcareous).

Wassaic soils are most commonly associated with Benson soils, but they are 20 to 40 inches deep over bedrock, whereas Benson soils are 10 to 20 inches deep. They also have a Bt horizon, which Benson soils lack. They are shallower than the commonly associated, deep Cazenovia, Honeoye, Mohawk, and Ontario soils. They are also near the moderately deep Camillus and Palatine soils in places. They have a Bt horizon, which Camillus and Palatine soils lack, and they are also browner in the subsoil than the gray Camillus soils or the black to very dark gray Palatine soils.

Wassaic silt loam, 0 to 8 percent slopes (WcB).—This level to gently sloping soil in on the tops of bedrock-controlled landforms. Individual areas are irregular in shape and range in size from less than 10 acres to more than 50 acres, but a few areas are larger than 100 acres. This soil has the profile described as representative of the species.

Included with this soil in mapping are small areas of Benson soils where bedrock crops out or where the depth to bedrock is less than 20 inches. This shallow soil makes up as much as 15 percent of some areas. It is more droughty for crops, and the bedrock outcrops hinder tillage. Also included are small areas of deep Cazenovia, Honeoye, Mohawk, or Ontario soils where the depth to bedrock is more than 40 inches. These deeper soils make up as much as 15 percent of some areas, but they have little effect on use and management. Other inclusions are small areas of dark-gray to black Palatine soils where black shale bedrock is intermixed with or caps the limestone bedrock.

This soil is suited to crops, hay, pasture, and trees. Much of the acreage has been cleared and used for crops. It is suited to most crops commonly grown in the county. Runoff and the hazard of erosion are moderate on the gently sloping areas, especially those that have longer slopes, so measures to control erosion are needed on these areas. Capability unit IIe–1; woodland suitability group 2o1.

Wassaic silt loam, 8 to 15 percent slopes (WcC).—This sloping or rolling soil is on the sides of bedrock-controlled landforms. Slopes are generally short and uniform, but in some places they are undulating, short, and complex. In cultivated areas the soil is severely eroded in many places, and the surface layer is lighter in color, lower in content of organic matter, and slightly heavier in texture. Individual areas are irregular in shape, but many are long and narrow. Most areas are smaller than 20 acres, and only a few areas are larger than 30 acres.

This soil has a profile similar to the one described as representative of the series, but it is generally more variable in depth to the underlying bedrock.

Included with this soil in mapping are small areas of Benson soils where rock crops out or where the depth to bedrock is less than 20 inches. These shallow soils make up as much as 20 percent of some areas. They are droughty, and the shallow depth to bedrock hinders tillage. Also included are small areas of deeper Honeoye, Cazenovia, Mohawk, and Ontario soils where the depth to bedrock is more than 40 inches. These deeper soils make up as much as 20 percent of some areas, but they have little effect on

use and management. Other inclusions are small areas of Palatine soils.

This soil is suited to crops, hay, pasture, and trees. Runoff is moderate or moderately rapid, and the hazard of erosion is severe. Measures to control erosion are needed if this soil is used for row crops. Capability unit IIIe–1; woodland suitability group 2o1.

Wassaic-Benson silt loams, moderately steep (WDD).—This complex consists of moderately deep Wassaic soils and shallow Benson soils. It is about 40 to 60 percent Wassaic soils and 20 to 40 percent Benson soils. Each of these soils has a profile similar to the one described as representative of its respective series, but the depth to rock is more variable, and where cropped, it is severely eroded in most places and has the subsoil exposed on the surface. These soils are on the sides of bedrock-controlled landforms where many areas are steplike in shape. Individual areas are irregular in shape or are long and narrow in some places. They range in size from 5 to 20 acres, but a few areas are larger than 30 acres.

Included with these soils in mapping are areas of deeper Honeoye, Cazenovia, Mohawk, or Ontario soils. They make up as much as 20 percent of the mapped acreage, but they have little or no effect on use and management.

These soils are suited to hay, pasture, and trees. They are too steep and they include areas that are too shallow and have too many bedrock outcrops to be used for crops. The rock outcrops and the included short, steep slopes hinder mowing for hay and maintenance of pasture in places. Capability unit IVe–4; Wassaic part in woodland suitability group 2r2, Benson part in woodland suitability group 5d1.

Wayland Series

The Wayland series consists of deep, poorly drained and very poorly drained, medium-textured soils. These soils formed in silty alluvial deposits that are moderate to high in content of lime. They are in lower areas of flood plains along small and large streams.

In a representative profile the surface layer is very dark grayish-brown silt loam that has common, dark reddish-brown root mottles and is 9 inches thick. Between depths of 9 and 42 inches, the subtratum is friable silt loam. It is dark gray and has a few yellowish-brown mottles in the upper 25 inches, and it is gray in the lower part. Between depths of 42 and 50 inches, the substratum is friable, gray gravelly silt loam.

Wayland soils have a prolonged high water table at or near the surface that is governed by the water level of adjacent streams. These soils are subject to frequent flooding. They are often flooded during rainy periods in the growing season. Because of the prolonged high water table, rooting depth is limited mainly to the upper foot of soil. Plants seldom lack moisture, but are commonly affected by too much water. The capacity of these soils to supply phosphorus and potassium is generally medium. The supply of nitrogen is high, but it is released slowly because of prolonged wetness, so plants need additional nitrogen in spring. In unlimed areas reaction of the surface layer is neutral or mildly alkaline, so applications of lime are seldom needed.

Prolonged wetness and frequency of flooding are limitations to both farming and nonfarm uses. Drainage is extremely difficult to install because of a lack of outlets.

Representative profile of Wayland silt loam in pasture in the town of Marcellus, 1,700 feet west northwest of the intersection of Lee-Mulroy and Bishop Roads, 800 feet due north of Lee-Mulroy Road, 1,900 feet due south of Lawrence Road:

A1—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam, common, fine and medium, distinct dark reddish-brown (5YR 3/2) mottles in old root channels; moderate, fine, granular structure; friable, slightly sticky; many fine roots; mildly alkaline; clear, smooth boundary.

C1g—9 to 34 inches, dark-gray (10YR 4/1) silt loam; few, fine, distinct yellowish-brown mottles; massive; friable, slightly sticky; common fine roots in upper part decreasing to few in lower part; mildly alkaline; gradual, smooth boundary.

C2—34 to 42 inches, gray (10YR 5/1) silt loam; massive; friable, slightly sticky; moderately alkaline (calcareous); abrupt, smooth boundary.

IIC3g—42 to 50 inches, gray (10YR 5/1) gravelly silt loam; massive; friable; 30 percent gravel; moderately alkaline (calcareous).

Thickness of silty deposits over contrasting materials is more than 40 inches. Depth to bedrock is more than 40 inches and generally is more than 10 feet. Reaction of the upper layers is commonly neutral or mildly alkaline, but in some places the soil is moderately alkaline (calcareous) at a depth below 24 to 60 inches. Texture of the layer between depths of 10 and 40 inches is silt loam to silty clay loam. The A1 and Ap horizon, to a depth of at least 4 inches, has a moist color value darker than 4. Dominant chroma in all horizons between the Ap horizon and a depth of 30 inches is 1 or less, and values are 5 or less in hues from 2.5Y to 7.5YR.

Wayland soils are most commonly associated with Hamlin and Teel soils on flood plains, but they have lower chromas below the Ap or A1 horizons and have darker A1 or Ap horizons that have a higher content of organic matter. They are also similar to Warners soils, but they lack the light-gray to white, calcareous-marl substratum within a depth of 40 inches that is typical of Warners soils. They have an irregular decrease in content of organic matter with increasing depth, which similar Canandaigua, Fonda, and Rhinebeck soils lack. They have coarser textures than Fonda and Rhinebeck soils.

Wayland silt loam (Wn).—This nearly level soil is in low positions on flood plains along most streams in the county. Individual areas are generally long and narrow and follow the configurations of the flood plain valleys. Most areas are smaller than 50 acres, but a few areas in the larger valleys are larger than 100 acres.

Included with this soil in mapping are small areas of better drained Hamlin and Teel soils on slight rises and knolls or in slightly higher positions on the flood plains. These better drained soils make up as much as 15 percent of some areas, but they have little effect on use and management. Also included, generally adjacent to streams, are small areas of gravel and stream rubble deposited during recent floods. These deposits make up as much as 5 percent of some areas, but they have little effect on use and management.

Undrained areas of this soil are not suited to crops, and drainage measures are extremely difficult to establish. This soil is suited to hay, pasture, and trees. Most areas are used for pasture or trees. Only a few small areas are used for hay, mainly native

wetland species. A few isolated areas have been drained and are used for crops. Capability unit Vw–1; woodland suitability group 4w1.

Weaver Series

The Weaver series consists of deep, moderately well drained, medium-textured soils that formed in recent alluvium washed from areas of calcareous glacial material. The lime concentrations in the water involved in the deposition of these alluvial materials are so high that they have precipitated as soft, marly material and lime nodules. These marly materials and lime nodules are prominent features of Weaver soils and occur in variable amounts throughout the profile. These soils are on flood plains and alluvial fans.

In a representative profile the surface layer is friable, dark-brown silt loam 17 inches thick. Between depths of 17 and 26 inches, the upper part of the subsoil is mottled, brown, friable loam. Between depths of 26 and 29 inches, the lower part of the subsoil is firm, dark-brown silty clay loam that contains a few lime nodules and some soft marly material. The substratum, between depths of 29 and 50 inches, is mottled, very pale brown, very friable silt loam that has a high content of soft, marly material and some hard lime nodules. This soil is calcareous throughout.

Weaver soils are subject to flooding, generally in spring but rarely during the growing season. Other than during periods of flooding, they have a seasonal high water table that fluctuates to within 15 to 24 inches of the surface and persists for long periods of time. It is governed by the water level of the adjacent streams. Rooting depth is limited by wetness and concentrations of marly material mainly to the upper 18 to 30 inches of soil. This zone has high available water capacity. The capacity of these soils to supply phosphorus and potassium is low to medium, mainly because of the high content of lime. The supply of nitrogen is high and causes lodging in small grains.

Flooding and seasonal wetness are limitations to farming these soils. Many plants cannot tolerate the excessive amounts of lime. Flooding, seasonal wetness, and poor stability are limitations for many nonfarm uses.

Representative profile of Weaver silt loam in the town of Elbridge, 100 feet west of Fikes Road, 700 feet south of Whiting Road:

Ap—0 to 8 inches, dark-brown (7.5YR 4/2) silt loam; moderate, medium and coarse, granular structure; friable; many roots; moderately alkaline (calcareous); abrupt, smooth boundary.

A11—8 to 12 inches, dark-brown (7.5YR 3/2) silt loam; weak, medium, subangular blocky structure; friable; many roots; many pores; moderately alkaline (calcareous); clear, smooth boundary.

A12—12 to 17 inches, dark-brown (7.5YR 4/2) silt loam, few, fine, faint brown mottles; weak, medium, subangular blocky structure; friable; many roots; many pores; moderately alkaline (calcareous); clear, wavy boundary.

B21—17 to 26 inches, brown (7.5YR 4/4) loam; few, fine, faint light-gray and strong-brown mottles; very weak, medium, subangular blocky structure; friable; many roots; common pores; few lime nodules and some soft marly material; moderately alkaline (calcareous); clear, smooth boundary.

IIB22—26 to 29 inches, dark-brown (7.5YR 4/4) light silty clay loam, moderate, medium, subangular blocky structure; firm, slightly sticky; common fine roots; common pores; few lime nodules and some soft marly material; moderately alkaline (calcareous); abrupt, smooth boundary.

IIIC—29 to 50 inches, very pale brown (10YR 7/4) silt loam; high content of soft marly material; common, medium, prominent yellow, dark-red, and yellowish-red mottles; massive; very friable; 10 percent porous, hard-lime concretions of variable sizes; moderately alkaline (calcareous).

The solum ranges from 18 to 35 inches in thickness. Depth to bedrock is more than 5 feet. Reaction of the upper 8 to 12 inches of soil ranges from neutral to moderately alkaline (calcareous). The content of lime concretions, soft marly material, and shell fragments ranges from 0 to 15 percent, by volume, in the Ap horizon and upper 8 to 12 inches of the solum, and from 15 to 50 percent in the solum and substratum. Reaction below a depth of 8 to 12 inches is moderately alkaline (calcareous). Texture ranges from silt loam to light clay loam, but generally is silt loam or loam. Hues range from 7.5YR to 10YR, values from 3 to 6, and chromas from 2 to 4. Mottles range from few to many at a depth of 12 to 24 inches. The soft marl material is silty and has shell fragments and tufa rock fragments that are white to pink.

Weaver soils are better drained and generally have a browner subsoil than Warners soils and formed in similar material. They lack the muck layers that are typical of the Edwards and Martisco soils and are better drained. They have a higher content of lime than similar Teel soils.

Weaver silt loam (Wv).—This nearly level to very gently sloping soil is on flood plains and alluvial fans along streams that are mainly fed by springs issuing from the Onondaga Limestone and Camillus Shale bedrock formations. Slopes range from 0 to 4 percent. Areas are long and narrow or fan shaped and generally are smaller than 10 acres.

Included with this soil in mapping are areas of Warners soils in depressions and in lower areas on flood plains. These poorly drained and very poorly drained soils make up as much as 15 percent of some areas, and they delay tillage unless they are drained. Also included are small areas of soils similar to Weaver soils that are slightly dryer and other areas of soils that are slightly wetter. Other inclusions around springs are areas of tufa rock and areas that have a marly surface layer.

This soil is suited to crops, pasture, or trees. It is subject to flooding, but rarely during the growing season. Slight wetness in places delays planting briefly in spring. Much of the acreage is cropped. It is used mainly for such annual crops as corn and beans. The hazard of erosion is slight on sloping areas of fans. Streambank erosion is a problem in places. Capability unit IIw–2; woodland suitability group 2o2.

Williamson Series

The Williamson series consists of deep, moderately well drained, medium-textured soils that have a distinct fragipan. These soils formed in lake-deposited silt and very fine sand low in content of clay. They are on lake plains.

In a representative profile the surface layer is dark grayish-brown silt loam 9 inches thick. Between depths of 9 and 19 inches the upper part of the subsoil is very friable, brown light silt loam. Between

depths of 19 and 22 inches is a thin, leached layer of friable, mottled, grayish-brown very fine sandy loam. Between depths of 22 and 45 inches, the subsoil is a firm, brittle fragipan of slightly mottled, brown and dark yellowish-brown very fine sandy loam. The substratum, between depths of 45 and 60 inches, is friable, mottled, dark yellowish-brown very fine sandy loam.

Williamson soils have a seasonal high water table at a depth of 15 to 24 inches that persists for a long time in spring and during wet periods. It is perched on the slowly permeable or moderately slowly permeable fragipan. Rooting depth is limited by the fragipan to the upper 15 to 24 inches of soil. Available water capacity of this zone is low to moderate. The capacity of these soils to supply nitrogen and phosphorus is generally medium, and to supply potassium, low. In unlimed areas reaction of the surface layer ranges from very strongly acid to medium acid. Crops respond well to applications of lime fertilizer.

The main limitations to farming Williamson soils are slight seasonal wetness and lack of available water capacity to sustain plant growth during long, dry periods. The hazard of erosion is severe even on gentle slopes. Seasonal wetness and poor stability are limitations for many nonfarm uses.

Representative profile of Williamson silt loam, 0 to 2 percent slopes, in an idle field in the town of Lysander, 50 feet west of Dinglehole Road, 950 feet south of Rabbit Lane Road:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) light silt loam, dark brown (10YR 4/3) crushed; weak, fine and medium, granular structure; very friable; many fine and medium roots; medium acid; abrupt, smooth boundary.

B2—9 to 19 inches, brown (7.5YR 5/4) light silt loam, fading with increasing depth to brown (10YR 5/3); few reddish-brown (5YR 5/5) iron concretions as much as 1/2 inch in diameter that have dark reddish-brown (5YR 3/4) centers; weak, fine, subangular blocky structure; very friable; common fine and medium roots; few fine pores; medium acid; clear, wavy boundary.

A'2—19 to 22 inches, grayish-brown (10YR 5/2) very fine sandy loam; common, coarse, distinct reddish-brown mottles; weak, medium, platy structure; friable; few fine and medium roots; few fine pores; clear, wavy boundary.

B'x1—22 to 35 inches, brown (7.5YR 5/4) very fine sandy loam; few, fine, distinct reddish-brown mottles; strong, very coarse, prismatic structure parting to weak, medium and thick, platy; firm, brittle; few fine roots along prism faces; few fine and medium pores; occasional large pores that have thin, patchy clay films,; prisms separated by 1/2-inch of grayish-brown fine sandy loam at top tapering to silt coat at bottom; silt coat is friable, mottled, brown along prism faces and reddish-brown in center; medium acid; clear, wavy boundary.

B'x2—35 to 45 inches, dark yellowish-brown (10YR 4/4) very fine sandy loam; common, medium and coarse, distinct light-gray and brown mottles; weak, very coarse, prismatic structure parting to weak, medium and thick, platy; firm, brittle; very few fine and medium pores; slightly acid.

C—45 to 60 inches, dark yellowish-brown (10YR 4/4) very fine sandy loam; common, fine and medium, distinct light brownish-gray and brown mottles; weak, medium and thick, platy structure; firm in place, friable when removed; few fine pores; slightly acid.

The solum is 40 to 60 inches thick over weakly stratified silt and very fine sand and corresponds with the depth to the bottom of the fragipan. Depth to the top of the fragipan is 15 to 24 inches. Depth to bedrock is more than 5 feet and generally is more than 10 feet.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) to brown (7.5YR 5/2). In unlimed areas reaction is very strongly acid to medium acid. Undisturbed areas have an A1 horizon that is black (N 2/0) to dark gray (10YR 4/1) and ranges from 2 to 6 inches in thickness.

The B2 horizon ranges from strong brown (7.5YR 5/6) to yellowish brown (10YR 5/4) or brown (10YR 5/3). It is silt loam to light very fine sandy loam and has few to common high-chroma mottles below a depth of 12 inches in places. Reaction of the B2 horizon ranges from very strongly acid to medium acid, and thickness ranges from 5 to 15 inches.

The A'2 horizon ranges from brown (7.5YR 5/4) to light grayish brown (2.5Y 6/2). It is silt loam to light very fine sandy loam and has common to many mottles. Reaction of the A'2 horizon ranges from very strongly acid to medium acid.

The B'x or fragipan horizon ranges from dark yellowish brown (10YR 4/4) to reddish brown (5YR 5/3) and has few to common mottles. It is silt loam to light very fine sandy loam. Reaction of the B'x horizon ranges from very strongly acid to medium acid in the upper part and is slightly acid below a depth of 3 feet in places. The B'x horizon ranges from 12 to 36 inches in thickness and extends to a depth of 40 inches or more. The solum is generally gravel free, but it contains as much as 5 percent coarse fragments in places.

The C horizon is very fine sandy loam or weakly stratified silt and very fine sand that contains thin layers of sand, clay, or gravel in places. Reaction ranges from strongly acid to neutral.

Williamson soils are most commonly associated with the somewhat poorly drained Niagara soils and the poorly drained and very poorly drained Canandaigua soils and formed in similar material. They have higher chromas in the upper part of the subsoil and a distinct fragipan, which these soils lack. They lack the Bt horizon that is typical of Niagara soils. They differ from similar Collamer soils in that they have a fragipan and lack a Bt horizon, and they are generally more acid. They have a fragipan and a higher content of silt than nearby Arkport, Colonie, and Galen soils. They lack the lamellae of Arkport and Galen soils, and they are less well drained than Arkport and Colonie soils.

Williamson silt loam, 0 to 2 percent slopes (WwA).—This level or nearly level soil is on lake plains where runoff is somewhat slow or where some water accumulates. Individual areas are generally irregular in shape and smaller than 30 acres, but a few areas are larger than 50 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Niagara soils in shallow depressions and along narrow drainageways. These wetter soils make up as much as 15 percent of some areas, and they delay tillage in spring unless they are drained. Also included are small areas of Arkport or Colonie soils. These sandy areas make up as much as 5 percent of some areas, but they have little effect on use and management.

This soil is suited to crops, hay, pasture, and trees. Most of the acreage is cleared and used for crops. The main limitations to cropping are slight seasonal wetness that delays tillage in places and the fragipan, which limits rooting depth and available water capacity. If adequately limed, fertilized, and irrigated, the soil is suited to many crops, especially vegetables. Capability unit IIw–1; woodland suitability group 3o1.

Williamson silt loam, 2 to 6 percent slopes (WwB).—This gently sloping or gently undulating soil is on lake plains where runoff is retarded somewhat or where some water accumulates. Individual areas are generally irregular in shape and mainly less than 50 acres in size, but a few areas are larger than 100 acres.

This soil has a profile similar to the one described as representative of the series, but it is generally slightly lighter in color of the surface layer and slightly shallower in some places to the fragipan.

Included with this soil in mapping are small areas of Niagara soils in depressions and along narrow drainageways. These somewhat poorly drained soils make up as much as 15 percent of some areas, and they delay tillage in spring unless they are drained. Also included are small areas of Colonie or Arkport soils. These sandy areas make up as much as 10 percent of some areas, but they have little effect on use and management.

This soil is suited to crops, hay, pasture, and trees. Much of the acreage has been cleared and is used for crops. Runoff is moderate, and the hazard of erosion is moderate to severe. Most areas need measures to control runoff and erosion if they are used for row crops. Many of the gently undulating areas have short, complex slopes on which such erosion-control measures as contouring or stripcropping are difficult to establish. This soil needs complete fertilizer and lime for most crops. Slight seasonal wetness delays tillage briefly in places. Capability unit IIe–5; woodland suitability group 3o1.

Williamson silt loam, rolling (WwC).—This soil is on lake plains where some runoff water from adjacent higher areas accumulates. Most areas have short, complex slopes. Individual areas are generally irregular in shape. Most areas are smaller than 30 acres, but a few are larger than 50 acres.

This soil has a profile similar to the one described as representative of the series, but it is generally slightly lighter in color of the surface layer and is more variable in thickness above the fragipan.

Included with this soil in mapping are small areas of Niagara soils in deeper depressions and along narrow drainageways. These somewhat poorly drained soils make up as much as 15 percent of some areas, and they delay tillage in spring unless they are drained. Also included are small sandy areas of Colonie and Arkport soils. These sandy areas make up as much as 15 percent of some areas, but they have little effect on use and management.

This soil is suited to crops, hay, pasture, and trees. Most of the acreage of this soil is still forested or is used for pasture. The few areas that have been cleared and used for crops have not been farmed too intensively, so they are only moderately eroded. If this soil is used for crops, it needs intensive measures to control runoff and erosion. Most areas have short, complex slopes on which such erosion-control measures as contouring or stripcropping are difficult to establish. Capability unit IVe–7; woodland suitability group 3r1.

Williamson silt loam, rolling, eroded (WwC2).—This soil is on lake plains or on sloping hillsides where slopes generally are rolling and complex. In some places it is on the side slopes of drainageway dissections. Individual areas are generally irregular in shape or are long and narrow. Most areas are smaller than 30 acres, but a few areas are larger than 50 acres.

This soil has a profile similar to the one described as representative of the series, but because of past erosion it is generally lighter in color and lower in content of organic matter in the surface layer and much thinner above the fragipan.

Included with this soil in mapping are small areas of Niagara soils in deeper depressions and along narrow drainageways. These somewhat poorly drained soils commonly have accumulations on the surface of material that eroded from the Williamson soil. They make up as much as 15 percent of some areas, and they delay tillage in spring unless they are drained. Also included are small areas of sandy Colonie or Arkport soils. They make up as much as 15 percent of some areas, but they have little effect on use and management.

This soil is poorly suited to crops. It is suited to hay, pasture, and trees. Because of severe erosion in the past and short, complex slopes in most places, this soil is better suited to long-term hay crops than to most other uses. Runoff is rapid, and the hazard of further erosion is severe. Intensive measures to control runoff and erosion are needed if this soil is used for row crops. Where there are short, complex slopes, such measures as contouring and stripcropping, which are needed to control both runoff and erosion, are difficult to establish. Because of rapid runoff and low available water capacity, this soil is very droughty. Crop growth is generally highly irregular, and numerous bare areas appear in cropped fields. Capability unit IVe–7; woodland suitability group 3r1.

Use and Management of the Soils

The first part of this section discusses general principles of management that apply to all of the soils used for farming in Onondaga County. The second part explains the capability classification system, describes the capability units in the county, and discusses the use, suitability, and management requirements for each unit. In the third part, estimated acre yields are given for the principal crops under two levels of management. Following this are other parts on the use of soils for woodland, wildlife, recreation, and engineering. Finally, there is a part that gives information about selected uses of soils in town and country planning.

General Management for Farming[3]

Some principles of management are general enough to apply to all the soils suitable for farm crops grown in the county, although the individual soils or groups of soils require different kinds of management. These general principles of management are discussed in the following paragraphs.

Many soils in the county need lime or fertilizer, or both. The amounts needed depend on the natural content of lime and plant nutrients, which can be determined by laboratory analyses of soil samples; on the needs of the crop; and on the level of yield desired. For assistance in testing and interpretations, farmers and others should consult their Cooperative

[3] HAROLD L. HANSEN, conservation agronomist, Soil Conservation Service, assisted in preparing this section.

Extension Agent. Only general suggestions for applications of lime and fertilizer are given in this publication.

The relationship of the different lime levels noted in the soil series and land capability unit descriptions are shown (fig. 8). New research findings are also presented in current editions of "Cornell Recommends for Field Crops" and "Vegetable Production Recommendations," both prepared by the staff of the New York State College of Agriculture at Cornell University. In the absence of soil tests, these references and this publication can be used as a guide in determining lime and fertilizer needs.

Most of the soils of Onondaga County are fairly high in organic-matter content, and it is important to keep it at a high level. This can be done by adding farm manure, leaving plant residue on the surface, and growing sod crops, cover crops, and green-manure crops. Tillage tends to reduce organic-matter content and break down soil structure. It needs to be kept to the minimum necessary to prepare a seedbed and control weeds. Maintaining the organic-matter content of the plow layer helps to protect soil structure.

On such wet soils as Kendaia silt loam, yields of cultivated crops can be increased by open-ditch drainage or tile drainage. Tile drains cost more to install, but they generally require less maintenance. Soils drained by tiles are easier to farm than those drained by open ditches. Drainage on sloping soils is more effective if the ditches or tile lines intercept the water as it moves horizontally downslope on top of a fragipan or other impervious layer. For drainage by either tile or open ditches, suitable outlets are needed. The effect of soil drainage on root development if the soils are not drained is shown (fig. 9).

Erosion is a principal source of sediment, which ranks above domestic sewage, industrial waste, and chemicals as a major cause of pollution. All of the gently sloping and steeper soils that are cultimated are subject to erosion. Runoff and erosion occur mostly while a cultivated crop is growing or soon after one has been harvested. On such erodible soils as Collamer silt loam, 2 to 6 percent slopes, or Honeoye and Lansing gravelly silt loams, 15 to 25 percent slopes, a cropping system that controls runoff and erosion is needed in combination with other erosion-control practices. As used here, "cropping system" refers to the sequence of crops grown in combination with management that includes minimum tillage, no-plow planting, using crop residue, growing cover crops and green-manure crops, and using lime and fertilizer. Other erosion-control practices are contour planting, terracing, contour stripcropping, diversion of runoff, use of grassed waterways, and windbreaks to control soil blowing. The effectiveness of a particular combination of these measures differs from one soil to another, but different combinations can be equally effective on the same soil. The local representative of the Soil Conservation Service is available to assist in planning an effective combination of practices to control erosion.

Pasture is effective in controlling erosion on all but a few of the soils that are subject to erosion, but a high level of pasture management is needed on some soils to provide enough ground cover to keep the soil from eroding. A high level of pasture management provides for fertilization, control of grazing, selection of pasture mixtures, and other practices that are adequate for maintaining good ground cover and forage for grazing. Grazing is controlled by rotating the livestock from one pasture to another and providing rest periods for the pasture after each grazing period to allow for regrowth of the plants. It is important on some soils that pasture mixtures be selected that need the least amount of renovation to maintain good ground cover and forage for grazing.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so 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,

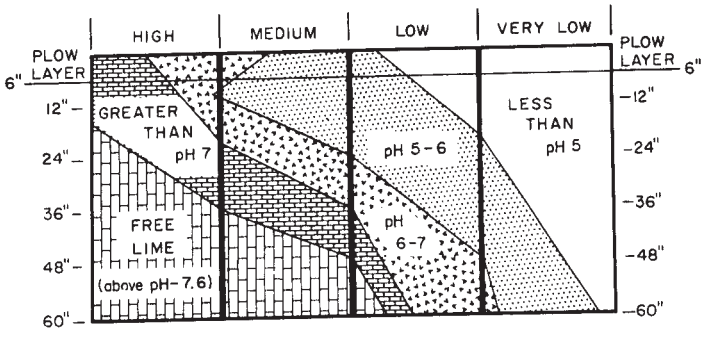

Figure 8.—Lime level of different soil profiles in Onondaga County.

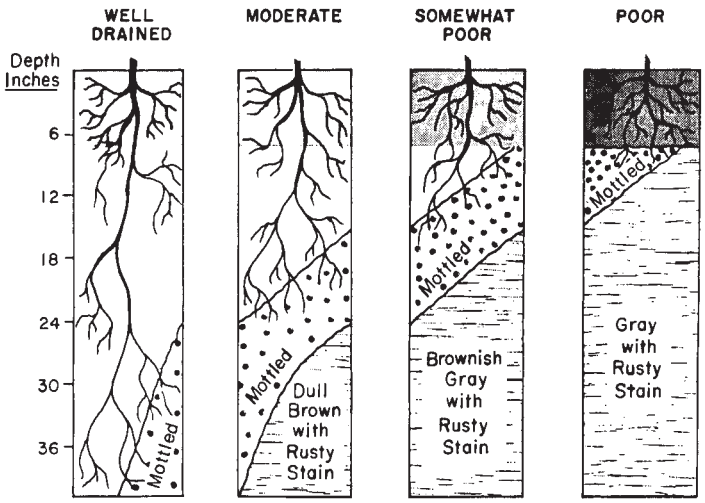

Figure 9.—Effect of soil drainage on root development.

cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, the kinds of soils are grouped at three levels: the capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, 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, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, 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 largely to pasture, range, woodland, or wildlife.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture, range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or to esthetic purposes.

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 can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, although they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–4 or IIIe–6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages, the capability units in Onondaga County are described, and suggestions for the use and management of the soils are given. Series names of soils in the capability units are given, but this does not mean that all soils of the series named are in those units. To find the capability unit in which any soil is placed, refer to that soil in the section "Descriptions of the Soils" or in the "Guide to Mapping Units" at the back of this survey.

CAPABILITY UNIT I–1

This unit consists of level or nearly level, dominantly well drained, deep, medium-textured soils of the Hamlin, Palmyra, and Wampsville series. In places, the Palmyra soils range to excessively drained. The Hamlin soils are on high bottoms that are subject to infrequent high floods. These floods, however, rarely occur during the growing season, and crops are almost never damaged by them. The Palmyra and Wampsville soils are on tops of gravel terraces or outwash plains.

The main root zone in the soils of this unit is at a depth of 30 to 40 inches. Available water capacity is high to moderate. Reaction in the surface layer ranges from medium acid to neutral. The capacity of these soils to supply plant nutrients is medium to low. Streambank erosion and channel gouging are limitations in some places on the Hamlin soils that are on high bottoms. Gravel hinders tillage and harvesting of some crops in places on the Palmyra and Wampsville soils.

The soils in this capability unit are well suited to farming (fig. 10). Crops grown on these soils respond well to applications of lime and fertilizer. The highest economic returns are generally from row crops. These can be grown continuously without damage to the soil if minimum tillage is practiced and crop residue and green manure are used to maintain content of organic matter, good soil structure, and rate of water intake.

CAPABILITY UNIT IIe–1

This unit consists of gently sloping, medium-textured soils on uplands. These soils are medium to high in content of lime. The soils of this unit in the Honeoye, Lansing, Madrid, Mohawk, and Ontario series are deep and dominantly well drained. Mohawk soil is moderately well drained in places. The Camillus, Palatine, and Wassaic soils in this unit are mod-

Figure 10.—Alfalfa and corn on Palmyra gravelly loam, 0 to 3 percent slopes, in capability unit I–1, near Tully, New York. The sloping soil behind the buildings is Lansing gravelly silt loam, 8 to 15 percent slopes, in capability unit IIIe–2. The forest in the background is Arnot-Lordstown association, very steep, in capability unit VIIs–1.

erately deep and dominantly well drained, and they have limy shale or limestone bedrock at a depth of 20 to 40 inches. In places, Palatine soils are somewhat excessively drained and Wassaic soils are moderately well drained.

Reaction ranges from strongly acid to neutral in the surface layer of soils in this unit. The root zone extends to a depth of 40 inches. Available water capacity is high to moderate in this zone in most of the soils in the unit, except for the Palatine soil, in which it is moderate to low. The capacity of these soils to supply nitrogen, phosphorus, and potassium is mostly medium. The hazard of ersoion is moderate.

Under good management, the soils in this unit are well suited to farming. Erosion-control measures are needed. The soils are easy to work throughout a fairly wide range of moisture content. Crops respond very well to fertilizer, and the need for lime varies.

Such close-growing crops as hay along with contour planting and contour stripcropping are needed to reduce runoff and the hazard of erosion. Other useful alternatives for reducing erosion and runoff are diversions or terraces. If the soils in this unit are used intensively for cultivated crops, such supplemental practices as returning crop residue, using minimum tillage, and planting on the contour are needed.

CAPABILITY UNIT IIe–2

This unit consists of deep, well-drained, gently sloping or undulating soils on terraces and deltas on valley sides and on outwash plains and alluvial fans on the valley floors. These are loamy soils of the Herkimer, Palmyra, and Wampsville series, all of which formed in glacial outwash material.

The main root in the soils of this unit is between depths of 24 to 40 inches. Available water capacity is moderate to high in this zone. Reaction ranges from medium acid to neutral in the surface layer. The capacity of these soils to supply plant nutrients is medium to low. The hazard of erosion is slight to moderate.

These soils are well suited to all field crops and most vegetable crops commonly grown in the county. The soils of this unit are easy to work throughout a fairly wide range of moisture content. Crops respond very well to lime and fertilizer.

Cropping systems in which tillage is kept to a minimum and crop residue is maintained on the soil surface are useful in controlling runoff and erosion in areas where contouring is not applicable or desired.

CAPABILITY UNIT IIe–3

The only soil in this unit is Arkport very fine sandy loam, 2 to 6 percent slopes. This is a deep, well-drained, medium-textured, nearly level to gently sloping or undulating soil on the tops of sandy deltas on lake plains.

This soil can be tilled early in the season. Available

water capacity is moderate to high. Reaction ranges from strongly acid to neutral in the surface layer. The capacity of this soil to supply plant nutrients is low. The hazard of water erosion is moderate, and exposed areas are subject to soil blowing.

This soil is suited to most crops commonly grown in the county. It is especially well suited to truck crops, but large amounts of fertilizer need to be added and supplemental irrigation is required. Applied lime and fertilizer are rapidly leached from these soils, so smaller but more frequent or timely applications generally provide better crop response. This soil is easy to work throughout a wide range of moisture content. If good management practices such as returning crop residues to the soil, using cover crops, and plowing down green-manure crops are used to maintain organic-matter content, row crops can be grown year after year.

Erosion is a hazard in areas of gently sloping and undulating soils. Contour planting can be used to help reduce the hazard of erosion on the longer, uniform, gentle slopes. Cropping systems that include sod crops and in which tillage is kept to a minimum and plant residues are maintained on the surface can be used in undulating areas or large fields where contouring is not applicable or desired.

These are excellent soils for irrigated crops because they have a moderate infiltration rate and they can be cultivated soon after irrigation.

CAPABILITY UNIT IIe-4

This unit consists of deep and moderately deep, moderately well drained, gently sloping soils on uplands at elevations above 1,400 feet. These are medium-textured soils that have a dense, slowly permeable or very slowly permeable fragipan at a depth of 15 to 24 inches. They are deep soils of the Mardin series and a moderately shallow variant of the Mardin series in which bedrock is at a depth of 20 to 40 inches.

Roots are limited mainly to the 15- to 24-inch zone above the fragipan. Available water capacity is moderate to high in this zone. Reaction ranges from strongly acid to medium acid in the surface layer. The capacity of these soils to supply plant nutrients is medium. The hazard of erosion is moderate.

The soils in this unit are well stuied to most field crops commonly grown in the county. They are easy to work throughout a fairly wide range of moisture content, and crops grown on them respond very well to lime and fertilizer. In places, slight wetness briefly delays spring planting. Spot drainage of these areas provides more uniform moisture conditions when working entire fields.

Contour planting, stripcropping, and minimum tillage practices help to reduce the hazard of erosion, and diversions or terraces are also useful in reducing runoff and erosion. Crop residues need to be plowed under if these soils are intensively cropped.

CAPABILITY UNIT IIe-5

This unit consists of deep, moderately well drained, gently sloping or undulating, medium-textured soils on lake plains. These are soils of the Collamer, Galen, and Williamson series.

Williamson soils have a dense fragipan at a depth of 15 to 24 inches which limits roots mainly to the zone above the pan. Available water capacity is low to moderate in the root zone. Available water capacity is high in Collamer soils and moderate to high in Galen soils. Reaction ranges from very strongly acid to neutral in the surface layer. The capacity of these soils to supply plant nutrients ranges from medium to low. The hazard of erosion is moderate to severe, and gullies form readily where water concentrates. Slight seasonal wetness briefly delays planting and tillage in places.

Under good management that includes erosion control, these soils are well suited to all field crops commonly grown in the county, and the sandier soils are suited to vegetables. These soils are easy to work throughout a fairly wide range of moisture content, and crops respond very well to lime and fertilizer. Normally, the seasonal high water table in these soils is not too limiting, but where necessary, it can be lowered by installing a drainage system. The included areas of wetter soils need spot or random drainage to allow for timely tillage.

Contour planting and contour stripcropping are useful in reducing runoff and erosion. Diversions or terraces and minimum tillage practices also help reduce runoff and erosion. If these soils are used intensively, crop residues need to be returned to the soil.

CAPABILITY UNIT IIe-6

This unit consists of deep, moderately well drained, gently sloping, medium-textured soils. They are soils of the Bombay, Conesus, Hilton, and Lima series on uplands and soils of the Phelps series on gravel terraces and deltas in valleys.

These soils have a seasonal high water table at a depth of 15 to 24 inches, which somewhat restricts rooting depth and delays tillage in places. They have moderate to high available water capacity. The inherent capacity to supply plant nutrients is medium to low in Bombay soils and dominantly medium in the other soils. In unlimed areas, reaction ranges from strongly acid to slightly acid in the surface layer of Bombay, Conesus, and Hilton soils and from medium acid to neutral in the surface layer of Lima and Phelps soils. Erosion is a hazard if these soils are cultivated and not protected.

These soils are well suited to most crops commonly grown in the county. They can be worked throughout a fairly wide range of moisture content. Crops respond very well to fertilizer. The need for lime varies.

Measures such as contour farming or contour stripcropping are useful in controlling runoff and erosion. Diversions or terraces are needed in places to break up long slopes. If the soils in this unit are used intensively, such additional measures as minimum tillage, returning crop residue to the soil, and using cover crops are needed to maintain good tilth. Random drainage of wet spots is needed in places to provide more uniform tillage conditions.

CAPABILITY UNIT IIe-7

This unit consists of deep and moderately deep, medium-textured, gently sloping soils on uplands.

These soils are dominantly moderately well drained, and in places they are deep soils of the Cazenovia series and moderately deep soils of the Aurora series. Bedrock is mainly shale and is at a depth of 20 to 40 inches. In places, Aurora soils are nearly level.

These soils have a seasonal high water table at a depth of 18 to 24 inches that is perched on the slowly permeable subsoil and substratum. It somewhat restricts root growth, and slight wetness sometimes delays tillage. Available water capacity is moderate to high in Aurora soils and high in Cazenovia soils. Reaction of the surface layer ranges from strongly acid or medium acid to neutral in unlimed areas. The inherent capacity to supply plant nutrients is medium in the Aurora soil and medium to high in Cazenovia soil. Erosion is a hazard on the sloping areas if they are cultivated and not protected. These soils clod and puddle readily if they are tilled when too wet.

Under good management, the soils of this unit are well suited to most crops commonly grown in the county. The range of moisture content within which they can be tilled without becoming cloddy is fairly narrow. Crops respond well to applications of fertilizer. The need for lime varies.

The sloping soils can be used for row crops if such measures as contour farming or contour stripcropping and grassed waterways are used to control runoff and erosion. Diversions or terraces are needed in places to break up long slopes. Depth to bedrock restricts the use of diversions and terraces in places on Aurora soils. Other such supporting practices as keeping tillage to a minimum, returning crop residues to the soil, and using cover crops help to maintain good tilth. Random drainage of wet spots in places provides more uniform tillage conditions.

CAPABILITY UNIT IIe–8

This unit consists of deep and moderately deep, gently sloping, medium-textured soils that are moderately well drained to well drained. They are moderately deep soils of the Lairdsville series that have shale bedrock at a depth of 20 to 40 inches and deep soils of the Schoharie series on lake plains.

These soils have a fine textured or moderately fine textured subsoil that restricts water movement. Available water capacity of the root zone in these soils is moderate to high. The inherent capacity of these soils to supply nitrogen and phosphorus is generally medium, and to supply potassium is high. Reaction in the surface layer ranges from medium acid or slightly acid to neutral. Slight wetness in places delays planting briefly. Infiltration rates are slow. Runoff is rapid, and the hazard of erosion is moderate to severe.

The soils in this unit are fairly well suited to most crops commonly grown in the county. They have only a narrow range of moisture content within which they can be tilled. If they are worked when too wet, they clod and puddle readily. Crops respond well to fertilizer. Lime is needed in places.

Using minimum tillage practices, returning crop residues to the soil, and plowing down green-manure crops are important practices that aid in maintaining good soil structure and in controlling erosion. Contour farming and diversions or terraces are also beneficial on long, uniform slopes.

CAPABILITY UNIT IIw–1

This unit consists of deep, moderately well drained, level or nearly level, medium-textured soils on lake plains. These are soils of the Collamer, Galen, and Williamson series.

Williamson soils have a dense fragipan at a depth of 15 to 24 inches, which limits root growth to the zone above the pan. Consequently, Williamson soils have low to moderate available water capacity. Available water capacity is high in Collamer soils and moderate to high in Galen soils. Reaction ranges from very strongly acid to neutral in the surface layer. The capacity of these soils to supply nutrients ranges from medium to low. Seasonal wetness in places briefly delays planting and tillage.

The soils in this unit are well suited to most crops commonly grown in the county. The sandier soils are suited to vegetables. A seasonal high water table somewhat limits the choice of crops. Crops respond very well to applications of lime and fertilizer. They are easy to work throughout a fairly wide range of moisture content. The best economic returns are generally obtained by growing row crops. They can be grown continuously without damage to the soil if minimum tillage practices are used and if crop residues are returned to the soil. Winter cover crops are also desirable. In places, drainage of wet spots aids in timeliness of tillage.

CAPABILITY UNIT IIw–2

This unit consists of deep, well-drained to somewhat poorly drained, level, medium-textured soils on bottom lands that are subject to flooding. These soils are in the Hamlin, Teel, and Weaver series. The Hamlin soils are well drained and are generally less frequently flooded, or the floods are of shorter duration than those that occur on moderately well drained Weaver soils and the moderately well drained to somewhat poorly drained Teel soils. Flooding occurs mainly early in spring during the peak runoff period from melting snow, although flooding may occur at any time during the year.

Available water capacity is high in the main root zone of these soils. Reaction ranges from medium acid to moderately alkaline in the surface layer. The capacity to supply plant nutrients is medium to high in Hamlin and Teel soils. In Weaver soils, the capacity to supply nutrients ranges from high to low, depending on the content of carbonates. These soils are subject to streambank erosion and cutting in places, and are subject to gouging by rapidly flowing floodwaters if the surface is left bare.

These soils are suited to most crops commonly grown in the county, but spring grains are subject to lodging. Crops grown on the Weaver soils need to be tolerant of lime. Crops respond very well to fertilizer. Lime is needed in places on Hamlin and Teel soils.

These soils are easy to work throughout a fairly wide range of moisture content. The best economic returns are generally obtained by growing row crops. They can be grown continuously without damage to the soil if minimum tillage practices are used and if

crop residues are returned to the soil. Winter cover crops are also desirable. In places, improvement and maintenance of existing stream channels along with the use of levees help to control flooding.

CAPABILITY UNIT IIw–3

This unit consists of deep, moderately well drained, nearly level, medium-textured soils. These are soils of the Conesus, Hilton, and Lima series on uplands and soils of the Phelps series on gravel terraces and deltas in valleys.

These soils have a seasonal high water table at a depth of 15 to 24 inches, which restricts rooting depth somewhat and delays tillage in places. They have moderate to high available water capacity. The capacity of these soils to supply plant nutrients is mostly medium. In unlimed areas, reaction ranges from strongly acid to neutral in the surface layer of Conesus and Hilton soils and from medium acid to neutral in the surface layer of Lima and Phelps soils.

The soils in this unit are well suited to most crops commonly grown in the county. They can be worked throughout a fairly wide range of moisture content. Crops respond very well to fertilizer. The need for lime varies. Row crops can be grown continuously if crop residues are returned to the soil. Minimum tillage and the use of cover crops are also important measures that are needed to maintain good tilth. Random drainage of wet spots is needed in places to provide more uniform tillage conditions.

CAPABILITY UNIT IIs–1

This unit consists of deep, level or nearly level and gently sloping or undulating gravelly soils on outwash terraces, deltas, alluvial fans, and beaches. The soils are well drained or somewhat excessively drained. They are moderately coarse textured soils of the Alton series and moderately coarse textured and medium textured soils of the Howard series.

Roots are unrestricted, but most are in the upper 30 to 40 inches. Available water capacity is low to moderate in the root zone, and these soils tend to be droughty after relatively short dry periods. The inherent capacity to supply nutrients is low in Alton soils and low to medium in Howard soils. Reaction ranges from strongly acid to neutral in the surface layer in unlimed areas. Erosion is generally not a hazard except on longer slopes. It generally takes place in spring during periods of alternate freezing and thawing in areas without protective plant cover. Soil blowing is a hazard in some of the sandier areas (fig. 11).

These soils can be tilled early in the season and, if irrigated, are well suited to truck crops. Infiltration rates and internal drainage are dominantly rapid. Thus, the soils are well suited to irrigation. Gravel hinders tillage and limits the choice of truck crops that can be grown.

The soils in this capability unit are suited to most crops commonly grown in the county. Deep-rooted crops are preferred for general cropping in unirri-

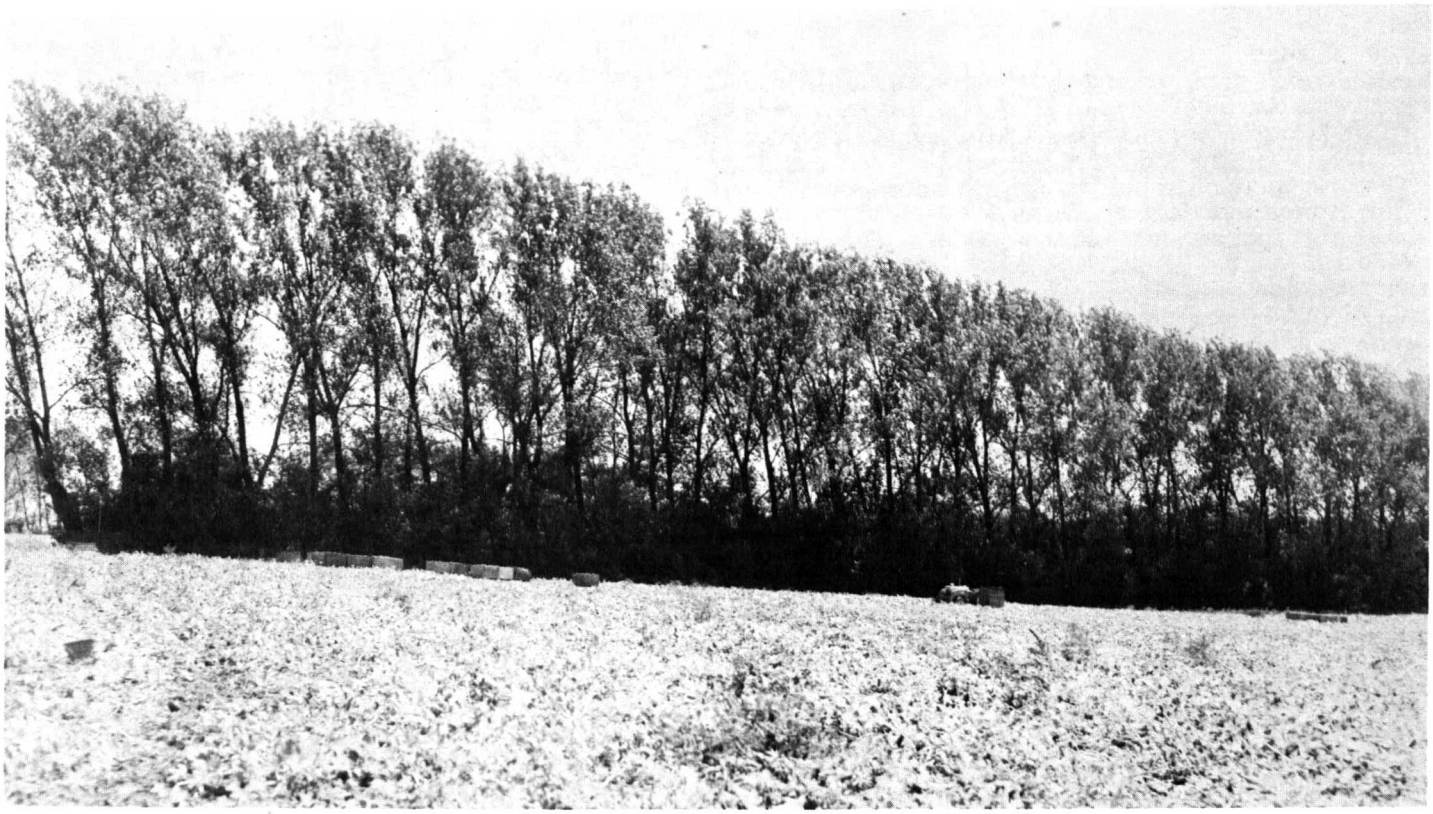

Figure 11.—**Windbreak on Alton gravelly fine sandy loam, capability unit IIs–1, near Duck Lake. The windbreak controls soil blowing and assures more uniform distribution of sprinkler water during irrigation. Acorn squash is being harvested in foreground.**

gated areas. Crops respond very well to fertilizer. Applications, especially of nitrogen, however, should be light and made at frequent intervals because these porous soils are rapidly leached. The need for lime varies.

If these soils are used intensively, such measures as minimum tillage, returning crop residues to the soil, and using cover crops help to maintain good tilth. In many areas the sloping soils are undulating, so contouring to control runoff and erosion is generally not practical. Sod crops are needed in the cropping system in these areas.

CAPABILITY UNIT IIIe-1

This unit consists of moderately deep, dominantly well drained, medium-textured, sloping soils that are underlain by limy shale or limestone bedrock at a depth of 20 to 40 inches. These are soils of the Camillus, Palatine, and Wassaic series. In places, the Palatine soils are somewhat excessively drained and the Wassaic soils are moderately well drained.

Root growth is confined mainly to the 20 to 40 inches above the bedrock. Available water capacity of this zone is moderate to high in Camillus and Wassaic soils and moderate to low in Palatine soils. The inherent capacity of these soils to supply plant nutrients is dominantly medium. Reaction of the surface layer ranges from medium acid to neutral in unlimed areas. Runoff is rapid, and the hazard of erosion is severe.

The soils in this unit are suited to most crops commonly grown in the county. Crops respond very well to fertilizer. Need for lime varies from place to place because of the range in reaction of the surface layer. These soils are easy to work throughout a fairly wide range of moisture content, but the operation of tillage equipment is difficult, particularly in the more sloping areas.

Contour planting and contour stripcropping and using minimum tillage practices are useful in controlling runoff and erosion and in reducing deposition of sediment. A hay crop helps to maintain good soil structure and reduces runoff and erosion. Hay or sod crops can also be plowed under as green manure. Crop residues need to be returned to the soil if row crops are grown. The use of diversions and terraces is generally not feasible because the depth to bedrock is variable within short distances.

CAPABILITY UNIT IIIe-2

This unit consists of deep, dominantly well drained, sloping, medium-textured soils on uplands. These are soils of the Honeoye, Lansing, Madrid, Mohawk, and Ontario series. Mohawk soils are moderately well drained in places.

These soils are medium to high in content of lime. Reaction ranges from strongly acid to neutral in the surface layer. Available water capacity of the root zone is high in the Honeoye, Lansing, and Mohawk soils and moderate to high in Madrid and Ontario soils. The capacity of these soils to supply nitrogen, phosphorus, and potassium is dominantly medium, except that it is low to medium in Madrid soils, and the capacity to supply potassium is medium to high in Mohawk soils. Runoff is moderate to rapid, and the hazard of erosion is severe.

These soils are well suited to most crops commonly grown in the county. They are easy to work throughout a fairly wide range of moisture content, but because of slope, the operation of tillage equipment is difficult. The gravel in some of the soils interferes slightly with tillage.

Contour planting and contour stripcropping are useful in controlling runoff and erosion. Hay or sod crops help to maintain good soil structure, and they can also be plowed under as green manure. If these soils are row cropped, the crop residue needs to be returned to the soil. Minimum tillage practices and diversions to break up long slopes are additional measures useful in controlling runoff and erosion.

CAPABILITY UNIT IIIe-3

This unit consists of moderately deep, well-drained Lordstown soils and well-drained to excessively drained Manlius soils. They are medium-textured, acid soils that are dominantly sloping, but in places they are gently sloping. These soils are mainly on the tops and upper parts of hillsides of the higher hills in the county. They are underlain by acid, fine-grained sandstone or shale bedrock at a depth of 20 to 40 inches.

The main root zone is in the soil above bedrock, although a few roots extend down into cracks in the rock. Available water capacity is low or moderate in the root zone. Reaction ranges from very strongly acid to medium acid in the surface layer. The capacity to supply plant nutrients is medium in Lordstown soils and low in Manlius soils. The hazard of erosion is moderate to severe, depending on slope. Stones and outcrops of bedrock hinder tillage in places. High elevations limit the length of the growing season.

The soils in this unit are fairly well suited to most crops commonly grown in the county. Crops respond fairly well to lime and fertilizer. The soils are easy to work throughout a fairly wide range of moisture content. Tillage on the more sloping areas is relatively difficult. The rock fragments in the soils interfere slightly with tillage in places.

Contour planting or stripcropping is useful in controlling runoff and erosion and in reducing sedimentation. Hay and sod crops help to maintain good soil structure and reduce runoff and erosion. They can also be plowed under as green manure. If the soils are used for row crops, residues should also be returned to the soil. Minimum tillage and no-till practices help control runoff and erosion on these soils. The use of diversions to break up long slopes is generally not feasible on these soils because depth to bedrock is variable.

CAPABILITY UNIT IIIe-4

The only soil in this unit is Arkport very fine sandy loam, rolling. It is a deep, well-drained, medium-textured soil on dissected sandy deltas of the lake plain. Slopes are generally short and complex.

The main root zone in this soil extends to a depth of 30 to 40 inches. Available water capacity is moderate to high in the root zone. Reaction ranges from strongly acid to neutral in the surface layer. The

capacity of these soils to supply plant nutrients is low. Runoff is moderate to rapid, and the hazard of erosion is severe, especially during periods of alternate freezing and thawing. Exposed areas are also subject to soil blowing.

This soil is suited to most crops commonly grown in the county. It is easy to work throughout a wide range of moisture content. Crops respond very well to fertilizer. Applications of nitrogen should be light and made at frequent intervals because of leaching. The need for lime varies because of the range in reaction of the surface layer.

Contour measures and such practices as minimum tillage, green-manure crops, and cover crops are useful in controlling runoff and erosion and in reducing sedimentation. Land smoothing to establish uniform slopes is feasible in some areas. It facilitates the use of contour measures. If the soil is row cropped, returning crop residues to the soil is also helpful. Hay and sod crops help to protect the soil against erosion, and they can also be plowed under as green manure. Diversions or terraces are good erosion-control practices on the longer, uniform slopes.

CAPABILITY UNIT IIIe-5

This unit consists of deep and moderately deep, moderately well drained, sloping soils that are on uplands at elevations above 1,400 feet. These are medium-textured soils that have a dense, slowly permeable or very slowly permeable fragipan at a depth of 15 to 24 inches. They are deep soils of the Mardin series and a moderately shallow variant of the Mardin series. Bedrock is at a depth of 20 to 40 inches.

Root growth in these soils is limited mainly to the 15- to 24-inch zone above the fragipan. Available water capacity is moderate to high in the root zone. Reaction ranges from strongly acid to medium acid in the surface layer. The capacity of these soils to supply plant nutrients is medium. Runoff is rapid, and the hazard of erosion is severe.

The soils in this unit are fairly well suited to most field crops commonly grown in the county. They are easy to work throughout a fairly wide range of moisture content. Crops respond very well to lime and fertilizer. High elevations and the short growing season somewhat limit the suitability and choice of crops.

Contour planting and stripcropping are useful in controlling runoff and erosion and in reducing sedimentation. Such close-grown crops as hay protect the soil, and they also improve soil structure. Minimum tillage, returning crop residues to the soil, and diversions also help control runoff, erosion, and sedimentation. The use of diversions is generally not feasible on the moderately shallow variant of Mardin soils because the depth to bedrock is variable.

CAPABILITY UNIT IIIe-6

This unit consists of deep and moderately deep, medium-textured, sloping soils on uplands. These soils are dominantly moderately well drained. They are deep soils of the Cazenovia series and moderately deep soils of the Aurora series. Shale bedrock is at a depth of 20 to 40 inches. In places, the Cazenovia soils are well drained, and the relief is rolling.

These soils have a seasonal high water table that is perched on the slowly permeable subsoil and substratum. It restricts root growth somewhat, and the slight wetness delays tillage in places. Available water capacity is moderate to high in Aurora soils and high in Cazenovia soils. Reaction of the surface layer ranges from strongly acid or medium acid to neutral in unlimed areas. The inherent capacity to supply plant nutrients is medium in Aurora soils and medium to high in Cazenovia soils. Runoff is rapid, and the hazard of erosion is severe. These soils clod and puddle readily if they are tilled when they are too dry or too wet.

Under good management, the soils of this unit are fairly well suited to most crops commonly grown in the county. The range of moisture content within which they can be tilled without becoming cloddy is fairly narrow. Crops respond well to applications of fertilizer. The need for lime varies.

These soils can be used to a limited extent for row crops if such measures as contour stripcropping and grassed waterways are used to control runoff and erosion. Diversions are needed in places to break up long slopes. Depth to bedrock in places restricts the use of diversions in Aurora soils. Such supporting practices as keeping tillage to a minimum, returning crop residues to the soil, and using cover crops help to maintain good tilth, control erosion and runoff, and reduce sedimentation. Rolling areas of Cazenovia soils, on which the use of contour farming measures is impractical, need to have a cropping system that includes sod crops.

CAPABILITY UNIT IIIe-7

This unit consists of somewhat poorly drained, deep and moderately deep, sloping, medium-textured soils on uplands. These are soils of the Angola and Darien series. They are on bedrock-controlled landforms, and they have a medium-textured or moderately fine textured subsoil that contains varying amounts of shale fragments similar to the underlying shale bedrock. Angola soils are 20 to 40 inches deep over bedrock, and Darien soils are more than 40 inches deep.

The main root zone in Angola and Darien soils extends to a depth of 20 to 30 inches. Available water capacity is moderate to high in this zone. Reaction is strongly acid or medium acid to neutral in the surface layer. The supply of nitrogen is generally high. The capacity of these soils to supply phosphorus and potassium is medium. Seepage and runoff from adjacent higher soils is prolonged, and the hazard of erosion is severe. Measures to cut off seepage and runoff and to control erosion are needed.

Unless the soils in this unit are drained, wetness delays planting and limits the choice of crops mainly to crops that tolerate wetness. Workability is greatly affected by seasonal wetness, but if these soils are drained, they are easy to work throughout a fairly wide range of moisture content.

If these soils are drained and used for row crops, such practices as contour planting, stripcropping, and diversions where possible are needed to control ero-

sion. The variable depth to bedrock in Angola soils limits the use of diversions in places. If the soils are to be used intensively, keeping tillage to a minimum, returning crop residues to the soils, and plowing down green-manure crops are good supplemental practices to help control erosion and reduce sedimentation.

CAPABILITY UNIT IIIe-8

The only soil in this unit is Volusia channery silt loam, 8 to 15 percent slopes. It is a deep, somewhat poorly drained, medium-textured, sloping soil on uplands. This soil has a seasonal high water table at a depth of 6 to 12 inches that is perched on a very slowly permeable fragipan which is at a depth of 10 to 16 inches.

Root growth is restricted mainly to this 10 to 16 inches of soil above the fragipan. Available water capacity of this zone is low to moderate. Normally there is more than enough moisture for plant growth, but during long, dry periods, plants suffer. The inherent capacity of this soil to supply phosphorus and potassium is generally medium, and to supply nitrogen is medium to high. In unlimed areas, reaction of the surface layer is strongly acid to slightly acid. The hazard of erosion is moderate to severe if this soil is cultivated and not protected. This and seasonal wetness are the main limitations to farming this soil.

Unless this soil is drained, seasonal wetness delays planting and limits the choice of crops. Crops respond fairly well to lime and fertilizer. Angular stone fragments hinder tillage and harvesting in places.

If adequately drained, this soil is suited to row crops if such measures to control erosion as contour planting and stripcropping are used. Diversions are needed in places to improve drainage conditions and break up the long slopes. Keeping tillage to a minimum and returning crop residues to the soil help to reduce erosion and sedimentation.

CAPABILITY UNIT IIIw-1

The only soil in this unit is Carlisle muck. It is a deep, very poorly drained, organic soil in bogs. It consists of 51 inches or more of muck over mineral soil or marl.

Unless this soil is drained, the water table is at or near the surface much of the time, and water ponds on the surface. Available water capacity is high. Reaction is dominantly slightly acid to neutral but ranges from strongly acid to mildly alkaline. The inherent capacity of this soil to supply nitrogen is high, and to supply phosphorus and potassium is low to medium. Wetness and the hazard of soil blowing, if the soil is drained, are the main limitations to farming this soil.

If drained, the soil in this unit is better suited to such high-value specialty crops as vegetables than to most other crops. After drainage, organic soils shrink and settle as a result of compaction, decomposition, and soil blowing. Controlled drainage is generally desirable to accommodate the moisture needs of crops and to reduce the amount of shrinkage and rate of decomposition. If this soil is used intensively, the structure of the surface layer breaks down and the soil is highly susceptible to blowing. Windbreaks are needed to help reduce soil loss and crop damage and to prevent drainage ditches from becoming plugged and ineffective.

CAPABILITY UNIT IIIw-2

This unit consists of deep and moderately deep, dominantly somewhat poorly drained soils that are nearly level or gently sloping on uplands. These are soils of the Angola, Darien, Manheim, and Ovid series. All but the Angola soils are deep. The Angola soil has shale bedrock at a depth of 20 to 40 inches. Ovid soils are moderately well drained in places.

The soils of this unit have a medium-textured surface layer and a medium-textured or moderately fine textured subsoil that is slowly permeable or very slowly permeable. Unless drained, these soils have a seasonal high water table at a depth of 6 to 12 inches that persists for a long time in spring and during wet periods. It affects rooting depth and soil workability. Available water capacity of the root zone is moderate to high. Natural fertility is medium to high. Reaction of the surface layer ranges from strongly acid or medium acid to neutral in unlimed areas. Wetness is the main limitation to farming these soils. Erosion is a hazard on the gently sloping soils if they are cultivated and not protected.

Undrained areas of this soil are better suited to water-tolerant grasses and legumes or short-season crops than to most other uses. Surface drains are generally more effective than tile drains because of the slowly permeable or very slowly permeable subsoil. If adequately drained, these soils are suited to most of the annual field crops commonly grown in the county. Crops respond well to fertilizer. The need for lime varies. The range of moisture conditions within which the soils can be worked without becoming cloddy is relatively narrow. Contour measures and diversions are needed on sloping areas to reduce the hazard of erosion.

CAPABILITY UNIT IIIw-3

This unit consists of deep, dominantly somewhat poorly drained, medium-textured and moderately coarse textured soils that are nearly level or gently sloping on uplands, outwash terraces, or lake plains. These soils are of the Appleton, Fredon, Kendaia, Minoa, and Niagara series. All but the Minoa soils have a medium-textured surface layer. Drainage ranges to poor in Fredon soils in places.

Unless drained, these soils have a seasonal high water table at a depth of 6 to 12 inches that persists for a long time in spring and during wet periods. It affects root growth and workability. Available water capacity of the root zone ranges from moderate to high, but normally there is more than enough moisture available for plant growth. The supply of nitrogen is mainly high. The inherent capacity of these soils to supply phosphorus and potassium is mainly medium but ranges to low in Fredon and Minoa soils. Wetness is the main limitation to farming these soils. Erosion is a hazard on the gently sloping soils if they are cultivated and not protected.

Undrained areas of these soils are better suited to water-tolerant grasses and legumes or to short-season crops than to most other uses. This soil responds

well to both subsurface and surface drainage measures. If adequately drained, the soil is suited to most crops commonly grown in the county, including vegetables. Crops respond well to fertilizer. The need for lime varies. If used intensively, the more sloping soils need such runoff- and erosion-control measures as stripcropping, contour planting, and diversions.

CAPABILITY UNIT IIIw-4

This unit consists of somewhat poorly drained, nearly level to gently sloping, moderately fine textured and medium-textured soils. These are deep soils of the Odessa and Rhinebeck series that formed in lake-deposited clays or silty clays on lake plains and similar, moderately deep soils of the Lockport and Brockport series on uplands where clay shale bedrock is at a depth of 20 to 40 inches.

All of these soils have a slowly permeable or very slowly permeable, clayey subsoil, and they are slow to dry out. The nearly level areas are subject to surface ponding, and sloping areas receive prolonged runoff and seepage from adjacent higher soils. These soils have moderate to high available water capacity. Reaction ranges from neutral to slightly acid in the surface layer. The capacity of these soils to supply plant nutrients is medium to high. Wetness and the difficulty of maintaining good tilth are the main limitations to farming these soils. Erosion is a hazard in areas of gently sloping soils if they are cultivated and not protected.

Unless these soils are drained, planting is delayed and the choice of crops is limited mainly to sod crops that tolerate wetness. The range of moisture content within which these soils can be successfully worked is very narrow. If tilled when too wet, they clod and puddle readily. Crops respond fairly well to fertilizer. The need for lime varies.

If row crops are grown, an effective drainage system is needed. Because of the slowly permeable or very slowly permeable subsoil, such surface drainage measures as land shaping in flatter areas and using drainage diversions coupled with graded rows on gently sloping areas are generally more effective than tile drainage systems. Such measures as minimum tillage and returning crop residues are very beneficial in maintaining good soil structure, and in areas of sloping soils, these measures also help to control erosion. Fall plowing is needed in places.

CAPABILITY UNIT IIIw-5

The only soils in this unit are Volusia soils and a moderately shallow variant of the Volusia series. These are deep and moderately deep, somewhat poorly drained, nearly level to gently sloping, medium-textured soils that have a very firm, very slowly permeable fragipan at a depth of 10 to 16 inches. Volusia soils, moderately shallow variant, have sandstone and hard shale bedrock under the fragipan at a depth of 20 to 40 inches.

Root growth in the soils of this unit is limited mainly to the 10 to 16 inches of soil above the fragipan. Available water capacity is low to moderate in this zone. Reaction ranges from strongly acid to medium acid or slightly acid in the surface layer. The capacity of these soils to supply plant nutrients is medium. Water is perched above the fragipan and is slow to drain from nearly level soils, and depressions are commonly ponded. Soils in gently sloping areas are subject to prolonged seepage from adjacent higher soils. Wetness is the main limitation to farming these soils. Erosion is a moderate hazard on gently sloping soils.

The soils in this unit are better suited to short-season, shallow-rooted crops that can tolerate both wetness and drought than to most other uses. Drainage systems to remove excess water are needed for row crops. Diversions to cut off seepage water are an effective method of draining these soils and controlling erosion on sloping soils. Workability is affected by seasonal wetness. Crops respond fairly well to lime and fertilizer.

CAPABILITY UNIT IIIs-1

This unit consists of deep, coarse-textured soils of the Colonie and Otisville series that are dominantly excessively drained. These soils are nearly level to gently sloping or undulating on sandy deltas or gravelly outwash terraces and beaches. The sandy Colonie soils range to well drained in places.

Rooting growth is not restricted, but the main root zone of these soils is in the upper 30 to 40 inches. Available water capacity in this zone in the Colonie soil is low to moderate and in the Otisville soil it is low or very low. Reaction of the surface layer is very strongly acid or strongly acid in unlimed areas. Natural fertility is low or very low. Lack of sufficient moisture and low natural fertility are the main limitations to farming these soils. The sandy Colonie soils are subject to soil blowing if they are left without protective cover.

The soils in this unit are better suited to deep-rooted crops than to most other uses. Use of these soils for shallow-rooted crops is limited unless they are irrigated. These soils are easy to work throughout a wide range of moisture content. They warm up early in spring, allowing earlier tillage and seeding than on many other soils. Crops respond very well to lime and fertilizer. Nitrogen fertilizer is readily lost by leaching, so small amounts applied at frequent or timely intervals generally give the best results. In order to maintain organic-matter content and stabilize soil structure, a cropping system is needed that includes the use of minimum tillage, cover crops, and crop residues returned to the soil. Gravel in the Otisville soils hinders tillage slightly in places.

These soils are suited to specialty crops, but they require intensive management, heavy fertilization, and supplemental irrigation if used for this purpose.

CAPABILITY UNIT IIIs-2

The only soil in this unit is Croghan loamy fine sand, 0 to 6 percent slopes. It is a deep, moderately well drained, coarse-textured soil that is nearly level to gently sloping on sandy deltas on the lake plain.

A seasonal high water table fluctuates to within 18 to 24 inches of the surface in spring and during wet periods, but it has little effect on the use of this soil for farming.

Available water capacity of the main root zone is low to moderate. Reaction of the surface layer is very

strongly acid or strongly acid in unlimed areas. Natural fertility is low. Low natural fertility and lack of moisture during extended dry periods are the main limitations to farming these soils. They are subject to soil blowing if left without protected cover.

This soil is suitable for intensive truck crop farming if adequate liming, fertilizing, and supplemental irrigation are used. Crops respond to lime and fertilizer. Nitrogen, however, is easily lost through leaching, so applications should be light and made at frequent or timely intervals. In places, drainage of wet areas provides more uniform drainage conditions for intensive tillage. In order to maintain the organic-matter content and good soil structure in the surface layer, the use of such measures as minimum tillage, cover crops, and crop residues returned to the soil is desirable.

CAPABILITY UNIT IIIe-3

The only soil in this unit is Benson silt loam, undulating. It is a shallow, somewhat excessively drained or excessively drained, medium-textured soil on uplands. Limestone or calcareous sandstone bedrock is at a depth of 10 to 20 inches, but in places shallower areas and outcrops of bedrock interfere with tillage and harvesting.

Roots are confined mainly to the 10 to 20 inches above the bedrock. Available water capacity in this zone is very low to moderate. Reaction of the surface layer is neutral to moderately alkaline in unlimed areas. Natural fertility is medium. Lack of moisture and spotty inclusions of areas of shallower soils and rock outcrops that hinder tillage and harvesting are the main limitations to farming this soil. Erosion is a severe hazard in areas of more sloping soils.

This soil is poorly suited to the field crops commonly grown in the county. Application of fertilizer is needed for best crop response; however, the response of crops to fertilizer is spotty on this soil in places because of the lack of moisture. This soil can be worked throughout a fairly wide range of moisture content.

Sod-forming crops need to be favored in the cropping system used on this soil. Minimum tillage practices also help control runoff and erosion and reduce sedimentation. Returning crop residues and using cover crops and green-manure crops are good practices for row crops.

CAPABILITY UNIT IVe-1

This unit consists mainly of rolling or moderately steep, dominantly well drained soils of the Camillus, Cazenovia, Honeoye, Lansing, Madrid, Mohawk, and Ontario series. Also included are sloping areas of eroded Camillus, Cazenovia, Madrid, and Ontario soils. All of these soils are deep, except the Camillus soil, which is 20 to 40 inches deep to soft silty shale. All have a medium-textured surface layer, except the Madrid soils, which are moderately coarse textured. These soils are on uplands, and they formed in glacial till that is high to moderate in content of lime.

Available water capacity is high or moderate to high in the root zone, but runoff is rapid or very rapid, so the soils are somewhat droughty. Reaction of the surface layer ranges from neutral to strongly acid. The capacity of these soils to supply plant nutrients is dominantly medium, but the supply of nitrogen is deficient in the eroded soils. Because runoff is rapid or very rapid, the hazard of erosion is severe or very severe.

Because of slopes and the hazard of erosion, these soils are poorly suited to cultivated crops. They are better suited to close-growing grain crops and sod crops than to most other crops. High-yielding alfalfa grows especially well on these soils. These soils are easy to work throughout a fairly wide range of moisture content, but the slopes make them hazardous for operation of machinery. Contouring or cross-slope tillage needs to be used, if feasible, as an added erosion-control practice even when renovating for hay and pasture reestablishment.

Applications of fertilizer are needed for best crop response. The need for lime varies. Old pastures can be improved by adding fertilizer and in some places lime, but periodic renovation of pasture provides higher quality feed and provides better erosion control.

CAPABILITY UNIT IVe-2

The only soils in this unit are moderately steep silt loams of the Aurora series. They are eroded in places. These are moderately deep, moderately well drained, medium-textured soils that are underlain at a depth of 20 to 40 inches by dark-gray shale bedrock. They are on bedrock-controlled landscapes of the uplands.

The root zone is 20 to 40 inches above the bedrock. Available water capacity is moderate to high in this zone. Reaction ranges from strongly acid to neutral in the surface layer. The capacity of these soils to supply nitrogen, phosphorus, and potassium is mainly medium, except in eroded soils, where nitrogen is deficient. Runoff is rapid to very rapid, and the hazard of erosion is severe or very severe. Gullies frequently form where water concentrates.

Because of slopes and the hazard of erosion, these soils are poorly suited to cultivated crops. They are better suited to close-growing grain crops and sod crops. Trefoil or alfalfa varieties that tolerate seasonal wetness grow well on these soils. These soils are easy to work throughout a fairly wide range of moisture content, but slopes make them hazardous for operation of machinery. Where practical, contour or cross-slope tillage needs to be used as an added erosion-control practice even when renovating for hay or pasture reestablishment.

Crops respond very well to regular application of fertilizer. Crops grown on eroded soils need high fertilizer application rates. The need for lime varies. Returning crop residues and plowing under green-manure crops are good practices for maintaining good soil structure and for helping to control erosion and reduce sedimentation, especially on the eroded soils. Old pastures can be improved by adding fertilizer and, in some places, lime; but periodic renovation of pasture provides higher quality feed and gives better erosion control.

CAPABILITY UNIT IVe-3

This unit consists of moderately deep and shallow, well-drained to excessively drained, medium-textured, acid soils that are moderately steep. These

soils are in the Arnot, Lordstown, and Manlius series. They are mainly on the tops and upper parts of sides of the higher hills. The Lordstown and Manlius soils are underlain by acid, fine-grained sandstone and shale bedrock at a depth of 20 to 40 inches. In Arnot soils, bedrock is at a depth of 10 to 20 inches.

The main root zone is in the soil above the bedrock, although a few roots extend into cracks in the rock. Available water capacity is very low to high in this zone, depending on the depth to bedrock. Reaction ranges from very strongly acid to medium acid in the surface layer. The capacity of these soils to supply plant nutrients is medium. The hazard of erosion is severe or very severe. Stones and outcrops of bedrock hinder tillage. The use of machinery on the moderately steep slopes is difficult and hazardous, especially on those slopes where bedrock crops out.

The soils in this unit are better suited to close-growing grain crops and sod crops than to most other uses. They are easy to work throughout a fairly wide range of moisture content. Rock fragments interfere slightly with operation of machinery in places. Tillage of these soils needs to be confined largely to renovation for hay and pasture.

Applications of lime and fertilizer are needed for best crop response, but response is spotty in areas of the Lordstown-Arnot complex because of the very low or low available water capacity of the shallow Arnot soils.

CAPABILITY UNIT IVe-4

This unit consists of shallow and moderately deep, medium-textured, well-drained, somewhat excessively drained, or excessively drained soils that are mainly sloping or moderately steep. These are soils of the Benson, Farmington, and Wassaic series. They are underlain at a depth of 10 to 40 inches by limestone or lime-bearing shale and sandstone bedrock. Bedrock outcrops are common to numerous.

Roots are mostly limited to the soil above the bedrock in the soils in this unit. Available water capacity is low to moderate in this root zone. Areas of soils that are shallow over bedrock are very droughty. Reaction ranges from medium acid to moderately alkaline in the surface layer. The capacity of these soils to supply plant nutrients is dominantly medium but ranges to low in Farmington soils. Runoff is rapid, and the hazard of erosion is severe where soils are steeper.

The soils in this unit are poorly suited to cultivated crops because of slopes and the hazard of erosion or lack of moisture. Tillage and harvesting are difficult because of rock outcrops. Tillage needs to be confined to that needed for reestablishment of hay or pasture.

Applications of fertilizer are needed for best crop response, but response is spotty because of lack of moisture in some areas of Benson and Farmington soils. The need for lime varies.

CAPABILITY UNIT IVe-5

The only soil in this unit is Arnot channery silt loam, gently sloping. This is a well drained to moderately well drained, medium-textured soil that is underlain at a depth of 10 to 20 inches by fine-grained sandstone or interbedded sandstone and shale bedrock. It is on bedrock-controlled landscapes and has rock outcrops on narrow escarpments in places. The root zone is mainly in the 10 to 20 inches above the bedrock. Available water capacity is low to very low. Reaction ranges from very strongly acid to strongly acid in the surface layer. The capacity of these soils to supply plant nutrients is medium. Runoff is slight to moderate, and the hazard of erosion is moderately severe. Shallowness to bedrock and many coarse fragments hinder farming.

This soil is generally not suited to cultivated crops because of the shallow depth to bedrock and droughtiness. Crops that mature early or that can withstand dry periods are better suited to this soil than other crops. Bedrock outcrops interfere slightly with tillage. Tillage needs to be confined to that needed for reestablishment of hay or pasture. Crops respond well to lime and fertilizer. Fertilizer needs to be applied in spring when the soil is moist.

CAPABILITY UNIT IVe-6

The only soil in this unit is Mardin channery silt loam, 15 to 25 percent slopes. It is a deep, moderately steep, moderately well drained, medium-textured soil that has a dense fragipan at a depth of 15 to 24 inches.

The main root zone is the 15 to 24 inches of soil above the fragipan. Available water capacity is moderate to high in this zone. Reaction ranges from strongly acid to slightly acid in the surface layer. The capacity of this soil to supply plant nutrients is medium. Runoff is rapid or very rapid, and the hazard of erosion is severe.

Because of slope and the hazard of erosion, this soil is poorly suited to cultivated crops. It is better suited to close-growing grain crops and sod crops than to most other crops. It is especially well suited to grass-legume hay. This soil can be tilled throughout a fairly wide range of moisture content, but the slopes are hazardous for operation of machinery. Contour or cross-slope tillage needs to be used, if feasible, as an added erosion-control measure even where reestablishing hay or pasture.

Lime and fertilizer are needed for best crop response. Older pasture can be improved by applying lime and fertilizer, but periodic renovation of pasture improves quality of feed and provides better control of erosion.

CAPABILITY UNIT IVe-7

This unit consists of deep, moderately well drained, rolling, medium-textured soils of the Williamson series. Both uneroded and eroded phases are included. These soils have a fragipan that is normally at a depth of 15 to 24 inches, but in eroded areas, it is as shallow as 12 inches. Root growth is limited mainly to the soil above the fragipan. This zone has low moderate available water capacity. Reaction ranges from very strongly acid to medium acid in the surface layer. Natural fertility is medium to low. The supply of nitrogen is especially deficient in eroded areas, and soil structure is poor and difficult to improve. Runoff is rapid, and the hazard of further erosion is very severe. These are the main limitations to farming these soils.

Because of the rolling relief, the use of contour farming measures to control erosion and runoff are generally not feasible. Tillage needs to be confined mostly to that necessary to reestablish hay or pasture. Applications of lime and fertilizer are needed for best crop response. If an occasional row crop is grown, using minimum tillage practices and returning crop residues help to reduce runoff and erosion.

CAPABILITY UNIT IVe-8

This unit consists of soils of the Schoharie and Lairdsville series. Schoharie soils are deep, rolling and hilly, medium-textured and moderately fine textured soils on lake plains. The Lairdsville soils are moderately deep, sloping, moderately fine textured soils that are eroded and on uplands. Clayey shale bedrock is at a depth of 20 to 40 inches in Lairdsville soils. The soils of this unit are moderately well drained to well drained.

These soils have a fine textured or moderately fine textured subsoil that restricts root depth and water movement. Available water capacity of the root zone is moderate to high. Reaction of the surface layer ranges from medium acid or slightly acid to neutral. Natural fertility is dominantly medium to high, except on the eroded Lairdsville soils, which are deficient in nitrogen. Runoff is rapid, and the hazard of further erosion is severe.

Because of complex slopes, heavy textures, and the hazard of erosion, these soils are poorly suited to cultivated crops. The range of moisture content within which they can be worked without becoming cloddy is narrow. Good seedbeds are difficult to establish. The use of contour measures is not feasible on rolling and hilly areas, so tillage needs to be confined mainly to renovation for hay and pasture. Eroded soils are low in content of organic matter and they need such special measures as plowing under green-manure crops and using minimum tillage when reestablishing hay or pasture to increase organic-matter content.

Applications of fertilizer are needed for good crop growth. The need for lime varies.

CAPABILITY UNIT IVe-9

The only soil in this unit is Dunkirk silt loam, rolling. It is a deep, well-drained, medium-textured soil that formed in dissected, silty, glacial-lake deposits.

Available water capacity of the root zone is high. Reaction of the surface layer ranges from strongly acid to neutral in unlimed areas. Natural fertility is medium. Runoff is rapid on this rolling soil, and the hazard of erosion is very severe.

This soil is poorly suited to cultivated crops because of the hazard of erosion and the complex slopes that preclude the use of contour measures to control runoff and erosion. It is better suited to close-growing grain crops and sod crops. It is especially well suited to high-yielding varieties of alfalfa. This soil is easy to work throughout a fairly wide range of moisture content. Steep areas are difficult and hazardous to work. Tillage on this soil needs to be limited to that necessary for reestablishment of hay or pasture.

CAPABILITY UNIT IVe-10

This unit consists of deep, well-drained to excessively drained, medium-textured or moderately coarse textured, rolling or hilly soils of the Alton, Howard, Palmyra, and Wampsville series and hilly soils of the Arkport series. These are gravelly or sandy soils on outwash kames, terrace edges, or dissected deltas in valleys or on lake plains.

The main root zone in these soils extends to a depth of 40 inches. Available water capacity is low to high in this zone. Reaction of the surface layer ranges from strongly acid to neutral in unlimed areas. The capacity of these soils to supply nutrients is low to medium. Runoff is moderate to rapid, and the hazard of erosion is moderate to severe. Some of the sandier areas are subject to soil blowing if they are left without protective cover.

The use of contour measures to control erosion and runoff is generally impractical on these rolling or hilly areas that have short, complex slopes. These soils are poorly suited to cultivated crops. Tillage generally needs to be confined to that needed for reestablishment of hay and pasture. Operation of tillage and harvesting equipment is hazardous in places.

Deep-rooted grasses and legumes need to be favored on these soils because of droughtiness during dry periods. Applications of fertilizer are needed for best crop response. The need for lime varies. Applications of fertilizer, especially nitrogen, should be light and made at relatively frequent intervals because these soils are fairly rapidly leached.

CAPABILITY UNIT IVw-1

This unit consists of deep, somewhat poorly drained to poorly drained, level or nearly level, coarse-textured soils of the Naumburg and Wareham series. These soils are in low positions on sand deltas of the lake plain. They have a prolonged high water table. The lowest, wettest soils are subject to surface ponding in places.

These soils have low or very low available water capacity. They generally receive a large amount of runoff and seepage from adjacent higher soils, however, so more than enough water generally is available for adapted plants. Reaction ranges from very strongly acid to medium acid in the surface layer in unlimed areas. The capacity of these soils to supply phosphorus and potassium is low, and to supply nitrogen is medium or high where the soils are drained. Wetness and low natural fertility are the main limitations to farming these soils.

Unless these soils are drained, they are generally better suited to short-season crops than to most other uses. Where outlets are available, the soils can generally be effectively drained either by surface drains or subsurface drains, or both. If adequately drained, these soils are suited to most crops commonly grown in the county. If drained and intensively cultivated, these soils need protection from soil blowing. These soils can be row cropped continuously without significant soil damage if such practices as keeping tillage to a minimum, growing cover crops, returning crop residues to the soil, and plowing under green-manure

crops are used. These practices help to maintain organic-matter content and good soil structure.

Crop response to lime and fertilizer is fair to good, depending on the effectiveness of drainage measures. Native pastures can be improved with regular applications of fertilizer. These soils produce fairly good summer forage when drier soils lack moisture.

CAPABILITY UNIT IVw–2

This unit consists of deep, poorly drained and very poorly drained, level or nearly level, moderately fine textured soils of the Fonda and Lakemont series. These soils are in low, nearly level or depressional positions on the lake plain and are subject to prolonged surface ponding.

These soils have a slowly permeable or very slowly permeable clayey subsoil and are slow to dry out. They have moderate to high available water capacity. They are neutral to slightly acid in the surface layer. Natural fertility is high to medium. Wetness and the difficulty of maintaing good tilth are the main limitations to farming these soils.

Unless drained, these soils are too wet for cultivated crops; they are better suited to native pasture or trees. Completely effective drainage is difficult to accomplish, so hay and pasture seeding mixtures that tolerate wetness are generally better suited to these soils if they are cropped than other mixtures. Where outlets are available, surface drainage using open ditches or land shaping, or a combination of both, is more effective than tile drainage because of the slowly permeable or very slowly permeable subsoil layers. The moisture content within which these soils can be worked is very narrow. They clod and puddle readily if tilled when too wet, and they become hard when they dry. As a consequence, more favorable moisture conditions for plowing, seedbed preparation, and seeding generally occur during periods of low rainfall. When these soils are wet, livestock and machinery tend to compact them and cause puddling in places.

Crops respond fairly well to fertilizer. The need for lime varies. Native pastures can be improved by annual applications of complete fertilizer, and they provide fairly good summer forage.

CAPABILITY UNIT IVw–3

This unit consists of deep, poorly drained and very poorly drained, level or nearly level, medium-textured soils. These soils are of the Canandaigua, Halsey, Lamson, and Lyons series. They are in low, level, or depressional positions in the landscape and are subject to surface ponding. Available water capacity of the root zone is moderate to high. The capacity of these soils to supply nitrogen is high and to supply phosphorus and potassium is medium to low. Reaction of the surface layer ranges from medium acid to neutral in unlimed areas. Wetness is the main limitation to farming these soils.

Undrained areas of these soils are too wet for cultivated crops; they are better suited to native pasture or trees. Where outlets are available, these soils generally can be effectively drained by either surface drains or subsurface drains, or a combination of both. If such supporting practices as keeping tillage to a minimum, using cover crops, returning crop residues to the soil, and plowing under green-manure crops are used to help maintain organic-matter content and good soil structure, these soils can be continuously rowcropped.

Response of crops to fertilizer is fair to good, depending upon drainage effectiveness. Native pasture can be improved by regular applications of complete fertilizer, and they provide fairly good summer forage when vegetation on drier soils suffers from lack of moisture.

CAPABILITY UNIT IVw–4

The only soil in this unit is Varick silt loam. It is a moderately deep, poorly drained, nearly level to very gently sloping, medium-textured soil on bedrock-controlled landscapes of the uplands. Moderately hard shale bedrock is at a depth of 20 to 40 inches. This soil is on nearly level hilltops from which water drains slowly, or it is on very gently sloping benches on hillsides which receive runoff and seepage from adjacent higher soils.

Root growth is limited by wetness mainly to the upper 18 inches of the soil. Available water capacity is moderate to high in this zone. Reaction ranges from medium acid to neutral in the surface layer. The capacity of these soils to supply nitrogen is high, and to supply phosphorus is medium. Potassium reserves are medium.

Undrained areas of this soil are suited only to water-tolerant grasses and legumes. If adequately drained, this soil is suited to annual row crops, but the depth to bedrock hinders the establishment of drainage systems in places. The hazard of erosion is moderate on gentle slopes, especially where there is a large amount of runoff and seepage from adjacent higher soils. Contouring, minimum tillage, and returning crop residues to the soil reduce the hazard of erosion and help maintain organic-matter content.

Crops respond well to fertilizer. The need for lime varies. Regular applications of a complete fertilizer on native pastures helps provide additional summer forage when vegetation on drier soils suffers from lack of moisture.

CAPABILITY UNIT IVw–5

This unit consists of very poorly drained organic soils of the Edwards and Palms series. These soils are in depressions mainly on the lake plain. In Edwards soils, the muck deposits are 16 to 50 inches thick over marl, and in Palms soils, they are 16 to 50 inches thick over loamy mineral layers. Available water capacity of these soils is high. Reaction of the surface layer in Edwards muck ranges from neutral to moderately alkaline; in the surface layer of Palms muck, reaction ranges from medium acid to mildly alkaline. The supply of nitrogen is high. The inherent capacity of these soils to supply phosphorus and potassium is mainly low, but it ranges to medium in places. Prolonged wetness and the relatively shallow thickness of the muck deposits are the main limitations to farming these soils.

If adequately drained, these soils are well suited to specialty crops. If drained, the muck settles and oxidizes, and it is very susceptible to soil blowing.

Controlling drainage reduces the rate of settling and oxidation and prolongs the useful life of the muck. Windbreaks are needed to reduce soil blowing. Areas of these soils that have muck deposits less than 3½ feet thick generally are not economically feasible to drain.

CAPABILITY UNIT IVs–1

This unit consists of deep, coarse-textured soils of the Colonie and Otisville series. These rolling soils are dominantly excessively drained, but the sandy Colonie soils are well drained in places. These soils are on sandy deltas or gravelly outwash terraces, kames, and beaches.

Roots are unrestricted, but the main root zone of these soils is in the upper 30 to 40 inches. Available water capacity of this zone in the Colonie soil is low to moderate, and in the Otisville soil it is low or very low. Reaction of the surface layer is very strongly acid or strongly acid in unlimed areas. Natural fertility is low or very low. Lack of sufficient moisture for good plant growth, low natural fertility, and the hazard of erosion are the main limitations to farming these soils. The sandy Colonie soils are also subject to soil blowing if they are left without protective cover.

Unless irrigated, the droughty soils in this unit are better suited to deep-rooted crops or early-maturing crops than to most other crops. Irrigation is generally not feasible because of the rolling relief and the hazard of erosion. These soils can be worked early in spring and are easy to till throughout a wide range of moisture content. The gravel in the Otisville soils interferes slightly with tillage in places. Frequent tilling of these soils contributes to soil blowing. Tillage on these soils needs to be limited to that needed for reestablishment of hay or pasture. Crops respond well to lime and fertilizer. Applications, however, should be light and made at frequent intervals because these soils are easily leached.

CAPABILITY UNIT Vw–1

This unit consists of deep, poorly drained or very poorly drained mineral soils of the Warners and Wayland series and shallow organic soils of the Martisco series. These wet soils are on bottom lands where they are subject to frequent floooding, or they are in low bog areas where they are subject to prolonged surface ponding. Martisco and Warners soils are underlain by marl.

Reaction of the surface layer ranges from slightly acid to moderately alkaline in unlimed areas. In Wayland soils, reaction of the surface layer ranges from neutral to mildly alkaline. The supply of nitrogen is high. The inherent capacity of these soils to supply phosphorus and potassium is low to medium. Prolonged wetness and frequent flooding or ponding are the main limitations to farming these soils.

Unless these soils are drained, they are not suitable for cropping because of prolonged wetness and the frequency of flooding or ponding. Drainage is seldom feasible because of the lack of outlets. Most areas are in wetland pasture or in swamp woods. If cleared of brush and trees, these soils provide some limited grazing during dry periods, and in places, they are suited to some forms of wildlife habitat.

CAPABILITY UNIT Vw–2

This unit consists of Fluvaquents, frequently flooded. This land type consists of soils that vary in drainage and texture. It is on the narrow flood plains of high-gradient streams in the uplands where it is subject to frequent flash floods, or it occurs as rubble deposits on the lowest parts of flood plains bordering streams in the larger valleys. These areas are mainly in pasture or trees. A few isolated, better drained areas are used for garden plots. Most areas need to be kept in permanent vegetation to minimize the damage of constantly changing stream channels and the deposition of stream rubble.

CAPABILITY UNIT VIe–1

This unit consists of steep soils of the Camillus, Honeoye, Howard, Lairdsville, Lansing, Mardin, Ontario, Palmyra, and Schoharie series. These soils are on all types of depositional landscapes throughout the county. Camillus and Lairdsville soils are moderately deep over shale bedrock. The other soils are deep. All of these soils are dominantly well drained and medium textured. Drainage ranges from excessive to moderate in places. Some Howard and Palmyra soils are coarser in texture, and Schoharie soils are finer textured.

Available water capacity of these soils ranges from moderate to high, but runoff is so rapid that little moisture soaks into the soils during summer rains. Reaction ranges from strongly acid to neutral in the surface layer. Natural fertility is dominantly medium but ranges to low in places. Steep slopes and the hazard of erosion are the main limitations to farming these soils.

The soils in this unit are too steep for cultivation, but they provide fairly good native pasture. They are also well suited to trees and to some types of wildlife habitat. In places, cleared areas that are used for pasture can be improved by applying fertilizer. The need for lime varies. Grazing on these soils can begin fairly early in spring, but grazing needs to be controlled to maintain good plant cover for protection from erosion.

CAPABILITY UNIT VIs–1

This unit consists of shallow and moderately deep, very rocky soils of the Benson and Wassaic series, and of deep, very stony soils of the Honeoye series. These soils are dominantly gently sloping and sloping on uplands. Rock outcrops cover about 20 percent of the areas of Benson and Wassaic soils, and many large stones and boulders cover areas of Honeoye soils.

Depth to the zone is variable from place to place. Available water capacity ranges from very low to high. Natural fertility is dominantly medium. Reaction of the surface layer ranges from medium acid to moderately alkaline in unlimed areas.

The soils in this unit are too stony or have too many bedrock outcrops for cultivation. The use of most farming machinery is greatly hindered. The soils provide some native pasture and are suited to trees and some types of wildlife habitat. In places, cleared areas that are used for pasture can be im-

proved by topdressing with fertilizer and hand seeding such legumes as birdsfoot trefoil. The need for lime varies. The soils in this unit can be grazed fairly early in the season. Grazing, however, needs to be controlled on improved areas to maintain quality stands, continued production, and good plant cover for protection from erosion.

CAPABILITY UNIT VIIe-1

This unit consists of very steep soils of the Honeoye, Lansing, and Ontario series on uplands and of soils of the Howard and Palmyra series on gravelly outwash terrace faces. These are deep soils that are dominantly medium textured and well drained. Some Howard and Palmyra soils are moderately coarse textured, and drainge in them is somewhat excessive or excessive. Available water capacity of these soils is moderate to high, but runoff is so rapid that little moisture infiltrates into the soils during summer rains. Reaction of the surface layer ranges from strongly acid or medium acid to neutral. Natural fertility is dominantly medium but ranges to low in some of the gravelly outwash soils. Very steep slopes and the hazard of erosion are limitations to farming these soils.

These very steep soils are too steep for the use of modern farm equipment. They are better suited to trees and wildlife habitat than to most other uses. In places, these soils provide some limited grazing, but in general, grazing animals should be restricted from these soils in order to preserve sufficient natural plant cover to control runoff and protect them from erosion.

CAPABILITY UNIT VIIs-1

This unit consists of shallow and moderately deep, dominantly well drained, very steep, medium-textured soils that have numerous bedrock ledges, stones and boulders, or both. These soils are of the Arnot, Aurora, Benson, Farmington, Lordstown, and Wassaic series.

Depth of the root growth is variable. Available water capacity ranges from very low to high. Reaction ranges from moderately alkaline to strongly acid in the surface layer. The supply of plant nutrients is dominantly medium. Runoff is very rapid, and the hazard of erosion is very severe. Slopes and bedrock outcrops make the use of machinery very hazardous.

The soils in this unit are too steep, too stony, or have too many rock outcrops for cultivation and improvement of pasture. Many areas of these soils are covered with woody plants. In order to preserve adequate plant cover for control of runoff and erosion, grazing animals need to be restricted from areas of these soils. The soils are well suited to some types of wildlife habitat.

CAPABILITY UNIT VIIIw-1

This unit consists of Saprists and Fluvaquents, ponded, popularly termed fresh water marsh. Areas of these soils are permanently under water and support various kinds of marsh vegetation. They are not suitable for the commercial production of plants, but they can be used for wetland wildlife habitat and recreation or for water supply.

Estimated yields[4]

Tables 2 and 3 show estimated average yields per acre of major crops grown on the soils in the county. Table 2 is for field crops, and table 3 is for vegetable crops. The estimates in these tables are based on average and high levels of management. Columns A show yields that can be expected if management of soils, water, and crops is average. This management consists of applying less than half of the recommended conservation and management practices. The estimates are for yields obtained in the early 1970's.

The estimated yields in columns B are the approximate high yields attained by the top 10 percent of the farmers in the county, who used the best combinations of conservation and management practices. High-level management consists of using suitable crop rotation; applying appropriate rates of lime and fertilizer; providing adequate drainage and irrigation where needed; using contour farming, stripcropping, grassed waterways, or other appropriate measures where needed to conserve soil and water; controlling weeds and insects as completely as possible; and tilling at the right time and in the proper way.

To obtain yields shown in column B, management needs are similar to those recommended in the annually published "Cornell Recommends for Field Crops," and "Vegetable Production Recommendations," both prepared by the New York State College of Agriculture and Life Sciences at Cornell University.

Actual estimated yields may vary by about 10 percent from year to year from those listed. Management that results in high crop yields as shown in column B, however, requires the farmer to be consistent in all factors over which he has management control. Yields can be expected to increase in the future as new varieties and improvements in management become available.

Yields of vegetables shown in table 3 are based upon marketable products. An important factor to be considered in comparing vegetable yields for the various soils is earliness of harvest. Generally, well-drained to excessively drained sandy or gravelly soils in the lower elevations of the county, such as Alton gravelly fine sandy loam, are highly regarded soils for fresh market vegetables, even though high-level management is needed to make production on them profitable (fig. 12).

Under average-level management, dry bean yields range from 15 to 30 bushels per acre, and under high-level management, yields range from 30 to 40 bushels per acre.

On the 300 acres of drained muck soils, the main vegetable crops are green onions and lettuce. Other crops are mainly radishes, spinach, beet greens, cabbage, carrots, fennel, and parsley (fig. 13). Most of these crops are sold through local markets, chain

[4] HAROLD L. HANSEN, conservation agronomist, Soil Conservation Service, assisted in the preparation of the tables in this section. Also assisting were extension agents of the Cooperative Extension Service—DONALD W. HAMMOND, who helped prepare the table on field crops; RICHARD H. ACKERMAN, who helped prepare the table on vegetable crops; and FRANCIS C. DELLAMANO, who helped prepare the narrative section on fruit.

TABLE 2.—*Estimated average yields per acre of principal field and forage crops under two levels of management*

[Yields in columns A are those to be expected under average management; those in columns B, under improved management. Absence of yield figure indicates that the crop is not suited to the soil or is not grown]

Soil	Corn				Oats		Wheat		Barley		Forage mixtures (hay)					
	For silage		For grain								Alfalfa-grass		Alfalfa-birdsfoot trefoil-grass		Birdsfoot trefoil-grass	
	A Tons	B Tons	A Bu	B Bu	A Bu	B Bu	A Bu	B Bu	A Bu	B Bu	A Tons	B Tons	A Tons	B Tons	A Tons	B Tons
Alton gravelly fine sandy loam, 0 to 3 percent slopes	12	20	60	100	50	100	35	60	40	70	2.5	4.5				
Alton gravelly fine sandy loam, 3 to 8 percent slopes	12	20	60	100	50	100	35	60	35	65	2.5	4.5				
Alton gravelly fine sandy loam, rolling	9	16	45	80	40	80	25	50	30	55	2.5	4.5				
Angola-Darien silt loams, 0 to 6 percent slopes	12	18	60	90	40	80	30	55	40	60		3.5	2.5	3.5	2.0	3.0
Angola-Darien silt loams, 6 to 12 percent slopes	12	18	60	90	40	80	30	55	40	60		3.5	2.5	3.5	2.0	3.0
Appleton loam, 0 to 3 percent slopes	10	24	50	120	40	80	30	50	40	60		3.5	2.0	3.5	2.0	3.0
Appleton channery silt loam, 0 to 3 percent slopes	10	20	50	100	40	80	30	50	40	60		3.5	2.0	3.5	2.0	3.0
Appleton channery silt loam, 3 to 8 percent slopes	10	20	55	100	40	80	30	50	40	60		3.5	2.0	3.5	2.0	3.0
Arkport very fine sandy loam, 2 to 6 percent slopes	12	20	60	100	50	100	25	55	30	60	2.0	3.5				
Arkport very fine sandy loam, rolling	10	17	50	90	50	100	25	55	30	60	2.0	3.5				
Arkport very fine sandy loam, hilly																
Arnot channery silt loam, gently sloping					40	60							2.0	3.0	2.0	3.0
Arnot-Lordstown association, very steep																
Aurora silt loam, 0 to 6 percent slopes	14	22	70	110	40	70	35	55	40	70	3.0	4.0	2.5	3.5		
Aurora silt loam, 6 to 12 percent slopes	12	20	60	100	40	70	35	55	40	70	3.0	4.0	2.5	3.5		
Aurora silt loam, 12 to 18 percent slopes	10	18	50	90	30	60	30	45	30	60	3.0	4.0	2.5	3.5		
Aurora silt loam, 12 to 18 percent slopes, eroded	8	14	40	70	30	60	20	40	20	50	2.0	3.0	2.0	3.0		
Aurora-Farmington-Rock outcrop association, steep																
Benson silt loam, undulating					50	70	25	50	30	60	3.0	4.0				
Benson silt loam, rolling					40	65	25	50	30	60	3.0	4.0				
Benson-Wassaic-Rock outcrop association, sloping																
Benson-Wassaic-Rock outcrop association, very steep																
Bombay gravelly loam, 2 to 8 percent slopes	12	20	60	100	60	90	40	60	50	75	3.5	4.5	3.0	4.0	2.5	3.0
Camillus silt loam, 2 to 6 percent slopes	14	24	70	120	60	100	40	60	50	70	3.5	5.0				
Camillus silt loam, 6 to 12 percent slopes	12	22	60	110	60	100	40	60	50	70	3.5	5.0				
Camillus silt loam, 6 to 12 percent slopes, eroded	10	20	50	100	50	80	30	50	40	60	3.0	4.0				
Camillus silt loam, 12 to 18 percent slopes, eroded	8	16	40	80	50	80	30	50	40	60	3.0	4.0	2.0	3.5		
Camillus and Lairdsville shaly soils, steep																
Canandaigua mucky silt loam		22		110											1.5	2.5
Carlisle muck																
Cazenovia silt loam, 2 to 8 percent slopes	12	24	60	120	60	90	40	60	50	70	3.5	4.5	3.0	4.0		
Cazenovia silt loam, 8 to 15 percent slopes	12	20	60	100	60	90	40	60	50	70	3.5	4.5	3.0	4.0		
Cazenovia silt loam, 8 to 15 percent slopes, eroded	10	18	50	90	50	80	30	50	30	60	3.0	4.0	2.5	3.5		
Cazenovia soils, 15 to 25 percent slopes					50	80	20	40	30	50	3.0	4.0	2.5	3.5		
Collamer silt loam, 0 to 2 percent slopes	14	24	70	120	60	90	40	60	50	70	3.0	4.0	2.5	3.5	2.0	3.0
Collamer silt loam, 2 to 6 percent slopes	14	24	70	120	60	90	40	60	50	70	3.0	4.0	2.5	3.5	2.0	3.0
Colonie loamy fine sand, 0 to 6 percent slopes		18		90		80						3.0				

TABLE 2.—*Estimated average yields per acre of principal field and forage crops under two levels of management—Continued*

Soil	Corn				Oats		Wheat		Barley		Forage mixtures (hay)					
	For silage		For grain								Alfalfa-grass		Alfalfa-birdsfoot trefoil-grass		Birdsfoot trefoil-grass	
	A *Tons*	B *Tons*	A *Bu*	B *Bu*	A *Bu*	B *Bu*	A *Bu*	B *Bu*	A *Bu*	B *Bu*	A *Tons*	B *Tons*	A *Tons*	B *Tons*	A *Tons*	B *Tons*
Colonie loamy fine sand, rolling		14		70		70						3.0				
Conesus gravelly silt loam, 0 to 3 percent slopes	12	20	60	100	50	90	30	50	40	60	3.5	4.5	3.0	4.0	2.5	3.0
Conesus gravelly silt loam, 3 to 8 percent slopes	12	20	60	100	50	90	30	50	40	60	3.5	4.5	3.0	4.0	2.5	3.0
Croghan loamy fine sand, 0 to 6 percent slopes		18		90												
Darien silt loam	12	18	60	90	50	80	30	50	40	60		3.5	2.5	3.5	2.0	3.0
Dunkirk silt loam, rolling	12	18	60	90	50	80	30	50	40	60	3.0	4.0	2.5	3.5	2.0	3.0
Edwards muck																
Farmington-Aurora association, sloping					30	60					2.0	3.0	2.0	3.0	2.0	3.0
Fluvaquents, frequently flooded																
Fonda mucky silty clay loam		20		100												
Fredon loam		20		100												
Galen very fine sandy loam, 0 to 2 percent slopes	10	22	60	120	50	80	40	60	50	70	2.5	4.0	2.5	3.5	2.0	3.0
Galen very fine sandy loam, 2 to 6 percent slopes	10	22	60	120	50	80	40	60	50	70	2.5	4.0	2.5	3.5	2.0	3.0
Halsey mucky loam		20		100												
Hamlin silt loam	16	26	80	130	60	100					3.0	5.0				
Hamlin silt loam, high bottom	16	26	80	130	60	100	50	70	60	80	3.0	5.0				
Herkimer silt loam	14	24	70	120	60	100	50	70	60	80	3.0	5.0				
Hilton loam, 0 to 3 percent slopes	12	24	60	120	60	100	40	60	50	70	3.5	4.5	3.0	4.0	2.5	3.0
Hilton loam, 3 to 8 percent slopes	12	24	60	120	60	100	40	60	50	70	3.5	4.5	3.0	4.0	2.5	3.0
Honeoye silt loam, 2 to 8 percent slopes	16	26	80	130	60	100	50	70	60	80	3.5	5.0	3.0	4.5		
Honeoye silt loam, 8 to 15 percent slopes	14	22	70	110	60	100	50	70	60	80	3.5	5.0	3.0	4.5		
Honeoye silt loam, rolling	14	20	70	100	50	90	40	60	50	70	3.5	5.0	3.0	4.5		
Honeoye and Lansing gravelly silt loams, 15 to 25 percent slopes											3.5	4.5	2.5	4.0		
Honeoye very stony soils, sloping																
Honeoye, Lansing and Ontario soils, steep																
Honeoye, Lansing and Ontario soils, very steep																
Howard gravelly fine sandy loam, 0 to 3 percent slopes	16	22	80	110	60	100	40	60	50	70	3.5	5.0				
Howard gravelly fine sandy loam, 3 to 8 percent slopes	16	22	80	110	60	100	40	60	50	70	3.5	5.0				
Howard gravelly fine sandy loam, rolling	14	20	70	100	50	90	40	60	50	70	3.5	5.0				
Howard gravelly loam, 0 to 3 percent slopes	16	24	80	120	60	100	50	70	60	80	3.5	5.0				
Howard gravelly loam, 3 to 8 percent slopes	16	24	80	120	60	100	50	70	60	80	3.5	5.0				
Howard gravelly loam, rolling	14	20	70	100	50	90	40	60	50	70	3.5	5.0				
Howard gravelly silt loam, 0 to 3 percent slopes	16	24	80	120	60	100	40	60	50	70	3.5	5.0				
Howard gravelly silt loam, 3 to 8 percent slopes	16	24	80	120	60	100	40	60	50	70	3.5	5.0				
Kendaia silt loam, 0 to 3 percent slopes	10	24	50	120	50	80	30	50	40	60		3.5	2.0	3.5	2.0	3.0
Kendaia silt loam, 3 to 8 percent slopes	10	24	50	120	50	80	30	50	40	60		3.5	2.0	3.5	2.0	3.0
Lairdsville silt loam, 2 to 6 percent slopes	10	20	50	100	50	80	50	70	40	60	3.0	4.0	2.5	3.5	2.0	3.0
Lairdsville silty clay loam, 6 to 12 percent slopes, eroded											2.5	3.5	2.0	3.0	2.0	3.0
Lakemont silty clay loam		20		100												3.0
Lamson very fine sandy loam	12	22	60	110											2.0	3.0
Lansing gravelly silt loam, 2 to 8 percent slopes	12	22	70	110	60	90	50	70	50	80	3.5	5.0	3.0	4.5		
Lansing gravelly silt loam, 8 to 15 percent slopes	14	20	70	100	60	90	50	70	60	80	3.5	5.0	3.0	4.5		
Lansing gravelly silt loam, rolling	12	18	60	90	60	90	40	60	60	80	3.5	5.0	3.0	4.5		
Lima silt loam, 0 to 3 percent slopes	12	24	60	120	60	90	30	50	40	60	3.5	4.5	3.0	4.0	2.5	3.0

TABLE 2.—*Estimated average yields per acre of principal field and forage crops under two levels of management—Continued*

Soil	Corn				Oats		Wheat		Barley		Forage mixtures (hay)					
	For silage		For grain								Alfalfa-grass		Alfalfa-birdsfoot trefoil-grass		Birdsfoot trefoil-grass	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Tons	*Tons*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*
Lima silt loam, 3 to 8 percent slopes	12	24	60	120	60	90	30	50	40	60	3.5	4.5	3.0	4.0	2.5	3.0
Lockport and Brockport silty clay loams, 0 to 6 percent slopes	8	18	40	90	40	70							2.5	3.5	2.0	3.0
Lordstown channery silt loam, sloping	8	18	50	80	50	70					2.5	3.5	2.0	3.0		
Lordstown-Arnot channery silt loams, moderately steep											2.0	3.0	2.0	3.0		
Lyons silt loam		22		110											1.5	2.5
Made land, chemical waste																
Madrid fine sandy loam, 2 to 8 percent slopes	15	24	75	120	60	100	50	70	60	80	3.5	5.0	3.0	4.5		
Madrid fine sandy loam, 8 to 15 percent slopes	14	22	70	110	60	100	50	70	60	80	3.5	5.0	3.0	4.5		
Madrid fine sandy loam, 8 to 15 percent slopes, eroded	12	20	60	100	50	80	40	60	50	70	3.0	4.5	2.5	3.5		
Madrid fine sandy loam, rolling	13	20	65	100	60	100	50	70	60	80	3.5	5.0	3.0	4.5		
Madrid gravelly loam, 2 to 8 percent slopes	14	22	70	110	60	100	50	70	60	80	3.5	5.0	3.0	4.5		
Madrid gravelly loam, 8 to 15 percent slopes	13	20	65	100	60	100	50	70	60	80	3.5	5.0	3.0	4.5		
Manheim silt loam, 0 to 3 percent slopes	14	24	70	120	50	80	30	50	40	60		3.5	3.0	4.0	2.5	3.0
Manheim silt loam, 3 to 8 percent slopes	14	24	70	120	50	80	30	50	40	60		3.5	3.0	4.0	2.5	3.0
Manlius shaly silt loam, 2 to 6 percent slopes	10	16	50	80	50	90					2.5	3.5	2.0	3.0		
Manlius shaly silt loam, 6 to 12 percent slopes	10	16	50	80	50	90					2.5	3.5	2.0	3.0		
Manlius shaly silt loam, 12 to 18 percent slopes	8	14	40	70	50	90					2.5	3.5	2.0	3.0		
Mardin channery silt loam, 2 to 8 percent slopes	8	18	50	80	50	80					2.5	3.5	2.0	3.0	1.5	2.5
Mardin channery silt loam, 8 to 15 percent slopes	8	18	50	80	50	80					2.5	3.5	2.0	3.0	1.5	2.5
Mardin channery silt loam, 15 to 25 percent slopes											2.5	3.5	2.0	3.0	1.5	2.5
Mardin soils, steep																
Mardin channery silt loam, moderately shallow variant, 2 to 6 percent slopes	8	18	50	80	50	80					2.5	3.5	2.0	3.0	1.5	2.5
Mardin channery silt loam, moderately shallow variant, 6 to 18 percent slopes	8	18	50	80	50	80					2.5	3.5	2.0	3.0	1.5	2.5
Martisco and Warners soils																
Minoa fine sandy loam, 0 to 2 percent slopes	10	22	50	110	40	80	30	50	40	60		3.5	2.0	3.5	2.0	3.0
Minoa fine sandy loam, 2 to 6 percent slopes	10	22	50	110	40	80	30	50	40	60		3.5	2.0	3.5	2.0	3.0
Mohawk silt loam, 2 to 8 percent slopes	16	24	80	120	60	100	50	70	50	80	3.5	5.0	3.0	4.5		
Mohawk silt loam, 8 to 15 percent slopes	14	22	70	110	60	100	50	70	60	80	3.5	5.0	3.0	4.5		
Mohawk silt loam, 15 to 25 percent slopes											3.0	4.5	2.5	4.0		
Naumburg loamy fine sand		18		90												
Niagara silt loam, 0 to 4 percent slopes	10	22	50	110	50	80	30	50	40	60		3.5	2.0	3.5	2.0	3.0
Odessa silty clay loam, 0 to 2 percent slopes	10	20	50	100	40	70							2.0	3.5	2.0	3.0
Odessa silty clay loam, 2 to 6 percent slopes	10	20	50	100	40	70							2.0	3.5	2.0	3.0
Ontario loam, 2 to 8 percent slopes	15	26	75	130	60	100	50	70	60	80	3.5	5.0	3.0	4.5		
Ontario gravelly loam, 8 to 15 percent slopes	14	22	70	110	60	100	50	70	60	80	3.5	5.0	3.0	4.5		
Ontario gravelly loam, 8 to 15 percent slopes, eroded	12	16	80	90	40	80	30	50	40	60	3.0	4.5	2.5	4.0		
Ontario gravelly loam, rolling	14	20	70	100	50	90	40	60	50	70	3.5	5.0	3.0	4.5		
Ontario and Madrid soils, 15 to 25 percent slopes											3.0	4.0	2.5	3.5		

TABLE 2.—*Estimated average yields per acre of principal field and forage crops under two levels of management—Continued*

Soil	Corn				Oats		Wheat		Barley		Forage mixtures (hay)					
	For silage		For grain								Alfalfa-grass		Alfalfa-birdsfoot trefoil-grass		Birdsfoot trefoil-grass	
	A *Tons*	B *Tons*	A *Bu*	B *Bu*	A *Bu*	B *Bu*	A *Bu*	B *Bu*	A *Bu*	B *Bu*	A *Tons*	B *Tons*	A *Tons*	B *Tons*	A *Tons*	B *Tons*
Otisville gravelly loamy fine sand, 0 to 8 percent slopes		14		70	40	70						4.0				
Otisville gravelly loamy fine sand, rolling												4.0				
Ovid silt loam, 0 to 3 percent slopes	10	20	50	100	40	70	30	50	40	70		3.5	2.0	3.5	2.0	3.0
Ovid silt loam, 3 to 8 percent slopes	10	20	50	100	40	70	30	50	40	70		3.5	2.0	3.5	2.0	3.0
Palatine shaly silt loam, 2 to 6 percent slopes	14	22	70	110	60	100	50	70	60	80	3.5	4.5				
Palatine shaly silt loam, 6 to 12 percent slopes	12	20	60	100	60	100	50	70	60	80	3.5	4.5				
Palms muck																
Palmyra gravelly loam, 0 to 3 percent slopes	16	24	80	120	60	100	50	70	50	80	3.5	5.0				
Palmyra gravelly loam, 3 to 8 percent slopes	16	22	80	120	60	100	50	70	60	80	3.5	5.0				
Palmyra gravelly loam, rolling	14	20	70	100	50	90	40	60	50	70	3.5	5.0				
Palmyra and Howard soils, hilly											2.5	3.5				
Palmyra and Howard soils, steep																
Palmyra and Howard soils, very steep																
Phelps gravelly loam, 0 to 3 percent slopes	12	24	60	120	50	90	40	60	50	70	3.5	4.5	3.0	4.0	2.5	3.0
Phelps gravelly loam, 3 to 8 percent slopes	12	24	60	120	50	90	40	60	50	70	3.5	4.5	3.0	4.0	2.5	3.0
Rhinebeck silt loam	10	20	50	100	40	70							2.0	3.5	2.0	3.0
Saprists and Fluvaquents, ponded																
Schoharie silt loam, 2 to 6 percent slopes	14	20	70	100	50	80	50	70	50	80	3.0	4.5	2.5	3.5	2.0	3.0
Schoharie silt loam, rolling	14	20	70	100	50	80	40	60	50	70	3.0	4.5	2.5	3.5	2.0	3.0
Schoharie silty clay loam, hilly											2.5	4.0	2.0	3.0	2.0	3.0
Schoharie soils, steep																
Teel silt loam	14	24	70	120	60	90							3.0	4.0	2.5	3.5
Urban land																
Varick silt loam		18		90											2.0	3.0
Volusia channery silt loam, 0 to 8 percent slopes	8	14			40	60								3.5	2.0	3.0
Volusia channery silt loam, 8 to 15 percent slopes	8	14			40	60								3.5	2.0	3.0
Volusia channery silt loam, moderately shallow variant, 0 to 6 percent slopes	8	14			40	60								3.5	2.0	3.0
Wampsville gravelly silt loam, 0 to 3 percent slopes	16	26	80	130	60	100	50	70	60	80	4.0	6.0	3.0	4.5		
Wampsville gravelly silt loam, 3 to 8 percent slopes	16	26	80	130	60	100	50	70	60	80	4.0	6.0	3.0	4.5		
Wampsville gravelly silt loam, rolling	14	20	70	100	50	90	40	60	50	70	3.5	5.0	3.0	4.5		
Wareham loamy fine sand	12	22	60	110											2.0	3.0
Wassaic silt loam, 0 to 8 percent slopes	14	22	70	110	60	100	50	70	60	80	3.5	4.5				
Wassaic silt loam, 8 to 15 percent slopes	12	20	60	100	50	90	50	70	60	80	3.5	4.5				
Wassaic-Benson silt loams, moderately steep											3.0	4.0				
Wayland silt loam																
Weaver silt loam	14	24	70	120	60	90							3.0	4.0	2.5	3.5
Williamson silt loam, 0 to 2 percent slopes	12	20	60	100	50	90	30	60	50	70	2.5	3.5	2.0	3.0	2.0	3.0
Williamson silt loam, 2 to 6 percent slopes	10	20	60	100	50	90	30	60	50	70	2.5	3.5	2.0	3.0	2.0	3.0
Williamson silt loam, rolling	10	18	50	90	50	90	30	60	50	70	2.5	3.5	2.0	3.0	2.0	3.0
Williamson silt loam, rolling, eroded	8	16	40	80							2.0	3.0	1.5	2.5	1.5	2.5

TABLE 3.—*Estimated average yields per acre of specified vegetable crops under two levels of management*

[Yields in columns A are those to be expected under average management; those in columns B, under improved management. Absence of yield figure indicates that the crop is not suited to the soil or is not grown]

Soil	Sweet corn		Cabbage				Snap beans		Cauliflower		Peppers		Squash		Tomatoes	
			For market		For kraut											
	A *Tons*	B *Tons*	A *Crates*[1]	B *Crates*	A *Tons*	B *Tons*	A *Bu*	B *Bu*	A *Crates*	B *Crates*	A *Bu*	B *Bu*	A *Tons*	B *Tons*	A *Tons*	B *Tons*
Alton gravelly fine sandy loam, 0 to 3 percent slopes	5.0	10.0	200	500			100	180	200	400		500	6	12		12
Alton gravelly fine sandy loam, 3 to 8 percent slopes	5.0	10.0	200	500			100	180	200	400		500	6	12		12
Alton gravelly fine sandy loam, rolling	4.0	8.0	150	300			80	120	150	300		400	5	10		9
Angola-Darien silt loams, 0 to 6 percent slopes																
Angola-Darien silt loams, 6 to 12 percent slopes																
Appleton loam, 0 to 3 percent slopes		10.0		500		25		200		400				20		10
Appleton channery silt loam, 0 to 3 percent slopes																
Appleton channery silt loam, 3 to 8 percent slopes																
Arkport very fine sandy loam, 2 to 6 percent slopes	5.0	10.0		375						400		400	5	12		8
Arkport very fine sandy loam, rolling	4.0	8.0		300						350		300	4	10		6
Arkport very fine sandy loam, hilly																
Arnot channery silt loam, gently sloping																
Arnot-Lordstown association, very steep																
Aurora silt loam, 0 to 6 percent slopes																
Aurora silt loam, 6 to 12 percent slopes																
Aurora silt loam, 12 to 18 percent slopes																
Aurora silt loam, 12 to 18 percent slopes, eroded																
Aurora-Farmington-Rock outcrop association, steep																
Benson silt loam, undulating																
Benson silt loam, rolling																
Benson-Wassaic-Rock outcrop association, sloping																
Benson-Wassaic-Rock outcrop association, very steep																
Bombay gravelly loam, 2 to 8 percent slopes	6.0	10.0	250	500	15	30	100	200	300	400			8	15	5	10
Camillus silt loam, 2 to 6 percent slopes																
Camillus silt loam, 6 to 12 percent slopes																
Camillus silt loam, 6 to 12 percent slopes, eroded																
Camillus silt loam, 12 to 18 percent slopes, eroded																
Camillus and Lairdsville shaly soils, steep																
Canandaigua mucky silt loam																
Carlisle muck																
Cazenovia silt loam, 2 to 8 percent slopes	5.0	8.0			15	30	100	150					12	20	8	10
Cazenovia silt loam, 8 to 15 percent slopes																
Cazenovia silt loam, 8 to 15 percent slopes, eroded																
Cazenovia soils, 15 to 25 percent slopes																
Collamer silt loam, 0 to 2 percent slopes	5.0	10.0	300	625	15	30	130	250	300	400	250	450	8	15	5	10
Collamer silt loam, 2 to 6 percent slopes	5.0	10.0	300	625	15	30	130	250	300	400	250	450	8	15	5	10
Colonie loamy fine sand, 0 to 6 percent slopes		5.5									150	350	4	10	4	8
Colonie loamy fine sand, rolling		5.0									100	250	3.5	8	4	8
Conesus gravelly silt loam, 0 to 3 percent slopes																

TABLE 3.—*Estimated average yields per acre of specified vegetable crops under two levels of management—Continued*

Soil	Sweet corn		Cabbage				Snap beans		Cauli-flower		Peppers		Squash		Tomatoes	
			For market		For kraut											
	A *Tons*	B *Tons*	A *Crates*[1]	B *Crates*	A *Tons*	B *Tons*	A *Bu*	B *Bu*	A *Crates*	B *Crates*	A *Bu*	B *Bu*	A *Tons*	B *Tons*	A *Tons*	B *Tons*
Conesus gravelly silt loam, 3 to 8 percent slopes																
Croghan loamy fine sand, 0 to 6 percent slopes																
Darien silt loam																
Dunkirk silt loam, rolling																
Edwards muck																
Farmington-Aurora association, sloping																
Fluvaquents, frequently flooded																
Fonda mucky silty clay loam																
Fredon loam																
Galen very fine sandy loam, 0 to 2 percent slopes	6.0	10.0	250	500	12	30	100	200	250	400			4	10	5	10
Galen very fine sandy loam, 2 to 6 percent slopes	6.0	10.0	250	500	12	30	100	200	250	400			4	10	5	10
Halsey mucky loam																
Hamlin silt loam	7.0	12.0	250	500	20	35	130	200	250	450			10	20	8	12
Hamlin silt loam, high bottom	7.0	12.0	250	500	20	35	130	200	250	450			10	20	8	12
Herkimer silt loam	6.0	10.0	200	500	20	30	150	200	250	400	300	500	10	20	6	12
Hilton loam, 0 to 3 percent slopes	6.0	10.0	250	500	15	30	100	200	300	400			8	15	5	10
Hilton loam, 3 to 8 percent slopes	6.0	10.0	250	500	15	30	100	200	300	400			8	15	5	10
Honeoye silt loam, 2 to 8 percent slopes	6.0	10.0	300	625	20	35	160	230	250	450			10	20	8	12
Honeoye silt loam, 8 to 15 percent slopes	4.0	8.0	250	500	15	30	130	200	200	400			8	15	6	10
Honeoye silt loam, rolling	3.5	6.0	150	300	10	25	80	150	170	350			6	12	5	8
Honeoye and Lansing gravelly silt loam, 15 to 25 percent slopes																
Honeoye very stony soils, sloping																
Honeoye, Lansing and Ontario soils, steep																
Honeoye, Lansing and Ontario soils, very steep																
Howard gravelly fine sandy loam, 0 to 3 percent slopes	5.0	10.0	200	500			100	180	200	400		500	6	12		12
Howard gravelly fine sandy loam, 3 to 8 percent slopes	5.0	10.0	200	500			100	180	200	400		500	6	12		12
Howard gravelly fine sandy loam, rolling	4.0	8.0	150	300			80	120	150	300		400	5	10		9
Howard gravelly loam, 0 to 3 percent slopes	6.0	10.0	200	500	20	30	100	180	200	400		500	6	12		12
Howard gravelly loam, 3 to 8 percent slopes	6.0	10.0	200	500	20	30	100	180	200	400		500	6	20		12
Howard gravelly loam, rolling	4.0	8.0	150	300	15	25	80	120	150	300		400	5	10		9
Howard gravelly silt loam, 0 to 3 percent slopes	7.0	10.0	200	500	20	30	150	200	250	400	300	500	10	20	6	12
Howard gravelly silt loam, 3 to 8 percent slopes	7.0	10.0	200	500	20	30	150	200	250	400	300	500	10	20	6	12
Kendaia silt loam, 0 to 3 percent slopes		10.0		500		25		200		400				20		10
Kendaia silt loam, 3 to 8 percent slopes		10.0		500		25		200		400				20		10
Lairdsville silt loam, 2 to 6 percent slopes	4.0	8.0	300	500	15	25										
Lairdsville silty clay loam, 6 to 12 percent slopes, eroded																
Lakemont silty clay loam																
Lamson very fine sandy loam		8.0		500				130		300		500		14		9
Lansing gravelly silt loam, 2 to 8 percent slopes																
Lansing gravelly silt loam, 8 to 15 percent slopes																
Lansing gravelly silt loam, rolling																
Lima silt loam, 0 to 3 percent slopes	7.0	10.0	300	625	20	35	160	230	250	450			10	20	8	12
Lima silt loam, 3 to 8 percent slopes	7.0	10.0	300	625	20	35	160	230	250	450			10	20	8	12
Lockport and Brockport silty clay loams, 0 to 6 percent slopes																
Lordstown channery silt loam, sloping																
Lordstown-Arnot channery silt loams, moderately steep																
Lyons silt loam																

TABLE 3.—*Estimated average yields per acre of specified vegetable crops under two levels of management—Continued*

Soil	Sweet corn		Cabbage				Snap beans		Cauliflower		Peppers		Squash		Tomatoes	
			For market		For kraut											
	A *Tons*	B *Tons*	A *Crates*[1]	B *Crates*	A *Tons*	B *Tons*	A *Bu*	B *Bu*	A *Crates*	B *Crates*	A *Bu*	B *Bu*	A *Tons*	B *Tons*	A *Tons*	B *Tons*
Made land, chemical waste																
Madrid fine sandy loam, 2 to 8 percent slopes	6.0	10.0	250	500	20	30	130	200	250	400		400	10	20	8	12
Madrid fine sandy loam, 8 to 15 percent slopes	5.0	8.0	200	450	15	25	100	180	200	300		300	8	15	6	10
Madrid fine sandy loam, 8 to 15 percent slopes, eroded																
Madrid fine sandy loam, rolling	4.0	6.0	150	375					150	250		250	6	12	4	8
Madrid gravelly loam, 2 to 8 percent slopes	6.0	10.0	250	500	20	30	130	200	250	400		400	10	20	8	12
Madrid gravelly loam, 8 to 15 percent slopes	5.0	8.0	200	450	15	25	100	180	200	300		300	8	15	6	10
Manheim silt loam, 0 to 3 percent slopes		10.0		450		25		150		300				15	6	10
Manheim silt loam, 3 to 8 percent slopes		10.0		450		25		150		300				15	6	10
Manlius shaly silt loam, 2 to 6 percent slopes																
Manlius shaly silt loam, 6 to 12 percent slopes																
Manlius shaly silt loam, 12 to 18 percent slopes																
Mardin channery silt loam, 2 to 8 percent slopes																
Mardin channery silt loam, 8 to 15 percent slopes																
Mardin channery silt loam, 15 to 25 percent slopes																
Mardin soils, steep																
Mardin channery silt loam, moderately shallow variant, 2 to 6 percent slopes																
Mardin channery silt loam, moderately shallow variant, 6 to 18 percent slopes																
Martisco and Warners soils																
Minoa fine sandy loam, 0 to 2 percent slopes		10.0		500		25		130		300		500		14		9
Minoa fine sandy loam, 2 to 6 percent slopes		10.0		500		25		130		300		500		14		9
Mohawk silt loam, 2 to 8 percent slopes	7.0	10.0	375	625	20	35	160	230	250	450			10	20	8	12
Mohawk silt loam, 8 to 15 percent slopes	5.0	8.0	250	500	15	30	130	200	200	400			8	15	6	10
Mohawk silt loam, 15 to 25 percent slopes																
Naumburg loamy fine sand																
Niagara silt loam, 0 to 4 percent slopes		10.0		625		30		250		400		450		15		10
Odessa silty clay loam, 0 to 2 percent slopes						20										
Odessa silty clay loam, 2 to 6 percent slopes						20										
Ontario loam, 2 to 8 percent slopes	7.0	10.0	300	625	20	35	160	230	250	450			10	20	8	12
Ontario gravelly loam, 8 to 15 percent slopes	5.0	8.0	250	500	15	30	130	200	200	400			8	15	6	10
Ontario gravelly loam, 8 to 15 percent slopes, eroded	3.5	6.0	150	300	10	25	80	150	170	350			6	12	5	8
Ontario gravelly loam, rolling	3.5	6.0	150	300	10	25	80	150	170	350			6	12	5	8
Ontario and Madrid soils, 15 to 25 percent slopes																
Otisville gravelly loamy fine sand, 0 to 8 percent slopes		8.0		375								400				
Otisville gravelly loamy fine sand, rolling																
Ovid silt loam, 0 to 3 percent slopes		8.0				25								8		
Ovid silt loam, 3 to 8 percent slopes		8.0				25								8		
Palatine shaly silt loam, 2 to 6 percent slopes	5.0	10.0	250	500	20	30	130	180	300	400	250	500	8	12	6	12
Palatine shaly silt loam, 6 to 12 percent slopes		8.0		375		20		150		300		400		10		10
Palms muck		12.0		500												

TABLE 3.—*Estimated average yields per acre of specified vegetable crops under two levels of management—Continued*

Soil	Sweet corn		Cabbage				Snap beans		Cauliflower		Peppers		Squash		Tomatoes	
			For market		For kraut											
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Tons	*Tons*	*Crates*[1]	*Crates*	*Tons*	*Tons*	*Bu*	*Bu*	*Crates*	*Crates*	*Bu*	*Bu*	*Tons*	*Tons*	*Tons*	*Tons*
Palmyra gravelly loam, 0 to 3 percent slopes	7.0	10.0	300	625	20	35	160	230	250	450	250	500	10	20	6	10
Palmyra gravelly loam, 3 to 8 percent slopes	7.0	10.0	300	625	20	35	160	230	250	450	250	500	10	20	6	10
Palmyra gravelly loam, rolling	4.0	8.0	250	500	15	25			200	350			8	15	4	8
Palmyra and Howard soils, hilly																
Palmyra and Howard soils, steep																
Palmyra and Howard soils, very steep																
Phelps gravelly loam, 0 to 3 percent slopes	7.0	10.0	250	500	20	35	160	230	250	450	200	400	10	20	6	10
Phelps gravelly loam, 3 to 8 percent slopes	7.0	10.0	250	500	20	35	160	230	250	450	200	400	10	20	6	10
Rhinebeck silt loam						20										
Saprists and Fluvaquents, ponded																
Schoharie silt loam, 2 to 6 percent slopes		6.0			15	30	100	150					8	15	6	10
Schoharie silt loam, rolling																
Schoharie silty clay loam, hilly																
Schoharie soils, steep																
Teel silt loam	7.0	12.0	250	500	20	35	160	230	250	450			10	20	8	12
Urban land																
Varick silt loam																
Volusia channery silt loam, 0 to 8 percent slopes																
Volusia channery silt loam, 8 to 15 percent slopes																
Volusia channery silt loam, moderately shallow variant, 0 to 6 percent slopes																
Wampsville gravelly silt loam, 0 to 3 percent slopes	7.0	10.0	300	625	20	35	160	230	250	450			10	20	8	12
Wampsville gravelly silt loam, 3 to 8 percent slopes	7.0	10.0	300	625	20	35	160	230	250	450			10	20	8	12
Wampsville gravelly silt loam, rolling																
Wareham loamy fine sand																
Wassaic silt loam, 0 to 8 percent slopes	5.0	8.0			15	30	130	200					12	20	8	12
Wassaic silt loam, 8 to 15 percent slopes	5.0	8.0			12	25	100	150					10	15	6	8
Wassaic-Benson silt loams, moderately steep																
Wayland silt loam																
Weaver silt loam	7.0	10.0	250	500	20	35	160	230	250	450			10	20	8	12
Williamson silt loam, 0 to 2 percent slopes	5.0	8.0		500			130	200		350				14		9
Williamson silt loam, 2 to 6 percent slopes	5.0	8.0		500			130	200		300				14		9
Williamson silt loam, rolling																
Williamson silt loam, rolling, eroded																

[1] One crate of cabbage weighs 80 pounds.

stores, and roadside markets. Only a few acres of the muck soils are used for dried or winter onions.

The drained muck land is mainly in three areas. The largest area consists of about 120 acres along the western edge of Cicero Swamp in the town of Cicero. Another 100 acres is along the southern edge of Peat Swamp in the town of Clay. An additional 50 acres is between Erie Boulevard, Interstate Highway 90, Thompson Road, and Midler Avenue. This area is gradually being encroached upon by fills for new buildings. The rest of the drained muck land is scattered throughout the northern part of the county.

Apple trees can be grown in many areas of the county. Apple trees need deep, well-drained soils for deep rooting. Highest production per acre is attained on soils where the root zone is deepest. As drainage is reduced or where root growth is limited, production decreases. Minimum available water capacity of soils used for orchard production is 3 inches or more in the root zone. Soils that have less than 3 inches of available water capacity need irrigation for best yields.

The climate in the county varies greatly because of differences in elevation. At higher elevations, apple trees bloom later, and cooler temperatures during the growing season makes harvesting about one week later than at lower elevations. Such late varieties of apples as Red Delicious or Golden Delicious need high temperatures during the growing season. These varieties may not produce high-quality fruit at elevations higher than 1,200 feet. Early varieties of apples

Figure 12.—Truck crops on Alton gravelly fine sandy loam, 0 to 3 percent slopes, in capability unit IIs–1. The crops need extra water for maximum yields. They are being grown under a high level of management.

Figure 13.—Harvesting lettuce and spinach on Carlisle muck on the western edge of Cicero Swamp.

grown at these elevations are picked one to two weeks later, and they may be too late for profitable markets.

Since the southern part of the county is colder in winter (below −15° F), hardy root stocks and varieties need to be used. Lowlands and valleys are subject to frosts in spring. These frost pockets need to be avoided when planting orchards. The less sloping parts of drumlins in the northern part of the county are excellent orchard sites because they have good air drainage. Areas that have slopes steeper than 15 percent are not suitable for orchards. Planning for orchards should match root stock with the soil, climate, variety, and available market.

Winter temperatures in the county are too cold for peaches, and they are borderline for plums, pears, and cherries. These can be grown only in those parts of the county that have the warmest temperatures, generally those below 1,000 feet. Cherries are best suited to coarse-textured, well-drained soils.

Use of the Soils for Woodland[5]

Commercial forest land makes up about 31 percent of Onondaga County, or about 161,700 acres (*11*). In the 19 towns in the county, the percentage of woodland in rural areas ranges from 11 percent in the towns of Marcellus and Skaneateles to about 41 percent in the town of Geddes (*8*). The percentage of these rural areas covered by woodland north of the Onondaga Limestone escarpment averages about 26 percent, and woodland coverage south of this escarpment averages about 15 percent (*8*) (fig. 14).

According to the Forest Service Resource Bulletin NE–20 (*11*), the acreages of the commercial forest types in the county are: elm-ash-red maple, in wetland areas, 67,200 acres (fig. 15); maple-beech-birch, 65,200 acres; aspen-birch, 8,800 acres; other softwoods, including those in plantations, 8,500 acres; oaks, 8,300 acres; and white or red pine, 3,700 acres.

Woodland suitability groups

The soils of Onondaga County have been placed in 21 woodland suitability groups to assist owners in planning the use of their soils for wood crops. Each group is made up of soils that are suited to the same kinds of trees, that need about the same management where the vegetation on them is similar, and that have the same potential productivity.

Figure 14.—Well-managed upland forest on Madrid fine sandy loam in woodland suitability group 2o1.

[5] MEREDITH A. PETERS, woodland conservationist, Soil Conservation Service, assisted in the preparation of this section.

Figure 15.—Typical elm-ash-red maple forest on Palms muck, woodland suitability group 5wl, in Cicero Swamp.

Table 4 lists the 21 woodland groups, provides a brief description of each group, and lists the soil series and map symbols for each group. It indicates the potential productivity, rates the management problems, and indicates the species to favor in existing stands and those to plant in each group. Land types that generally are not suitable as sites for commercial woodland have not been placed in woodland groups and are not in table 4. These land types are Fluvaquents, frequently flooded (FL); Made land, chemical waste (Ma); Rock outcrop parts of AXE, BNC, and BNF; Saprists and Fluvaquents, ponded (SA); and Urban land (Ub). Plantings for special use are successful in some areas of these land types if field examination reveals suitable conditions.

Each woodland suitability group is identified by a three-part symbol, such as 2o2, 3w1, or 4s1.

The first element of the group symbol indicates the woodland suitability class. It expresses site quality by an Arabic numeral ranging from 1 to 5; soils in class 1 have the highest potential productivity.

The second element in the symbol indicates the suitability subclass. It expresses selected soil properties that cause moderate to severe hazards or limitations in woodland use or management, by one of the following:

Subclass x (stoniness or rockiness). Soils that have restrictions or limitations for woodland use or management because of stones or rocks.

Subclass w (excessive wetness). Soils in which excessive water, either seasonally or yearround, causes significant limitations for woodland use or management. These soils have restricted drainage, a high water table, or a flooding hazard that adversely affects stand development or management.

Subclass d (restricted rooting depth). Soils that have restrictions or limitations for woodland use or management because of restricted rooting depth. Soils that are shallow to hard rock, to a hardpan, or to other layers that restrict roots are examples.

Subclass s (sandy soils). Sandy soils that have little or no textural B horizon and have moderate to severe restrictions or limitations for woodland use or management. These soils have limitations for use of equipment, have low available moisture capacity, and are normally low in available plant nutrients. Where these soils are in river bottoms, however, available moisture capacity generally is very favorable for tree growth.

Subclass r (relief or slope). Soils that have restrictions or limitations for woodland use or management because of slope.

Subclass o (slight or no limitations). Soils that have no significant restrictions or limitations for woodland use or management.

Some kinds of soil may have more than one set of subclass characteristics. Priority in placing each kind of soil in a subclass is in the order that the subclass characteristics are listed above.

The third element in the symbol indicates the differences in degree of hazards or limitations and the general suitability of the soils for certain kinds of trees.

In addition to a brief description of the soils in the group, table 4 gives an indicator species for each group and the estimated site index for that species. Site index is the height that the tree will attain at 50 years of age. Under management problems for each group, ratings are given for erosion hazard, equipment limitations, seedling mortality, plant competition, and windthrow hazard. The ratings are *slight*, *moderate*, or *severe*, according to the severity of the problems. Also given in the table is species suitability for the soils of each group, both for planting and to favor in existing stands.

The hazard of erosion is rated according to the risk of erosion of woodland where normal practices are used in managing and harvesting the trees. The hazard is *slight* if erosion control is not important. It is *moderate* if some attention must be given to check soil loss. It is *severe* if special treatment or special methods of operation are necessary to minimize erosion losses.

The ratings for equipment limitations are based on the degree to which the soils and topographic features restrict or prohibit the use of equipment commonly used in managing trees or in harvesting tree

TABLE 4.—*Suitability of the*

Woodland suitability groups	Potential productivity		Management problems	
	Indicator species	Estimated site index	Erosion hazard	Equipment limitations
Group 2o1: Deep and moderately deep, dominantly well drained or moderately well drained, level to sloping or rolling soils that are medium textured or moderately coarse textured. These soils formed in many kinds of material that range from water-sorted clay, silt, fine sand, and gravel outwash to glacial till. They are medium to high in content of lime. (Arkport: ArB, ArC, ArD; Aurora: AwB, AwC, Aurora part of FAC [Farmington part of FAC is in group 5d1]; Bombay: BoB; Camillus: CaB; Cazenovia: CfB, CfC, CfC2; Collamer: ChA, ChB; Conesus: CoA, CoB; Galen: GaA, GaB; Herkimer: He; Hilton: HlA, HlB; Honeoye: HnB, HnC, HnCK, HSC; Howard: HwA, HwB, HwC, HxA, HxB, HxC, HyA, HyB; Lairdsville: LaB; Lansing: LsB, LsC, LsCK; Lima: LtA, LtB; Madrid: MdB, MdC, MdC2, MdCK, MgB, MgC; Mohawk: MwB, MwC; Ontario: OgB, OnC, OnC2, OnCK; Palatine: PaB, PaC; Palmyra: PgA, PgB, PgC; Phelps: PpA, PpB; Schoharie: ScB; Wampsville: WaA, WaB, WaC; Wassaic: WcB, WcC.)	Sugar maple	65–70	Slight	Slight
Group 2o2: Deep, well drained and moderately well drained, level and nearly level, medium-textured soils that formed in recent alluvium. Frequency of flooding ranges from annually to as little as once in 10 years. These soils are medium to high in content of lime. (Hamlin: Hb, Hc; Teel: Te; Weaver: Wv.)	Sugar maple	65–70	Slight	Slight
Group 2r1: Deep and moderately deep, well drained and moderately well drained, sloping or rolling to moderately steep or hilly soils that are medium textured or moderately fine textured. They are highly erodible, and they formed in thin till deposits over shale bedrock or water-sorted silt and clay. These soils are medium to high in content of lime. (Camillus: Cac, Cac2; Dunkirk: DuC; Lairdsville: LbC2; Schoharie: ScC, SdD.)	Sugar maple	65–70	Moderate	Slight
Group 2r2: Deep and moderately deep, well drained or moderately well drained, moderately coarse textured soils that are moderately steep. These soils formed in glacial till. They are medium to high in content of lime. (Aurora: AwD, AwD2; Cazenovia: CgD; Honeoye and Lansing: HoD; Mohawk: MwD; Ontario and Madrid: OpD; Wassaic part of BNC and WDD, [Benson parts of BNC and WDD are in group 5d1].)	Sugar maple	65–70	Moderate	Moderate
Group 2r3: Deep and moderately deep, well drained or moderately well drained, moderately steep or hilly to steep soils that are medium textured or moderately fine textured. They are very erodible, and they formed in thin till deposits over shale bedrock or water-sorted silt and clay. These soils are medium to high in content of lime. (Camillus: CaD2; Schoharie: SEE.)	Sugar maple	65–70	Severe	Moderate
Group 2r4: Deep, well-drained to excessively drained, hilly soils that are medium textured or moderately coarse textured. These soils formed in gravelly glacial outwash. They are medium to high in content of lime. (Palmyra and Howard: PHD.)	Sugar maple	65–70	Slight	Moderate
Group 2r5: Deep and moderately deep, well-drained to excessively drained, steep and very steep soils that are medium textured or moderately coarse textured. They formed in glacial till or gravelly glacial outwash. These soils are medium to high in content of lime. (Aurora part of AXE [Farmington part of AXE is in Group 5x1]; Honeoye, Lansing and Ontario: HTE, HTF; Palmyra and Howard: PHE, PHF; Wassaic part of BNF [Benson part of BNF is in group 5x1].)	Sugar maple	65–70	Moderate	Severe
Group 3o1: Deep and moderately deep, moderately well drained to excessively drained, level to sloping or rolling soils that are medium textured or moderately coarse textured. They formed in water-sorted silt or gravelly outwash deposits or in glacial till. These soils are very low, low, or medium in content of lime. (Alton: AlA, AlB, AlC; Lordstown: LWC; Manlius: MnB, MnC; Mardin: MoB, MoC; Mardin moderately shallow variant: MrB, MrC; Williamson: WwA, WwB.)	Sugar maple	60–65	Slight	Slight

soils for woodland

Management problems—Continued				Species suitability—	
Seedling mortality	Plant competition		Windthrow hazard	To favor in stands	For planting
	Hardwoods	Conifers			
Slight	Moderate	Severe	Slight	Sugar maple, white ash, basswood, white pine, hemlock, yellow birch, black cherry, red oak.	White pine, Norway spruce, white spruce, larches, black walnut, yellow-poplar, black locust.
Slight	Moderate	Severe	Slight	Sugar maple, white pine, white ash, basswood; red oak, northern white cedar, white oak.	White pine, Norway spruce, black walnut, larches, yellow-poplar.
Slight	Moderate	Severe	Slight	Sugar maple, white pine, basswood, white ash, black cherry, red oak.	White pine, Norway spruce, white spruce, larches, black locust, black walnut, yellow-poplar.
Slight	Moderate	Severe	Slight	Sugar maple, white pine, red oak, black cherry; white ash, basswood, northern white cedar, hemlock.	White spruce, Norway spruce, larches, white pine, black walnut, yellow-poplar.
Slight	Moderate	Severe	Slight	Sugar maple, basswood, white ash, black walnut, red oak, black cherry, northern white cedar.	White pine, black walnut, yellow-poplar, white spruce, Norway spruce.
Slight	Moderate	Severe	Slight	Sugar maple, white pine, red oak, hemlock, black cherry.	White pine, larches, black walnut.
Slight	Moderate	Severe	Slight	Sugar maple, white pine, red oak, hemlock, basswood, black cherry, white ash.	White pine, larches, black locust, black walnut.
Slight	Slight	Moderate	Slight	Sugar maple, basswood, white ash, red oak, black cherry, hemlock.	White pine, Norway spruce, white spruce, larches, black locust.

TABLE 4.—*Suitability of the*

Woodland suitability groups	Potential productivity		Management problems	
	Indicator species	Estimated site index	Erosion hazard	Equipment limitations
Group 3r1: Deep, moderately well drained, sloping soils that are medium textured. They are very erodible and they formed in water-sorted silt deposits. These soils are low or very low in content of lime. (Williamson: WwC, WwC2.)	Sugar maple	60–65	Moderate	Slight
Group 3r2: Dominantly deep and moderately deep, moderately well drained to excessively drained, moderately steep soils that are medium textured. Arnot soils in Unit LXD are shallow. These soils formed in glacial till. They are low or very low in content of lime. (Lordstown part of LXD [Arnot part of LXD in group 4d1]; Manlius: MnD; Mardin: MoD.)	Sugar maple	60–65	Slight	Moderate
Group 3r3: Moderately deep, well drained or moderately well drained, steep and very steep soils that are medium textured and moderately fine textured. They are very erodible, and they formed in thin till deposits over shale bedrock. These soils are medium to high in content of lime. (Camillus and Lairdsville: CBE.)	Sugar maple	60–65	Severe	Severe
Group 3r4: Deep and moderately deep, well-drained, steep and very steep soils that are medium textured. These soils formed in glacial till. They are low or very low in content of lime. (Lordstown part of AVF [Arnot part of AVF in group 4x1]; Mardin: MPE.)	Sugar maple	60–65	Moderate	Severe
Group 3w1: Deep and moderately deep, dominantly somewhat poorly drained, level to sloping soils that are medium textured, moderately fine textured, or moderately coarse textured. These soils formed in glacial till, gravelly outwash, and lake-deposited clay, silt, and fine sand. They are medium to high in content of lime. (Angola-Darien: AnB, AnC; Appleton: AoA, ApA, ApB; Darien: Da; Fredon: Fr; Kendaia: KeA, KeB; Lockport and Brockport: LvB; Manheim: MhA, MhB; Minoa: MtA, MtB; Niagara: NgA; Odessa: OdA, OdB; Ovid: OvA, OvB; Rhinebeck: Rh.)	Sugar maple	60–65	Slight	Moderate
Group 3w2: Deep and moderately deep, somewhat poorly drained, level to sloping soils that are medium textured. They have a dense, very slowly permeable fragipan at a depth of 10 to 16 inches that restricts rooting depth and water movement. These soils formed in glacial till. They are low or very low in content of lime. (Volusia: VoB, VoC; Volusia, moderately shallow variant: VuB.)	Sugar maple	60–65	Slight	Moderate
Group 4d1: Shallow, well drained and moderately well drained, level to moderately steep soils that are medium textured. They formed in thin till deposits 10 to 20 inches thick over hard bedrock, and they have few to common rock outcrops and ledges. These soils are very low in content of lime. (Arnot: ATB; Arnot part of LXD [Lordstown part of LXD in group 3r2].)	Sugar maple	50–60	Slight	Slight
Group 4s1: Deep, moderately well drained to excessively drained, level to sloping or rolling, coarse-textured soils. They formed in water- or wind-deposited fine sand or gravelly glacial outwash. These soils are low or very low in content of lime. (Colonie: ClB, ClC; Croghan: CrB; Otisville: OtB, OtC.)	White pine	60–70	Slight	Slight
Group 4w1: Deep, level and nearly level, very poorly drained to somewhat poorly drained, coarse-textured soils, and deep and moderately deep, poorly drained to very poorly drained, medium-textured soils. They formed in water-sorted fine sand or silt or in glacial till. These soils are low to high in content of lime. (Canandaigua: Cd; Lamson: Lm; Lyons: Ly; Naumburg: Na; Varick: Va; Wareham: Wb; Wayland: Wn.)	Red maple	60–70	Slight	Severe
Group 4x1: Shallow, well-drained, steep and very steep soils that are medium textured. They formed in thin till deposits over hard bedrock, and they have common rock outcrops and ledges. These soils are very low in content of lime. (Arnot part of AVF [Lordstown part of AVF in group 3r4].)	Sugar maple	50–60	Moderate	Severe

soils for woodland—Continued

Management problems—Continued				Species suitability—	
Seedling mortality	Plant competition		Windthrow hazard	To favor in stands	For planting
	Hardwoods	Conifers			
Slight	Slight	Moderate	Slight	Sugar maple, white pine, black cherry, yellow birch, black birch, red oak, hemlock.	White pine, red pine, Norway spruce, white spruce, larches.
Slight	Slight	Moderate	Slight	Sugar maple, white pine, red oak, white ash, black cherry, hemlock.	White pine, red pine, Norway spruce, larches, white spruce.
Moderate	Slight	Moderate	Slight	Sugar maple, red oak, white ash, white pine, basswood, hemlock, black cherry.	White pine, white spruce, Norway spruce, larches, black locust.
Slight	Slight	Moderate	Slight	Sugar maple, white pine, red pine, white ash, black cherry, hemlock, red oak.	White pine, red pine, white spruce, larches, Norway spruce.
Moderate	Moderate	Severe	Moderate	Sugar maple, white pine, red oak, white ash, basswood, hemlock, northern white cedar, black cherry.	White pine, Norway spruce, white spruce
Severe	Moderate	Severe	Moderate	Sugar maple, white ash, red oak, black cherry, hemlock.	White pine, white spruce, Norway spruce, larches.
Moderate	Slight	Moderate	Moderate	Sugar maple, white pine, red oak, hemlock, white ash, black cherry.	White pine, red pine, larches, Norway spruce, white spruce.
Moderate	Slight	Slight	Slight	White pine, red oak, sugar maple, black cherry.	White pine, larches, red pine.
Severe	Severe	Severe	Severe	Red maple, white pine, northern white cedar, hemlock; swamp white oak, swamp chestnut oak, black ash.	White pine, white spruce (unplantable in places).
Moderate	Slight	Moderate	Moderate	Sugar maple, red oak, white pine, hemlock, white ash, black cherry.	White pine, red pine, larches.

TABLE 4.—*Suitability of the*

Woodland suitability groups	Potential productivity		Management problems	
	Indicator species	Estimated site index	Erosion hazard	Equipment limitations
Group 5d1: Shallow, well-drained to excessively drained, level to moderately steep soils that are medium textured. These soils formed in thin till deposits over bedrock, and they have common to many rock outcrops and ledges. They are medium to high in content of lime. (Benson: BeB, BeC; Benson parts of BNC and WDD [Wassaic parts of BNC and WDD are in group 2r2]; Farmington part of FAC [Aurora part of FAC is in group 2o1].)	Sugar maple	45–55	Slight	Slight
Group 5w1: Deep, level and nearly level, very poorly drained organic soils, and poorly drained and very poorly drained mineral soils that are medium textured or moderately fine textured. They formed in water-sorted silt or clay, gravelly outwash or glacial till. These soils are medium to high in content of lime. (Carlisle: Ce; Edwards: Ed; Fonda: Fo; Halsey: Ha; Lakemont: Lk; Martisco and Warners: Ms; Palms: Pb.)	Red maple	50–60	Slight	Severe
Group 5x1: Dominantly shallow, moderately well drained to excessively drained, steep and very steep soils that are medium textured. They formed in thin till deposits over limestone, and they have numerous rock outcrops. These soils are medium to high in content of lime. (Benson part of BNF [Wassaic part of BNF is in group 2r5]; Farmington part of AXE [Aurora part of AXE is in group 2r5].)	Sugar maple	45–55	Moderate	Severe

crops. The limitation is *slight* if there is little or no restriction on the kind of equipment used. It is *moderate* if the use of equipment is seasonally limited or if modified equipment or methods of harvesting are needed. The limitation is *severe* if special equipment is needed or if the use of such equipment is severely restricted by one or more unfavorable soil characteristics. Limitations on the use of equipment are affected by the degree of slopes, height of the water table, rockiness, and soil texture.

Seedling mortality refers to the expected degree of mortality of naturally occurring or planted seedlings, as influenced by soil texture, depth, drainage, flooding, height of the water table, and degree of erosion. Normal rainfall, good planting stock, and proper planting methods are assumed. Mortality is *slight* if the expected loss is less than 25 percent, *moderate* if it is 25 to 50 percent, or *severe* if it is more than 50 percent.

Plant competition refers to the invasion or growth of unwanted trees, shrubs, vines, or other plants when openings are made in the canopy. Competition is *slight* if it does not hinder the establishment of a desirable stand for trees. It is *moderate* if competing plants delay the establishment of a desirable stand unless intensive cultural measures are applied. It is *severe* if competition prevents adequate natural or artificial regeneration without intensive site preparation and maintenance treatment, such as weeding. Some soil properties that affect plant competition are available moisture capacity, degree of erosion, and drainage.

Windthrow hazard depends on the development of tree roots and the capacity of the soils to hold trees firmly against the wind. The hazard is *slight* if windthrow is not a problem. It is *moderate* if roots hold the trees firmly, except when the soil is excessively wet or when the wind is strongest. It is *severe* if many trees are expected to be blown over because their roots do not provide enough stability.

Wildlife[6]

Wildlife is an important resource in Onondaga County. That part of the county in the Lake Plains Region and on the Allegheny Plateau has good populations of ring-necked pheasant, cottontail rabbit, woodcock, white-tailed deer, ruffed grouse, gray squirrel, and songbirds. Larger populations of deer, grouse, squirrel, and even a few snowshoe hares are in the southern Allegheny Plateau Region.

The kind and number of wildlife that live in a given area are closely related to land use; to the resulting kinds, amounts, and patterns of vegetation; and to the supply and distribution of water. These, in turn, are generally related to the soils.

Wildlife habitat generally can be created or improved by planting suitable vegetation, by properly managing the existing plant cover, by fostering the natural establishment of desirable plants, or by using a combination of these measures.

In table 5, the soils of the county are rated according to their suitability for seven elements of wildlife habitat: grain and seed crops, domestic grasses and legumes, wild herbaceous plants, hardwood plants, coniferous plants, wetland plants, and shallow-water areas. Also, the soils are rated for three general classes of wildlife habitat: open land, woodland, and wetland.

Not considered in the ratings are present land use,

[6] By ROBERT E. MYERS, wildlife biologist, Soil Conservation Service, Syracuse, New York.

soils for woodland—Continued

Management problems—Continued				Species suitability—	
Seedling mortality	Plant competition		Windthrow hazard	To favor in stands	For planting
	Hardwoods	Conifers			
Severe	Slight	Slight	Moderate	White pine, red oak, hemlock, sugar maple, white ash, hickories, black cherry, basswood.	White pine, larches, Norway spruce, black locust.
Severe	Severe	Severe	Severe	Red maple, white cedar, black ash, swamp white oak, swamp chestnut oak.	Generally unplantable.
Severe	Slight	Slight	Moderate	Sugar maple, white pine, white ash, hickories, red oak, hemlock, black cherry, basswood.	White pine, larches.

the location of a soil in relation to other soils, and the mobility of wildlife.

On soils rated *good*, habitat is generally easily created, improved, or maintained. There are few or no soil limitations in habitat management, and satisfactory results are well assured.

On soils rated *fair*, habitat generally can be created, improved, or maintained, but the soils have moderate limitations that affect the creation, improvement, or maintenance of the habitat. A moderate intensity of management and fairly frequent attention are required in places to assure satisfactory results.

On soils rated *poor*, habitat can generally be created, improved, or maintainted, but soil limitations are rather severe. Habitat management can be difficult, expensive, and require intensive effort. Satisfactory results are questionable.

On soils rated *very poor*, it is impractical to create, improve, or maintain habitat because of the very severe soil limitations. Unsatisfactory results are probable.

The suitability ratings in this subsection can be used as an aid in:

1. Planning the broad use of parks, refuges, nature-study areas, and other recreational developments for wildlife.
2. Selecting the better soils for creating, improving, or maintaining specific kinds of wildlife habitat elements.
3. Determining the relative intensity of management needed for individual habitat elements.
4. Avoiding sites that would be difficult or impractical to manage for specific kinds of wildlife.
5. Determining areas that are suitable for acquisition for use as wildlife habitat.

Elements of wildlife habitat

Each soil is rated in table 5 according to its suitability for various kinds of plants and other elements that make up wildlife habitat. The seven elements and soil properties which are considered important are as follows:

Grain and seed crops are such seed-producing annuals as corn, sorghum, wheat, barley, oats, millet, buckwheat, and sunflowers. These are planted mainly to provide food for upland wildife, but they can be planted for wetland wildlife. Soils well suited for these plants and that have a rating of *good* are deep, nearly level or gently sloping, medium textured, well drained or moderately well drained, and are free or nearly free of stones. They also have high available water capacity and are not subject to frequent flooding. These soils can be safely planted to a wide variety of grain crops each year. Soils that are not so well suited require more intensive management and are suited to fewer crops.

Domestic grasses and legumes are established by planting to provide food and cover for wildlife. Among these are alfalfa, trefoil, clover, bluegrass, switchgrass, fescue, brome, timothy, orchardgrass, and reed canarygrass. Soils that are rated *good* have slopes of 0 to 15 percent, are well drained, moderately well drained, or somewhat poorly drained, and have moderately high or high available water capacity. An adequate stand of a wide variety of plants can be easily maintained on these soils for nearly 10 years without renovation. Occasional flooding and surface stones are not of serious concern because the soils are seldom tilled.

Wild herbaceous plants are perennial grasses and

TABLE 5.—*Ratings of the soils*

[A rating of good means that limitations are slight, fair that limitations are moderate, and poor that limitations are severe; a rating determination of

Soil series and map symbols	Elements of wildlife habitat			
	Grain and seed crops	Domestic grasses and legumes	Wild herbaceous plants	Hardwood plants
Alton: AlA, AlB, AlC	Poor	Fair	Fair	Fair
Angola:				
AnB	Fair	Good	Good	Good
AnC	Fair	Good	Good	Good
Appleton:				
AoA, ApA	Fair	Good	Good	Good
ApB	Fair	Good	Good	Good
Arkport:				
ArB	Good	Good	Good	Good
ArC	Fair	Good	Good	Good
ArD	Poor	Fair	Good	Good
Arnot: ATB, AVF	Very poor	Poor	Poor	Very poor
For Lordstown part of AVF, see Lordstown series, unit LXD.				
Aurora:				
AwB	Fair	Good	Good	Good
AwC	Fair	Good	Good	Good
AwD, AwD2	Poor	Fair	Good	Good
AXE	Very poor	Poor	Good	Good
For Farmington part of AXE, see Farmington series.				
Benson:				
BeB, BeC	Poor	Poor	Fair	Poor
BNC, BNF	Very poor	Poor	Fair	Poor
For Wassaic part of BNC and BNF, see Wassaic series, unit WDD.				
Bombay: BoB	Good	Good	Good	Good
Brockport:				
Mapped only in undifferentiated units with Lockport soils. See the Lockport series for interpretations.				
Camillus:				
CaB	Fair	Good	Good	Good
CaC	Fair	Good	Good	Good
CaC2, CaD2	Poor	Fair	Good	Good
CBE	Very poor	Very poor	Good	Good
Canandaigua: Cd	Very poor	Poor	Poor	Poor
Carlisle: Ce	Very poor	Poor	Poor	Poor
Cazenovia:				
CfB	Good	Good	Good	Good
CfC	Fair	Good	Good	Good
CfC2, CgD	Poor	Fair	Good	Good
Collamer:				
ChA	Good	Good	Good	Good
ChB	Good	Good	Good	Good
Colonie: ClB, ClC	Poor	Fair	Fair	Fair
Conesus:				
CoA	Good	Good	Good	Good
CoB	Good	Good	Good	Good
Croghan: CrB	Poor	Fair	Fair	Fair
Darien: Da	Fair	Good	Good	Good
Dunkirk: DuC	Fair	Good	Good	Good
Edwards: Ed	Very poor	Poor	Poor	Poor
Farmington: FAC	Poor	Poor	Fair	Poor
For Aurora part of FAC, see Aurora series.				
Fluvaquents: FL.				
Onsite investigation needed.				
Fonda: Fo	Very poor	Poor	Poor	Poor
Fredon: Fr	Poor	Fair	Good	Fair
Galen:				
GaA	Good	Good	Good	Good
GaB	Good	Good	Good	Good
Halsey: Ha	Very poor	Poor	Poor	Poor
Hamlin: Hb, Hc	Good	Good	Good	Good
Herkimer: He	Good	Good	Good	Good

for wildlife

of very poor means that it is impractical to attempt to improve, maintain, or create habitat. Absence of entry indicates that onsite suitability is needed]

Elements of wildlife habitat—Continued			Classes of wildlife habitat		
Coniferous plants	Wetland plants	Shallow-water areas[1]	Open land	Woodland	Wetland
Fair	Very poor	Very poor	Fair	Fair	Very poor.
Good	Poor	Poor	Good	Good	Poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Very poor	Very poor	Very poor	Very poor	Poor	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Poor	Good	Good	Poor	Poor	Good.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Fair	Very poor	Very poor	Fair	Fair	Very poor.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Fair	Poor	Very poor	Fair	Fair	Very poor.
Good	Fair	Fair	Good	Fair	Fair.
Good	Very poor	Very poor	Good	Good	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Fair	Good	Poor	Fair	Fair	Fair.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.

TABLE 5.—*Ratings of the soils*

Soil series and map symbols	Elements of wildlife habitat			
	Grain and seed crops	Domestic grasses and legumes	Wild herbaceous plants	Hardwood plants
Hilton:				
HlA	Good	Good	Good	Good
HlB	Good	Good	Good	Good
Honeoye:				
HnB	Good	Good	Good	Good
HnC, HnCK	Fair	Good	Good	Good
HoD	Poor	Fair	Good	Good
HSC, HTF	Very poor	Poor	Good	Good
HTE	Very poor	Fair	Good	Good
Howard: HwA, HwB, HwC, HxA, HxB, HxC, HyA, HyB.	Fair	Good	Good	Good
Kendaia:				
KeA	Fair	Good	Good	Good
KeB	Fair	Good	Good	Good
Lairdsville:				
LaB	Fair	Good	Good	Good
LbC2	Fair	Fair	Good	Good
Lakemont: Lk	Poor	Fair	Fair	Fair
Lamson: Lm	Very poor	Poor	Poor	Poor
Lansing:				
LsB	Good	Good	Good	Good
LsC, LsCK	Fair	Good	Good	Good
Lima:				
LtA	Good	Good	Good	Good
LtB	Good	Good	Good	Good
Lockport: LvB	Fair	Good	Good	Good
Lordstown:				
LWC	Fair	Good	Good	Fair
LXD	Poor	Fair	Good	Fair
For Arnot part of LXD, see Arnot series.				
Lyons: Ly	Very poor	Poor	Poor	Poor
Made land, chemical waste: Ma. Onsite investigation needed.				
Madrid:				
MdB, MgB	Good	Good	Good	Good
MdC, MdC2, MdCK, MbC	Fair	Good	Good	Good
Manheim:				
MhA	Fair	Good	Good	Good
MhB	Fair	Good	Good	Good
Manlius:				
MnB, MnC	Fair	Good	Good	Fair
MnD	Poor	Fair	Good	Fair
Mardin:				
MoB	Fair	Good	Good	Fair
MoC	Fair	Good	Good	Fair
MoD	Poor	Fair	Good	Fair
MPE	Very poor	Poor	Good	Fair
Mardin, moderately shallow variant:				
MrB	Fair	Good	Good	Fair
MrC	Fair	Good	Good	Fair
Martisco: Ms	Very poor	Poor	Poor	Poor
Minoa:				
MtA	Fair	Good	Good	Good
MtB	Fair	Good	Good	Good
Mohawk:				
MwB	Good	Good	Good	Good
MwC	Fair	Good	Good	Good
MwD	Poor	Fair	Good	Good
Naumburg: Na	Poor	Fair	Fair	Fair
Niagara: NgA	Fair	Good	Good	Good
Odessa:				
OdA	Fair	Good	Good	Good
OdB	Fair	Good	Good	Good
Ontario:				
OgB	Good	Good	Good	Good
OnC	Fair	Good	Good	Good
OnC2, OnCK	Fair	Good	Good	Good
OpD	Poor	Fair	Good	Good
Otisville: OtB, OtC	Poor	Fair	Fair	Poor
Ovid:				
OvA	Fair	Good	Good	Good
OvB	Fair	Good	Good	Good
Palatine:				
PaB	Fair	Good	Good	Fair
PaC	Fair	Good	Good	Fair

for wildlife—Continued

Elements of wildlife habitat—Continued			Classes of wildlife habitat		
Coniferous plants	Wetland plants	Shallow-water areas[1]	Open land	Woodland	Wetland
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Fair	Good	Very poor.
Fair	Good	Good	Fair	Fair	Good.
Poor	Good	Fair	Poor	Poor	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Fair	Very poor.
Fair	Very poor	Very poor	Good	Fair	Very poor.
Fair	Very poor	Very poor	Fair	Fair	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Fair	Very poor	Very poor	Fair	Fair	Very poor.
Fair	Very poor	Very poor	Fair	Fair	Very poor.
Fair	Poor	Very poor	Good	Fair	Very poor.
Fair	Very poor	Very poor	Good	Fair	Very poor.
Fair	Very poor	Very poor	Fair	Fair	Very poor.
Fair	Very poor	Very poor	Poor	Fair	Very poor.
Fair	Poor	Very poor	Good	Fair	Very poor.
Fair	Very poor	Very poor	Good	Fair	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Fair	Fair	Very poor	Fair	Fair	Very poor.
Good	Fair	Fair	Good	Good	Fair.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Fair	Very poor	Very poor	Good	Fair	Very poor.
Fair	Very poor	Very poor	Good	Fair	Very poor.

TABLE 5.—*Ratings of the soils*

Soil series and map symbols	Elements of wildlife habitat			
	Grain and seed crops	Domestic grasses and legumes	Wild herbaceous plants	Hardwood plants
Palms: Pb	Very poor	Poor	Poor	Poor
Palmyra:				
PgA, PgB, PgC	Fair	Good	Good	Good
PHD	Poor	Fair	Fair	Fair
PHE, PHF	Very poor	Poor	Fair	Fair
Phelps: PpA, PpB	Good	Good	Good	Good
Rhinebeck: Rh	Fair	Good	Good	Good
Saprists and Fluvaquents, ponded: SA.	Very poor	Very poor	Very poor	Very poor
Schoharie:				
ScB	Good	Good	Good	Good
ScC	Fair	Good	Good	Good
SdD	Poor	Fair	Good	Good
SEE	Very poor	Poor	Good	Good
Teel: Te	Good	Good	Good	Good
Urban land: Ub. Onsite investigation needed.				
Varick: Va	Poor	Fair	Fair	Fair
Volusia:				
VoB	Poor	Fair	Fair	Fair
VoC	Poor	Fair	Fair	Fair
Volusia, moderately shallow variant: VuB.	Poor	Fair	Fair	Fair
Wampsville:				
WaA, WaB	Good	Good	Good	Good
WaC	Fair	Good	Good	Good
Wareham: Wb	Poor	Fair	Fair	Good
Warners: Mapped only in an undifferentiated unit with Martisco soils. See the Martisco series for interpretations.				
Wassaic:				
WcB	Fair	Good	Good	Good
WcC	Fair	Good	Good	Good
WDD	Poor	Fair	Good	Good
For Benson part of WDD, see Benson series, units BNC and BNF.				
Wayland: Wn	Very poor	Poor	Poor	Poor
Weaver: Wv	Fair	Good	Good	Good
Williamson:				
WwA	Fair	Good	Good	Good
WwB	Fair	Good	Good	Good
WwC	Fair	Good	Good	Good
WwC2	Poor	Fair	Good	Good

[1] Detailed investigation is needed at the site of a proposed shallow water development to determine feasibility. Table 8 in the section

for wildlife—Continued.

Elements of wildlife habitat—Continued			Classes of wildlife habitat		
Coniferous plants	Wetland plants	Shallow-water areas[1]	Open land	Woodland	Wetland
Poor	Good	Good	Poor	Poor	Good.
Good	Very poor	Very poor	Good	Good	Very poor.
Fair	Very poor	Very poor	Fair	Fair	Very poor.
Fair	Very poor	Very poor	Poor	Fair	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Fair	Fair	Good	Good	Fair.
Very poor	Good	Good	Very poor	Very poor	Good.
Good	Poor	Very poor	Good	Good	Very poor
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor
Good	Fair	Poor	Good	Good	Poor.
Fair	Good	Fair	Fair	Fair	Fair.
Fair	Poor	Very poor	Fair	Fair	Very poor.
Fair	Very poor	Very poor	Fair	Fair	Very poor.
Fair	Poor	Very poor	Fair	Fair	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Fair	Fair	Poor	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.

"Engineering Uses of the Soils" lists the soil features that affect the construction of the reservoir area and pond embankments.

Figure 16.—Border of shrubs along edge of woods prevents encroachment of woods on open land and provides food and cover for wildlife.

weeds that generally are established naturally. They include bluestem, quackgrass, panicgrass, goldenrod, wild carrot, nightshade, and dandelion. They mainly provide food and cover for upland wildlife. Soils that are well suited to these plants and that have a rating of *good* vary widely in texture, drainage, and slope. They are well drained to somewhat poorly drained. Slope is not a limiting factor. Stoniness and occasional flooding are not of serious concern.

Hardwood plants are nonconiferous trees, shrubs, and woody vines that produce nuts or other fruits, buds, catkins, twigs, or foliage that wildlife eat. These plants also serve as cover for wildlife (fig. 16). They are generally established naturally, but they can be planted. Among the native species are oak, beech, cherry, maple, birch, poplar, apple, hawthorn, dogwood, viburnum, grape, and briers. Soils rated *good* for these plants are deep or moderately deep, medium textured or moderately fine textured, and well drained to somewhat poorly drained. Slopes and surface stoniness are of little significance.

Also in this group are several varieties of fruiting shrubs that are raised commercially for planting. Among the shrubs that can be grown on soils rated *good* are autumn-olive, Amur honeysuckle, Tatarian honeysuckle, crabapple, multiflora rose, highbush cranberry, and silky dogwood. In addition, highbush cranberry, silky dogwood, and other shrubs that have similar site requirements can be planted on soils that have a rating of *fair*. Hardwoods that are not available commercially can commonly be transplanted successfully.

Coniferous plants are cone-bearing evergreen trees and shrubs that are used by wildlife mainly as cover, although some provide browse and seeds. Among these are Norway spruce, white pine, white-cedar, and hemlock. It is important that living branches are maintained close to the ground so that food and cover are readily available to rabbit, pheasant, and other small animals. The lower branches die if the trees form a dense canopy that shuts out sunlight.

Soils that are rated good are those on which conifers grow at a moderate to rapid rate. These are the deeper soils that are well drained, moderately well drained, or somewhat poorly drained and that have high available water capacity. Cover is easier and

quicker to establish on these soils than on less well suited soils. More management, however, is required to eliminate invading hardwoods, and stands have to be thinned more frequently or planted at a wider spacing to prevent canopy closure.

On soils rated poor, canopy closure is retarded because of slow tree growth. Seedling mortality is high, and a long time is needed until conifers are of adequate size to provide effective cover.

Wetland plants are wild, herbaceous, emergent annual and perennial plants that grow on moist to wet sites, exclusive of submerged or floating aquatics. They produce food and cover used mainly by wetland forms of wildlife. They include smartweed, wild millet, bulrush, sedges, barnyardgrass, duckmillet, arrowarum, pickeralweed, wetland grasses, wildrice, and cattails.

Soils that have a rating of *good* are nearly level and are poorly drained or very poorly drained. Soils that have a rating of *fair* are nearly level and somewhat poorly drained. Depth, stoniness, and texture of the surface layer are of little concern.

Shallow-water areas are open water that is essential for waterfowl courtship, mating, and brood rearing. It is also essential for other kinds of wildlife associated with wetlands. Many upland types of wildlife, including deer, use these areas as a source of drinking water.

Shallow-water areas (fig. 17) are natural wet areas, beaver ponds, or natural muskrat marshes. They are also manmade impoundments created by the construction of low dikes that impound a shallow body of water, commonly called a marsh, or by the excavation or blasting of potholes and level ditches. Water supply for these impoundments is either surface runoff or a high ground water table, or a combination of the two.

Deep-water farm ponds are not considered in rating this habitat element.

Detailed field investigation is needed to determine feasibility of constructing water impoundments.

Table 8 in the section "Engineering Uses of the Soils" shows some of the limitations of the soil for use in reservoir areas and as embankments for ponds.

Soils rated *good* for natural or artificial impoundments are those that depend mainly on surface runoff. They are level or nearly level and deep soils that are poorly drained or very poorly drained and are slowly permeable to very slowly permeable.

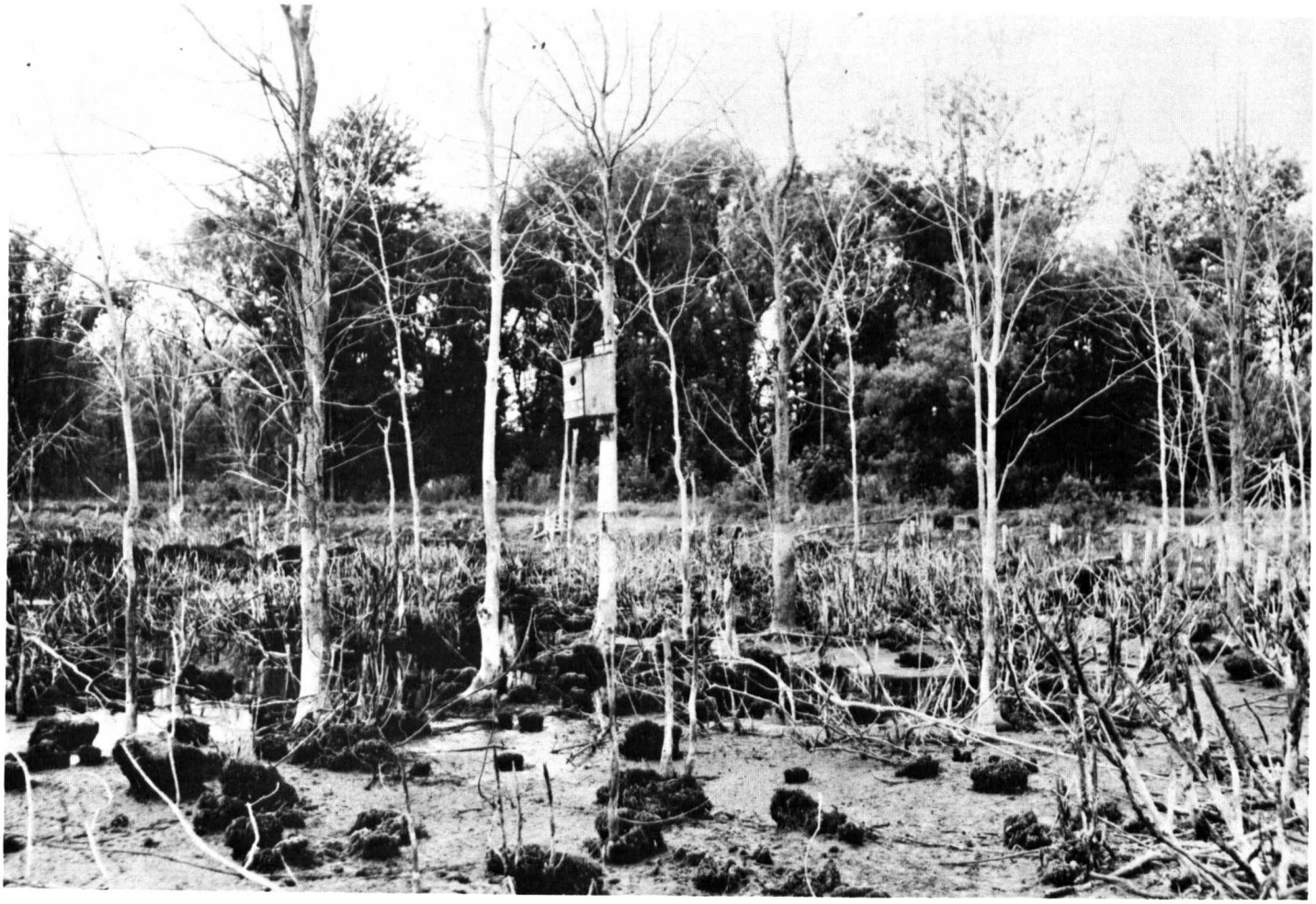

Figure 17.—Shallow-water area of Palms muck in the Three Rivers Game Management Area. The water level is regulated to encourage growth of food plants for waterfowl. The high watermark is visible on the trees. The nesting box for wood duck is protected by the wide metal predator guard around the tree trunk below the box.

Natural wet areas that are aquifer fed are rated only on the drainage class which includes the poorly drained and very poorly drained soils.

Kinds of wildlife

Table 5 rates the soils according to their suitability for three general kinds of wildlife habitat in the county: open land, woodland, and wetland.

Open land wildlife consists of pheasant, meadowlark, field sparrow, dove, cottontail rabbit, red fox, and woodchuck. These birds and mammals generally make their homes in areas of cropland, pasture, meadow, and lawns, and in areas overgrown with grasses, herbs, shrubs, and vines.

Woodland wildlife consists of such birds and mammals that prefer woodland as ruffed grouse, woodcock, thrush, vireo, scarlet tanager, gray squirrel, red squirrel, gray fox, white-tailed deer, and raccoon. They obtain food and cover in stands of hardwoods, coniferous trees, shrubs, or a mixture of these plants. Many of these animals graze on domestic grasses and legumes.

Wetland wildlife consists of ducks, geese, rails, herons, shore birds, and muskrat that generally make their homes in such wet areas as marshes and swamps.

Each rating under "Classes of Wildlife Habitat" in table 5 is based on the ratings listed for the habitat elements in the first part of the table. For open land wildlife, the rating is based on the ratings shown for grain and seed crops, domestic grasses and legumes, wild herbaceous upland plants, and either hardwood plants or coniferous plants, whichever is most applicable. The rating for woodland wildlife is based on the ratings listed for domestic grasses and legumes, wild herbaceous upland plants, and either hardwood plants or coniferous plants, whichever is most applicable. For wetland wildlife the rating is based on the ratings shown for wetland plants and shallow-water areas.

Engineering Uses of the Soils[7]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning boards, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage condition, shrink-swell potential, grain size, plasticity, stickiness, and soil reaction. Also important are depth to the water table, depth to bedrock, and soil slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables so that good locations can be occupied or where poor locations cannot be avoided to show the problems associated with these areas.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 6, 7, and 8, which show, respectively, the results of engineering laboratory tests on soil samples, several estimated soil properties significant to engineering, and interpretations for various engineering uses.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 7 and 8, and it also can be used to make other useful maps.

This information, however, does not eliminate need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths greater than 6 feet. Inspection of sites, especially the small ones, is essential because many delineated areas of a given mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning to soil scientists but are not known to all engineers. The Glossary defines many of these terms commonly used in soil science.

Engineering classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system used by the SCS engineers, Department of Defense, and others (*12*), and the AASHO system adopted by the American Association of State Highway Officials (*1*).

In the Unified system soils are classified according to particle-size distribution of the material less than 3 inches, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are 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

[7] EDWARD A. FERNAU, senior soils engineer, New York State Department of Transportation, Soil Mechanics Bureau; DONALD W. SHANKLIN, assistant state conservation engineer; and DONALD F. FLORA, soil scientist, Soil Conservation Service, assisted in the preparation of this section.

OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, CL-ML.

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution of the material less than 3 inches, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided 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 additional refinement, the engineering value of soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHO classification for tested soils, with group index numbers in parentheses, is shown in table 6; the estimated classification, without group index numbers, is given in table 7 for all soils mapped in the survey area.

According to the U.S. Department of Agriculture system (*9*), texture of the fine earth is determined by the relative proportions of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. These classes are termed loams, silt loams, fine sandy loams, etc. For soils in which 15 percent or more of the soil mass consists of particles larger than 2 millimeters, the textural classes are denoted by such names as gravelly sandy loam, gravelly silt loam, or shaly silt loam. "Sand," "silt," "clay," and some of the other terms used in the USDA textural classification are defined in the Glossary.

Engineering test data

Table 6 contains engineering test data for some of the major soil series in Onondaga County. These tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods.

Compaction (or moisture-density) data are important in earthwork. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the *optimum moisture content* is reached. After that, density decreases with increase in moisture content. The highest dry density obtained in the compactive test is termed *maximum dry* density. As a rule, maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density.

Moisture content is the ratio of the weight of water contained in a soil to the dry weight of the soil. It is generally expressed as a percentage.

Linear shrinkage is the descrease in one dimension, expressed as a percentage of the original dimension, of the soil mass when the moisture content is reduced from a given value to the shrinkage limit.

The tests for liquid limit and plastic limit indicate the effect of water on the strength and consistence of soil material. As the moisture content of a soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from the semisolid to the plastic state; and the liquid limit, from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Estimated soil properties significant in engineering

Several estimated soil properties significant in engineering are given in table 7. These estimates are made for representative soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 7.

Depth to bedrock is distance from the surface of the soil to the upper surface of the rock layer.

Depth to seasonal high water table is distance from the surface of the soil to the highest level that ground water or perched water reaches in the soil in most years.

Soil texture is described in table 7 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2.0 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains 15 percent or more of gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly silt loam." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structure, texture, and consistence. The estimates in table 7 do not take into account such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants. Estimates are to a depth of 40 inches or to depths of such root-restricting soil features as bedrock, fragipans, dense substrata, or high water tables.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

TABLE 6.—*Engineering*

[Tests performed by the New York State Department of Transportation, Soil Mechanics Bureau, in accordance with standard procedures > means

Soil name and location	Parent material	SCS report No. S69 NY–34	Depth from surface	Moisture-density[1]				Percolation rate[2]	Lineal shrinkage	Reaction	Organic matter[3]
				Maximum dry density	Optimum moisture	In-place dry density	In-place moisture content				
			In	*Lb/ft³*	*Pct*	*Lb/ft³*	*Pct*	*Min/in*	*Pct*	*pH*	*Pct*
Camillus silt loam:											
Town of Camillus, 200 feet north of State Route 5 and 400 feet east of intersection of Kasson Road and State Route 5. (Modal)	Thin till derived mainly from Camillus shale and partly from residuum.	1–1	0–9	97	24	71	36	-------	4	7.0	4.8
		1–2	9–16	101	21	78	29	-------	4	6.5	1.4
		1–3	16–22	102	22	74	34	14.8	3	6.0	1.0
		1–4	22–38	105	19	-------	29	-------	3	5.7	------
Croghan loamy fine sand:											
Town of Lysander, 60 feet south of Kellogg Road and 1,750 feet east of intersection of Kellogg Road and Smokey Hollow Road. (Modal)	Lake-laid sand.	10–1	0–9	106	15	76	21	-------	-------	5.1	2.6
		10–2	9–14	105	16	-------	22	-------	-------	5.2	1.9
		10–4	14–26	104	15	94	17	1.0	-------	5.2	1.0
		10–5	26–50	100	17	-------	28	-------	-------	5.4	------
Hamlin silt loam:											
Town of Pompey, 75 feet north of Hills Road and 900 feet west of intersection of Pompey Hollow Road and Hills Road. (Modal)	Silty alluvium.	19–1	0–9	100	23	85	28	-------	6	7.6	3.0
		19–2	9–16	101	21	87	26	-------	5	7.9	2.4
		19–3	16–41	99	24	86	25	2.8	7	8.2	1.7
Howard gravelly fine sandy loam:											
Town of Elbridge, 800 feet east of Foster Road and 1,350 feet south of intersection of State Route 321 and State Route 368. (Coarser textured than modal)	Calcareous glacial outwash.	5–1	0–9	112	14	-------	16	-------	3	5.9	4.0
		5–2	9–23	125	10	-------	14	1.0	3	7.2	1.2
		5–3	23–34	125	9	100	13	1.0	3	7.1	1.0
		5–4	34–46	135	8	-------	7	-------	0	8.5	------
		5–5	46–63	109	11	96	13	0.4	0	8.5	------
		5–6	63–81	133	8	111	9	0.4	0	8.5	------
Howard gravelly silt loam:											
Town of Pompey, 15 feet north of Gulf Road and 1,000 feet west of intersection of Oran-Delphi Road and Gulf Road. (Finer textured than modal)	Old alluvial fan material.	20–1	0–12	99	22	85	29	-------	6	6.5	4.7
		20–2	12–22	117	14	102	16	1.2	5	6.7	1.6
		20–3	22–38	120	13	-------	16	-------	6	7.8	1.3
		20–4	38–60	133	9	-------	8	-------	4	8.2	------
Kendaia silt loam:											
Town of Onondaga, 15 feet west of Makyes Road and 1,300 feet south of intersection of Young Road and Makyes Road. (Higher shale content than modal)	Calcareous glacial till.	18–1	0–10	87	30	70	56	-------	8	7.5	6.6
		18–2	10–18	108	19	-------	25	-------	5	7.9	1.6
		18–4	21–40	122	12	-------	17	-------	5	8.2	------
Lairdsville silt loam:											
Town of Cicero, 700 feet south of Gilette Road and 900 feet west of South Bay Road. (Less clay in subsoil than modal)	Thin till and residuum of red Vernon Shale.	12–1	0–7	94	25	-------	36	-------	7	5.8	5.3
		12–2	7–12	108	20	-------	22	-------	8	6.2	1.1
		12–3	12–24	106	21	103	23	-------	7	7.5	0.9
		12–4	24–32	115	17	110	15	-------	7	8.3	------
Lima silt loam:											
Town of Onondaga, 50 feet west of Makyes Road and 1,400 feet south of intersection of Young Road and Makyes Road. (More silt in lower subsoil layers than modal)	Calcareous till.	17–1	0–9	100	21	78	33	-------	8	7.0	4.2
		17–2	9–15	108	19	-------	20	-------	6	7.1	2.1
		17–3	15–22	115	14	102	18	7.3	5	7.3	1.5
		17–4	22–34	122	12	116	15	7.3	5	7.9	0.7
		17–5	34–60	126	11	115	14	-------	4	8.1	------
Lordstown channery silt loam:											
Town of Fabius, Highland Park, 50 feet south of Arab Hill Road and 1,760 feet east of intersection of Kenyon Hollow Road and Arab Hill Road, under powerline. (Modal)	Glacial till and congelifractate.	14–1	0–5	87	28	-------	50	-------	3	4.6	11.9
		14–2	5–10	95	26	-------	46	-------	3	4.8	5.4
		14–3	10–15	106	18	-------	37	-------	4	5.1	3.9
		14–4	15–22	115	14	-------	23	-------	3	5.1	2.3
		14–5	22–39	127	10	-------	-------	-------	3	5.5	------

test data

of the American Association of State Highway Officials (AASHO). Absence of an entry indicates no determination was made. The symbol more than]

Estimated coarse fragments greater than 3 inches	Mechanical analysis[4]											Liquid limit	Plasticity index	Classification	
	Percentage passing sieve—							Percentage smaller than—						AASHO[5]	Unified[6]
	3 in	1½ in	¾ in	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.02 mm	0.005 mm	0.002 mm				
Pct												Pct			
	100	99	99	89	72	60	57	51	36	16	7	35	8	A-4(4)	ML
	100	99	97	90	74	60	55	46	24	10	5	28	6	A-4(4)	ML-CL
			100	99	95	90	88	74	40	20	10	28	5	A-4(8)	ML-CL
	100	95	93	87	77	56	50	41	23	9	3	28	4	A-4(3)	SM-SC
		100	99	98	98	96	14						[7]NP	A-2-4(0)	SM
					100	98	9	([8])					NP	A-3(0)	SP-SM
					100	99	4	([8])					NP	A-3(0)	SP
					100	98	9	([8])					NP	A-3(0)	SP-SM
						100	92	79	46	19	6	31	11	A-6(8)	CL
						100	92	80	47	20	8	31	11	A-6(8)	CL
						100	98	89	66	34	21	37	13	A-6(9)	ML-CL
2	100	95	91	77	72	59	26	22	14	2	1		NP	A-2-4(0)	SM
2	100	96	82	57	49	38	18	15	9	4	2	16	1	A-1-b(0)	GM
2	100	96	86	65	57	43	19	16	10	5	1	17	1	A-1-b(0)	SM
5	100	96	89	60	45	23	8	([8])					NP	A-1-a(0)	SW-SM
					100	98	42	31	5	0			NP	A-4(1)	SM
5	100	99	97	79	61	30	10	8	3	1	0		NP	A-1-b(0)	SW-SM
5	100	97	90	85	81	76	63	55	38	18	8	39	12	A-6(7)	ML-CL
10	100	94	83	66	58	49	36	32	21	9	6	25	6	A-4(0)	GM-GC
20-25	100	95	88	59	44	32	23	21	14	8	5	27	10	A-2-4(0)	GC
25-30	100	85	66	38	29	16	11	9	5	2	2	20	6	A-1-a(0)	GP-GC
2	100	93	93	92	89	85	77	69	47	22	9	50	17	A-7-5(13)	ML, OL
5	100	91	86	76	69	61	52	46	32	17	9	32	13	A-6(4)	CL
10-15	100	98	94	82	74	66	59	53	37	18	11	24	6	A-4(5)	ML-CL
	100	94	92	90	89	85	70	64	50	30	18	44	13	A-7-5(9)	ML, OL
			100	96	93	87	75	69	57	42	32	35	15	A-6(10)	CL
	100	99	99	97	97	95	92	85	66	48	36	32	12	A-6(9)	CL
		100	86	72	72	72	72	64	47	32	24	29	10	A-4(7)	CL
2		100	98	93	88	84	75	71	57	30	14	41	14	A-7-6(10)	ML-CL
2		100	98	93	88	84	74	68	53	29	18	34	15	A-6(10)	CL
5-10		100	98	89	83	75	64	56	36	23	12	28	11	A-6(6)	CL
5-10	100	96	90	74	65	56	49	42	28	15	7	24	9	A-4(3)	GC
10-15	100	93	84	71	65	54	45	40	29	14	9	21	8	A-4(2)	GC
	100	89	81	66	60	54	49	40	18	4	2		NP	A-4(3)	GM-OL
	100	92	85	74	67	60	57	48	25	7	2		NP	A-4(3)	ML-OL
	100	86	75	65	60	51	45	38	23	8	2		NP	A-4(2)	GM
	100	82	71	55	49	40	35	31	20	7	2	30	1	A-2-4(0)	GM
	100	87	72	52	43	32	26	23	17	7	6	21	5	A-2-4(0)	GM-GC

TABLE 6.—*Engineering*

Soil name and location	Parent material	SCS report No. S69 NY–34	Depth from surface	Moisture-density[1]				Percolation rate[2]	Linear shrinkage	Reaction	Organic matter[3]
				Maximum dry density	Optimum moisture	In-place dry density	In-place moisture content				
			In	*Lb/ft³*	*Pct*	*Lb/ft³*	*Pct*	*Min/in*	*Pct*	*pH*	*Pct*
Madrid fine sandy loam:											
Town of Van Buren, 300 feet south of Conners Road and 1,350 feet east of intersection of Kingdom Road and Conners Road. (Modal)	Neutral sandy glacial till.	7–1	0–9	111	14	92	20	-------	2	6.4	3.2
		7–2	9–23	122	11	98	18	28.8	1	6.3	0.8
		7–4	23–42	128	10	126	13	-------	3	6.5	0.2
		7–5	42–74	127	10	112	17	-------	4	6.8	------
Mardin channery silt loam:											
Town of Fabius, Highland Park, 15 feet south of Arab Hill Road and 600 feet east of Kenyon Hollow Road under powerline. (Coarser textured fragipan and substratum than modal)	Glacial till.	13–1	0–4	76	40	-------	75	-------	5	5.2	10.0
		13–2	4–12	85	32	-------	54	-------	5	5.0	4.1
		13–3	12–17	105	20	-------	35	-------	4	5.3	1.3
		13–4	17–21	115	15	-------	18	-------	5	5.4	0.7
		13–5	21–39	124	12	-------	12	-------	7	6.5	0.4
		13–6	39–53	127	10	-------	13	-------	6	7.3	------
Manlius shaly silt loam:											
Town of Fabius, Highland Park, edge of road just east of park office in pine plantation. (Fewer shale fragments in subsoil than modal)	Till and congelifractate.	15–1	0–6	102	19	-------	29	3.2	4	5.1	5.3
		15–2	6–19	115	15	86	27	-------	3	5.4	2.7
Mohawk silt loam:											
Town of Onondaga, 60 feet east of Cedarvale Road and 4,880 feet north of State Route 175. (Thinner solum than modal)	Calcareous glacial till.	3–1	0–7	104	17	82	23	-------	5	6.8	4.9
		3–2	7–23	107	16	94	20	0.8	6	7.1	2.4
		3–3	23–50	117	14	95	20	-------	5	8.1	------
Town of Onondaga, 50 feet west of Makyes Road and 1,350 feet south of intersection of Young Road and Makyes Road. (Grading to Honeoye)	Calcareous glacial till.	16–1	0–10	103	20	77	32	-------	7	6.3	3.8
		16–2	10–17	110	17	94	20	-------	8	7.0	2.2
		16–3	17–41	121	12	108	15	26.6	5	8.0	0.7
		16–4	41–72	127	10	114	14	-------	6	8.2	------
Naumburg loamy fine sand:											
Town of Lysander, 25 feet south of Kellogg Road and 1,800 feet east of intersection of Smokey Hollow Road and Kellogg Road. (Modal)	Lake-laid sand.	9–1	0–9	105	17	77	29	-------	-------	5.8	3.6
		9–2	9–15	105	16	-------	32	-------	-------	5.5	1.8
		9–4	15–16	-------	-------	-------	-------	4.6	-------	-------	-------
		9–5	16–26	102	14	101	22	4.6	-------	5.0	1.6
		9–6	26–50	101	17	-------	27	-------	-------	5.7	------
Niagara silt loam:											
Town of Clay, 50 feet north of Ver Plank Road and 1,600 feet west of intersection of Morgan Road and Ver Plank Road. (Less clay in subsoil than modal)	Lake-laid silt, clay, and very fine sand.	11–1	0–11	95	23	75	37	-------	3	5.2	4.4
		11–3	11–28	107	18	103	23	36.7	2	6.0	1.1
		11–4	28–54	108	18	105	23	-------	6	6.8	------
Schoharie silt loam:											
Town of Marcellus, 75 feet west of State Route 174 and 1,500 feet north of U.S. Highway 20. (Modal)	Lake-deposited calcareous silt and clay.	4–1	0–6	93	23	-------	36	-------	6	6.9	5.1
		4–2	6–12	108	17	-------	29	-------	7	7.6	1.1
		4–3	12–26	112	17	105	23	29.5	8	8.3	0.6
		4–4	26–55	113	17	110	20	-------	7	8.3	------
Wampsville gravelly silt loam:											
Town of Elbridge, 75 feet west of McDonald Road and 900 feet south of Power House Road. (Coarser textured solum, less well stratified, and shallower to bedrock than modal)	Till on morainic dump.	6–1	0–10	112	15	87	17	-------	5	6.5	3.6
		6–2	10–19	116	14	95	16	-------	6	8.0	0.9
		6–3	19–28	109	19	104	20	>120	6	8.2	0.8
		6–4	28–60	115	16	-------	24	-------	6	8.4	------

test data—Continued

Estimated coarse fragments greater than 3 inches	Mechanical analysis[4]												Classification	
	Percentage passing sieve—							Percentage smaller than—				Liquid limit	Plasticity index	AASHO[5]	Unified[6]
	3 in	1½ in	¾ in	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.02 mm	0.005 mm	0.002 mm				
Pct												*Pct*			
1	--------	100	97	93	91	86	54	43	19	8	4	20	4	A–4(4)	ML–CL
1	--------	100	97	92	89	82	48	39	17	8	5	--------	NP	A–4(3)	SM
1	100	99	98	94	92	86	49	38	14	11	7	15	4	A–4(3)	SM–SC
1	100	99	97	93	91	85	51	40	16	12	8	16	6	A–4(3)	ML–CL
2	100	96	94	94	93	93	92	79	47	14	5	59	4	A–5(12)	ML–OL
2	--------	100	99	97	97	96	96	85	60	26	12	49	14	A–7–5(12)	ML–OL
3	100	98	96	92	91	90	87	74	45	28	17	30	6	A–4(8)	ML–CL
5	--------	100	95	82	74	67	63	55	37	21	13	27	10	A–4(6)	CL
5–10	100	92	86	71	62	51	47	42	31	20	13	28	10	A–4(2)	GC
10–15	100	90	78	60	51	41	36	33	26	16	11	27	11	A–6(0)	GC
----------	--------	100	98	87	78	68	55	48	32	12	4	37	11	A–6(4)	ML–CL
----------	--------	100	96	72	63	53	38	33	22	10	4	27	7	A–4(1)	SM–SC
----------	100	93	93	90	87	77	62	56	42	21	9	33	9	A–4(5)	ML–CL
10	--------	100	98	93	84	73	61	54	39	23	13	29	9	A–4(5)	ML–CL
10	100	89	83	72	60	50	41	36	24	14	10	25	8	A–4(1)	SC
2	--------	100	98	95	92	88	80	73	55	29	14	36	12	A–6(9)	ML–CL
2	100	99	97	90	86	81	74	64	37	20	8	33	11	A–6(8)	CL–ML
5–10	100	98	92	75	67	59	54	47	30	17	9	24	8	A–4(4)	CL
10–15	100	99	96	77	67	57	51	45	33	17	9	21	7	A–4(3)	ML–CL
----------	--------	--------	--------	100	99	98	96	15	--------	--------	--------	--------	--------	NP	A–2–4(0)	SM
----------	--------	--------	--------	100	99	99	96	9	(8)	--------	--------	--------	--------	NP	A–3(0)	SP–SM
----------	--------	--------	--------	--------	--------	100	93	5	(8)	--------	--------	--------	--------	NP	A–3(0)	SP
----------	--------	--------	--------	--------	--------	100	99	10	(8)	--------	--------	--------	--------	NP	A–3(0)	SP–SM
----------	--------	--------	--------	--------	--------	100	99	97	86	60	14	7	--------	NP	A–4(8)	ML
----------	--------	--------	--------	--------	--------	100	96	92	79	49	13	6	23	4	A–4(8)	ML–CL
----------	--------	--------	--------	--------	--------	--------	100	99	87	54	22	12	28	12	A–6(9)	CL
----------	--------	--------	--------	--------	--------	100	99	95	84	58	28	14	40	15	A–6(10)	CL–ML
----------	--------	--------	--------	--------	--------	--------	100	98	91	72	41	28	30	12	A–6(9)	CL
----------	--------	--------	--------	100	99	98	94	85	63	37	27	29	13	A–6(9)	CL
----------	--------	--------	--------	--------	100	99	97	88	66	37	24	26	11	A–6(8)	CL
3	100	94	88	79	74	67	51	44	30	16	9	28	9	A–4(3)	CL
2	100	96	91	81	73	65	50	44	32	19	13	25	10	A–4(3)	CL
5	100	95	93	88	76	63	55	48	31	20	14	30	8	A–4(4)	ML–CL
5–10	100	94	85	68	60	48	41	34	19	12	9	28	10	A–4(1)	GC

TABLE 6.—*Engineering*

Soil name and location	Parent material	SCS report No. S69 NY–34	Depth from surface	Moisture-density[1]				Percolation rate[2]	Linear shrinkage	Reaction	Organic matter[3]
				Maximum dry density	Optimum moisture	In-place dry density	In-place moisture content				
			In	*Lb/ft³*	*Pct*	*Lb/ft³*	*Pct*	*Min/in*	*Pct*	*pH*	*Pct*
Wassaic silt loam:											
Town of Onondaga, 75 feet west of intersection of Corporal Welch Road and Perry Road. (Modal)	Calcareous till.	2–1	0–9	106	16	81	23	-------	4	6.8	3.7
		2–2	9–23	114	14	101	16	5.8	5	8.0	1.4
		2–3	23–35	124	11	98	16	-------	3	8.3	------
Williamson silt loam:											
Town of Lysander, 50 feet west of State Route 48 and 900 feet south of intersection of Lamson Road and State Route 48. (Higher silt content in fragipan and substratum than modal)	Neutral lacustrine silt and very fine sand.	8–1	0–7	91	24	73	34	-------	3	6.5	5.6
		8–2	7–23	103	17	81	26	>120	0	6.4	1.3
		8–3	23–42	105	15	95	27	-------	0	6.6	0.3
		8–4	42–52	106	15	100	24	45	1	6.4	------

[1] Maximum dry density and optimum moisture based on AASHO Designation T 99–57, Method C (*1*). Inplace dry density based on A.S.T.M. Designation D 1556–64. Inplace moisture content based on A.S.T.M. Designation D 2216–63T.

[2] Based on standard percolation test given in Bull. No. 1, New York Health Department.

[3] Determined by wet combustion method—based on 1942 Cornell University agronomy test procedure as modified by the Soil Mechanics Bureau.

[4] Mechanical analyses according to the AASHO Designation T 88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material,

TABLE 7.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of more than one kind of soil. The soils instructions for referring to other series that appear in the first column of this table. Absence of data indicates that the soil is

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification
	Bedrock	Seasonal high water table			Unified
	Feet	*Feet*	*Inches*		
Alton: AlA, AlB, AlC	>5	>5	0–8	Gravelly fine sandy loam	SM
			8–17	Gravelly sandy loam or loam, very gravelly sandy loam or loam.	GM, SM, GC, SC
			17–36	Very gravelly sandy loam or fine sandy loam.	GM, GC
			36–46	Very gravelly loamy sand	GW, GM, GP
			46–144	Stratified sand and gravel	GW, GP
*Angola: AnB, AnC	1½–3½	½–1	0–8	Silt loam	ML, OL
For Darien part of AnB and AnC, see Darien series.			8–22	Shaly loam, silt loam, or silty clay loam.	ML, CL
			22–60	Thin-bedded calcareous sandstone.	
Appleton: AoA, ApA, ApB	>3½	½–1	0–9	Loam, channery silt loam	ML, OL, SM, SC
			9–22	Fine sandy loam, loam, silt loam or their gravelly or channery analogs.	ML, CL, SM, SC
			22–30	Sandy clay loam, loam, or silt loam or their gravelly or channery analogs.	ML, CL, SM, SC
			30–60	Gravelly loam or fine sandy loam, or their very gravelly analogs.	ML, CL, SM, SC, GM, GC

test data—Continued

Estimated coarse fragments greater than 3 inches	Mechanical analysis[4]											Liquid limit	Plasticity index	Classification	
	Percentage passing sieve—							Percentage smaller than—						AASHO[5]	Unified[6]
	3 in	1½ in	¾ in	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.02 mm	0.005 mm	0.002 mm				
Pct												*Pct*			
10	100	99	97	92	88	79	53	45	28	11	4	33	9	A–4(4)	ML–CL
10		100	98	93	91	85	61	52	32	22	14	22	7	A–4(5)	ML–CL
10	100	91	80	65	58	49	35	30	18	8	5	19	5	A–2–4(0)	GM–GC
					100	99	84	66	23	5	3		NP	A–4(8)	ML
					100	99	88	66	15	6	0		NP	A–4(8)	ML
						100	89	68	16	5	0		NP	A–4(8)	ML
						100	89	66	12	3	0		NP	A–4(8)	ML

including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

[5] Based on AASHO Designation M 145–49 (*1*).

[6] Based on the Unified Soil Classification System (*12*).

[7] NP = nonplastic.

[8] No hydrometer analysis performed on sands of less than 10 percent passing No. 200 sieve.

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in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the too variable to be rated or that no estimate was made. The symbol > means more than, and the symbol < means less than]

Classification—con.	Coarse fraction greater than 3 inches	Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
AASHO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)				
	Percent					*Inches per hour*	*Inches per inch of soil*	*pH*	
A–2	0–10	55–70	50–65	35–55	20–35	>6.0	0.07–0.10	5.1–7.3	Low.
A–1, A–2, A–4	0–10	45–70	40–65	25–60	10–50	>6.0	0.06–0.11	5.1–7.3	Low.
A–1, A–2	0–15	20–45	15–40	10–35	5–20	>6.0	0.02–0.06	5.1–7.3	Low.
A–1, A–2	0–20	20–45	15–40	10–30	0–10	>6.0	0.01–0.03	5.1–7.3	Low.
A–1, A–2	0–25	20–45	15–40	10–30	0–5	>6.0	0.01–0.02	6.1–8.4	Low.
A–6, A–4	0–5	85–95	80–90	80–90	55–75	0.6–2.0	0.17–0.20	5.6–7.3	Low.
A–6, A–7	0–5	65–90	60–85	55–85	51–80	<0.2	0.10–0.17	5.6–7.8	Low.
A–4	0–5	60–95	55–90	45–90	40–80	0.6–2.0	0.10–0.20	5.6–7.3	Low.
A–4, A–2	0–10	60–95	55–90	40–90	25–75	0.6–2.0	0.08–0.18	5.6–7.3	Low.
A–4, A–1, A–2	0–10	60–95	55–90	45–90	20–80	0.06–0.2	0.06–0.18	5.6–7.8	Low.
A–4, A–1, A–2	5–15	40–95	35–90	25–85	15–70	0.06–0.2	(1)	7.9–8.4	Low.

TABLE 7.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification
	Bedrock	Seasonal high water table			Unified
	Feet	*Feet*	*Inches*		
Arkport: ArB, ArC, ArD	>6	>3	0–10	Very fine sandy loam	SM
			10–18	Very fine sandy loam, loamy very fine sand, loamy fine sand.	SM
			18–60	Very fine sandy loam, loamy very fine sand, loamy fine sand or fine sand with finer textured lamellae.	SM
			60–70	Very fine sand, layers of silt or silty clay or stratified sand and gravel, variable.	
*Arnot: ATB, AVF For Lordstown part of AVF, see Lordstown series.	1–1½	1–1½	0–8	Channery silt loam	GM, GC, ML, CL, SM, SC
			8–18	Very channery silt loam	GM, GC
			18	Gray sandstone bedrock.	
*Aurora: AwB, AwC, AwD, AwD2, AXE For Farmington part of AXE, see Farmington series. Rock outcrop part of AXE is not rated in the table.	1½–3½	1½–2	0–18	Silt loam, shaly silt loam	ML, CL
			18–38	Shaly silt loam, shaly silty clay loam, silt loam, silty clay loam.	ML, CL
			38–50	Shale bedrock.	
*Benson: BeB, BeC, BNC, BNF For Wassaic part of BNC and BNF, see Wassaic series. Rock outcrop part of BNC and BNF is not rated in the table.	1–1½	>2	0–10	Silt loam or channery silt loam	ML, CL, GM, GC, SM, SC
			10–18	Very channery loam, silt loam or silty clay loam.	GM, GC
			18	Limestone bedrock.	
Bombay: BoB	>3½	1½–2	0–10	Gravelly loam	ML, CL, SM, SC
			10–38	Fine sandy loam or loam, or their gravelly analogs.	SM, SC
			38–60	Fine sandy loam or loam, or their gravelly analogs.	SM, SC
Brockport Mapped only in an undifferentiated unit with Lockport soils.	1½–3½	½–1	0–16	Silty clay loam	MH
			16–24	Silty clay, silty clay loam, clay or their shaly analogs.	ML, CL
			24–33	Very shaly silty clay	GC
			33–50	Soft shale bedrock.	
*Camillus: CaB, CaC, CaC2, CaD2, CBE For Lairdsville part of CBE, see Lairdsville series.	1½–3½	>1½	0–16	Silt loam	ML, CL
			16–22	Silt loam	ML, CL
			22–38	Very shaly silt loam	SM, SC, ML, CL
			38–60	Shale bedrock.	
Canandaigua: Cd	>3½	0–½	0–8	Mucky silt loam	OH, CH
			8–31	Silt loam, very fine sandy loam	ML, CL
			31–54	Stratified silt and very fine sand with lenses of silty clay and clay.	ML, CL
Carlisle: Ce	>4½	0	0–111	Organic material	Pt
			111–116	Clay loam, silt loam, silt, marl.	
Cazenovia: CfB, CfC, CfC2, CgD	>3½	>1½	0–15	Silt loam	ML, CL
			15–36	Silty clay loam or clay loam, or their gravelly analogs.	CL, ML
			36–70	Gravelly silty clay loam or loam.	CL, ML, SC, SM
Collamer: ChA, ChB	>3½	1½	0–24	Silt loam	ML, CL
			24–42	Silt loam, silty clay loam	CL
			42–50	Stratified silt loam, silt, and very fine sand with thin lenses of clay.	CL, ML
Colonie: ClB, ClC	>4	>3½	0–22	Loamy fine sand	SM
			22–65	Fine sand	SM, SP

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Classification—con.	Coarse fraction greater than 3 inches	Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
AASHO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)				
	Percent					*Inches per hour*	*Inches per inch of soil*	*pH*	
A–4		99–100	98–100	90–100	45–50	0.6–2.0	0.15–0.16	5.1–7.3	Low.
A–4, A–2		99–100	98–100	75–95	25–50	0.6–6.0	0.10–0.16	5.1–7.3	Low.
A–4, A–2		95–100	90–100	65–95	20–50	0.6–6.0	0.05–0.16	5.1–7.3	Low.
A–4, A–2	5–10	50–75	45–70	40–70	30–60	0.6–2.0	0.10–0.15	4.5–5.5	Low.
A–4, A–2	10–20	40–55	35–50	30–50	25–45	0.6–6.0	0.07–0.10	4.5–5.5	Low.
A–4, A–6		85–95	80–90	75–85	55–75	0.6–2.0	0.17–0.19	5.1–7.3	Low.
A–6, A–4		70–95	65–90	60–85	50–80	0.06–0.2	0.13–0.18	5.6–7.8	Low.
A–4	0–5	70–85	65–80	60–80	45–70	0.6–2.0	0.14–0.17	6.1–7.3	Low.
A–4, A–2	5–10	45–55	40–50	35–50	30–45	0.6–2.0	0.08–0.10	7.1–8.4	Low.
A–4, A–2	0–5	70–80	65–75	60–70	30–55	0.6–2.0	0.12–0.14	5.1–6.5	Low.
A–4, A–2	0–10	70–90	65–90	60–85	25–50	0.6–2.0	0.09–0.14	5.1–7.3	Low.
A–4, A–2	0–10	65–90	60–85	55–80	20–50	0.2–0.6	(1)	6.6–8.4	Low.
A–7		90–100	85–100	75–95	70–90	0.2–0.6	0.14–0.18	6.1–7.3	Moderate.
A–7, A–6		70–100	65–100	65–95	60–95	<0.06	0.08–0.17	6.1–7.8	Moderate.
A–2		50–55	35–40	30–35	25–30		0.05–0.06	6.6–8.4	Low.
A–4	0–2	85–95	65–75	55–65	51–60	0.6–2.0	0.14–0.16	5.6–7.3	Low.
A–4	0–5	75–100	65–95	60–95	55–95	0.6–2.0	0.13–0.19	5.6–7.3	Low.
A–4	0–5	80–90	65–80	50–60	45–55	0.6–2.0	0.13–0.16	6.6–8.4	Low.
A–7		100	100	95–100	80–100	0.6–2.0	0.19–0.21	6.1–7.8	Low.
A–4, A–6		95–100	95–100	90–100	75–100	0.6–2.0	0.19–0.20	6.1–8.4	Low.
A–4		95–100	95–100	90–100	85–100	0.06–0.2	(1)	6.6–8.4	Low.
						2.0–6.0	0.25–0.35	5.1–7.8	
A–6, A–4		85–100	80–95	70–95	55–85	0.6–2.0	0.17–0.20	5.6–7.3	Low.
A–7, A–6	0–5	80–100	75–95	65–95	55–90	<0.2	0.11–0.16	5.6–7.8	Low.
A–4, A–7, A–6	0–10	70–90	65–85	55–85	40–80	<0.2	(1)	7.4–8.4	Low.
A–4		95–100	95–100	85–95	60–85	0.6–2.0	0.19–0.21	5.1–7.3	Low.
A–6, A–4		95–100	95–100	90–100	75–95	0.2–2.0	0.16–0.20	5.1–7.8	Low.
A–4, A–6		95–100	95–100	85–100	60–95	0.06–0.2	(1)	6.6–8.4	Low.
A–2		100	100	95–100	15–30	>6.0	0.08–0.11	4.5–5.5	Low.
A–2		100	100	95–100	10–15	>6.0	0.04–0.06	5.1–7.3	Low.

TABLE 7.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification
	Bedrock	Seasonal high water table			Unified
	Feet	*Feet*	*Inches*		
Conesus: CoA, CoB	>3½	1–2	0–14	Gravelly silt loam	ML, CL
			14–40	Gravelly loam or silt loam or their nongravelly analogs.	ML, CL
			40–60	Gravelly loam or silt loam	SM, SC, GM, GC, ML, CL
Croghan: CrB	>4	1½–2	0–9	Loamy fine sand	SM
			9–50	Fine sand	SM, SP
Darien: Da	>3½	½–1	0–9	Silt loam	ML, CL
			9–16	Gravelly silt loam or loam	CL, ML
			16–30	Gravelly silty clay loam	CL
			30–60	Very gravelly silty clay loam to loam or their gravelly analogs.	CL, ML
Dunkirk: DuC	>3½	>2	0–16	Silt loam	ML, CL
			16–40	Heavy silt loam, silty clay loam	CL
			40	Layers of silt, very fine sand, and in places thin lenses of clay.	CL, ML
Edwards: Ed	>3½	0	0–24	Muck	Pt
			24–132	Silty marl	
			132–140	Silt.	
*Farmington: FAC	1–1½	1–1½	0–8	Silt loam	ML, CL
			8–16	Gravelly loam or silt loam	GM, GC, SM, SC, ML, CL
			16	Calcareous sandstone bedrock.	
For Aurora part of FAC, see Aurora series.					
Fluvaquents, frequently flooded: FL. Too variable for valid estimates.					
Fonda: Fo	>3½	0	0–9	Mucky silty clay loam	OH, ML
			9–33	Silty clay, clay, silty clay loam	MH, CH, CL
			33–60	Layers of silty clay and clay	MH, CH, CL
Fredon: Fr	>6	½–1	0–8	Loam	ML
			8–20	Sandy loam, fine sandy loam, loam.	ML, SM, SC
			20–27	Gravelly sandy loam, fine sandy loam or loam or their very gravelly analogs.	GM, GC, ML, SM, SC
			27–50	Very gravelly loam or loamy sand, or stratified sand and gravel; variable.	
Galen: GaA, GaB	>3½	1–2	0–15	Very fine sandy loam	ML
			15–30	Fine sandy loam	ML, SM
			30–48	Loamy fine sand with lamellae of fine sandy loam.	SM
			48–60	Stratified loamy fine sand and fine sand with lenses of silt.	SM
Halsey: Ha	>6	0	0–7	Mucky loam	ML, CL, OL
			7–20	Fine sandy loam, loam, or silt loam.	ML, CL, SM, SC
			20–27	Gravelly loam or fine sandy loam, or their sandy loam and nongravelly analogs.	ML, CL, SM, SC
			27–50	Stratified gravel and sand	GW, GP, GM, SW, SP, SM
Hamlin: Hb, Hc	>3½	[2]>2	0–9	Silt loam	CL, ML
			9–41	Silt loam, loam, fine sandy loam	ML, CL
			41–60	Silt loam, loam, fine sandy loam, or layers of silty clay or stratified sand and gravel; variable.	

significant to engineering—Continued

Classification—con.	Coarse fraction greater than 3 inches	Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
AASHO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)				
	Percent					*Inches per hour*	*Inches per inch of soil*	*pH*	
A–4		85–95	80–90	75–85	60–65	0.6–2.0	0.17–0.19	5.1–6.5	Low.
A–4, A–6	0–2	75–85	70–80	65–75	51–60	0.6–2.0	0.14–0.16	5.6–7.3	Low.
A–4	2–5	70–80	65–75	60–65	45–55	<0.2	(1)	6.6–8.4	Low.
A–2		95–100	95–100	90–100	13–15	>6.0	0.11–0.12	4.5–5.5	Low.
A–3		95–100	95–100	90–100	0–10	>6.0	0.05–0.06	4.5–5.5	Low.
A–4		90–95	85–95	80–90	70–80	0.6–2.0	0.18–0.20	5.1–7.3	Low.
A–6, A–4	0–2	80–95	75–85	70–80	65–75	0.6–2.0	0.13–0.17	5.1–7.3	Low.
A–6	0–5	85–90	80–85	70–75	60–70	<0.2	0.11–0.14	5.6–7.8	Low.
A–6, A–4	0–5	70–95	65–85	55–75	51–65	<0.2	(1)	6.6–8.4	Low.
A–4		95–100	95–100	85–95	60–85	0.6–2.0	0.19–0.21	5.1–7.3	Low.
A–6, A–4		95–100	95–100	90–100	75–95	0.2–2.0	0.16–0.20	5.6–7.8	Low.
A–4, A–6		95–100	95–100	85–100	60–95	0.2–2.0	(1)	5.6–8.4	Low.
						2.0–6.0	0.25–0.35	6.6–8.4	
								7.8–8.4	
A–4	0–2	85–90	80–90	70–85	51–70	0.6–2.0	0.17–0.19	5.1–6.5	Low.
A–4	0–5	70–80	65–75	55–70	40–60	0.6–2.0	0.11–0.15	5.6–7.3	Low.
A–6, A–7		100	100	95–100	85–95	0.2–2.0	0.16–0.18	6.1–7.3	Moderate.
A–6, A–7		100	100	90–100	75–95	<0.2	0.13–0.17	6.1–7.8	Moderate.
A–6, A–7		100	100	90–100	75–95	<0.2	(1)	7.3–8.4	Moderate.
A–4		85–90	80–85	70–80	51–65	0.6–2.0	0.14–0.15	5.1–7.3	Low.
A–2, A–4		85–90	80–85	50–80	25–65	0.6–6.0	0.12–0.14	5.6–7.3	Low.
A–2, A–4	0–5	45–85	40–80	25–75	15–60	0.6–6.0	0.06–0.14	5.6–7.8	Low.
A–4		100	100	85–95	50–65	0.6–2.0	0.14–0.17	5.1–7.3	Low.
A–4		100	100	70–85	40–55	0.6–2.0	0.12–0.15	5.1–7.3	Low.
A–2, A–4		100	100	75–95	25–40	0.6–2.0	0.08–0.11	5.6–7.8	Low.
A–2		100	100	65–80	20–35	0.2–2.0	(1)	6.6–8.4	Low.
A–4		80–90	75–90	65–90	55–80	0.6–2.0	0.14–0.18	5.6–7.3	Low.
A–4		80–90	75–90	65–90	40–80	0.6–2.0	0.12–0.18	5.6–7.3	Low.
A–4, A–2	<5	65–90	60–90	40–85	25–65	0.6–2.0	0.09–0.15	6.1–7.8	Low.
A–1, A–2	<5	20–70	15–50	5–45	0–10	>6.0	(1)	6.6–8.4	Low.
A–6, A–4		100	100	90–100	85–95	0.6–2.0	0.19–0.21	6.1–7.3	Low.
A–6, A–4		100	100	75–100	51–100	0.6–2.0	0.16–0.20	6.1–7.8	Low.

TABLE 7.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification
	Bedrock	Seasonal high water table			Unified
	Feet	*Feet*	*Inches*		
Herkimer: He	>3½	>2	0–8	Silt loam	ML, CL
			8–55	Silt loam or loam, or their shaly analogs.	ML, CL, SM, SC
			55–72	Very shaly loam	GM, GC
Hilton: HlA, HlB	>3½	1–2	0–9	Loam	ML, CL
			9–21	Loam or fine sandy loam, or their gravelly analogs.	ML, CL, SM, SC
			21–45	Loam, fine sandy loam, or their gravelly analogs.	ML, CL, SM, SC
			45–60	Gravelly loam or fine sandy loam, or their very gravelly analogs.	ML, CL, SM, SC, GM, GC
*Honeoye: HnB, HnC, HnCK, HoD, HSC, HTE, HTF. For Lansing parts of HoD, HTE, and HTF, and Ontario parts of HTE and HTF, see Lansing and Ontario series.	>3½	>2	0–10	Silt loam	ML, CL
			10–29	Loam or silt loam, or their gravelly analogs.	ML, CL
			29–50	Gravelly loam or gravelly silt loam, or their very gravelly analogs.	GC, SC
Howard: HwA, HwB, HwC, HxA, HxB, HxC, HyA, HyB.	>4	>3	0–16	Gravelly fine sandy loam, loam, or silt loam.	SM, ML, CL
			16–36	Gravelly and very gravelly sandy loam or fine sandy loam.	GM, GC, SM
			36–180	Stratified gravel and sand	GP, GC, SW, SM
Kendaia: KeA, KeB	>3½	½–1	0–7	Silt loam	ML, OL
			7–22	Silt loam, loam, or fine sandy loam, or their gravelly analogs.	CL, ML, GC, SC
			22–114	Gravelly silt loam or loam, or their very gravelly analogs.	ML, CL, GC, SC
Lairdsville: LaB, LbC2	1½–3½	>1	0–8	Silt loam	ML, OL
			8–26	Silty clay loam, clay, silty clay, clay loam.	CL
			26–30	Very shaly silty clay loam, clay, or clay loam.	CL
			30	Shale bedrock.	
Lakemont: Lk	>3½	0–½	0–10	Silty clay loam	OL, ML, CL
			10–31	Silty clay, clay	CL
			31–60	Layered silty clay or clay with thin lenses of silt and sand in places.	CL
Lamson: Lm	>6	0–½	0–9	Very fine sandy loam	ML, OL
			9–40	Fine sandy loam	SM, SC, ML
			40–60	Layers of fine sand, very fine sand, and silt.	SM, SC, ML
Lansing: LsB, LsC, LsCK	>3½	>2	0–13	Gravelly silt loam	ML, CL
			13–35	Gravelly and shaly heavy loam or silt loam.	ML, CL, GC, SC, SM
			35–50	Very gravelly loam or silt loam or their gravelly analogs.	ML, GC, GM, SM, SC
Lima: LtA, LtB	>3½	1–2	0–15	Silt loam	ML, CL
			15–22	Shaly loam or silt loam	CL, ML
			22–60	Very shaly loam, silt loam, or fine sandy loam.	GC, SC, ML, CL
*Lockport: LvB For Brockport part of LvB, see Brockport series.	1½–3½	½–1	0–9	Silty clay loam	ML, CL, OL
			9–30	Silty clay or clay	CL
			30–36	Shaly silty clay, clay loam, or clay.	CL
			36–50	Clay shale bedrock.	

significant to engineering—Continued

Classification—con.	Coarse fraction greater than 3 inches	Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
AASHO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)				
	Percent					*Inches per hour*	*Inches per inch of soil*	*pH*	
A–4, A–6, A–7	----------	90–100	85–95	75–95	60–80	0.6–2.0	0.18–0.20	5.6–7.3	Low.
A–4, A–6	<5	80–100	70–95	60–80	45–65	0.6–2.0	0.12–0.19	6.1–7.8	Low.
A–1, A–2	<10	55–60	45–55	35–40	15–30	>2.0	(1)	6.6–8.4	Low.
A–4	----------	85–95	80–90	75–85	55–70	0.6–2.0	0.15–0.16	5.1–6.5	Low.
A–4	<5	70–95	65–90	60–85	40–60	0.6–2.0	0.10–0.15	5.1–6.5	Low.
A–4	<5	70–95	65–90	60–85	40–65	0.6–2.0	0.10–0.15	5.6–7.3	Low.
A–4, A–2	5–10	60–85	55–80	50–75	30–55	<0.2	(1)	7.4–8.4	Low.
A–4, A–6, A–7	<2	90–95	85–90	80–85	70–80	0.6–2.0	0.18–0.20	5.6–7.3	Low.
A–4, A–6, A–7	<10	80–90	75–90	70–85	55–75	0.6–2.0	0.13–0.18	5.6–7.8	Low.
A–4	5–15	65–75	60–70	50–60	40–50	<0.2	0.06–0.10	7.9–8.4	Low.
A–2, A–4, A–6	<2	75–85	70–85	55–80	25–65	0.6–20	0.11–0.18	5.1–7.3	Low.
A–1, A–2, A–4	<2	55–70	40–60	30–50	15–40	0.6–20	0.06–0.09	5.6–7.8	Low.
A–1, A–2, A–4	3–5	35–100	25–100	15–100	5–45	>20	0.01–0.04	7.9–8.4	Low.
A–7	----------	85–95	85–95	80–90	75–85	0.6–2.0	0.18–0.20	6.1–7.3	Low.
A–6, A–4	0–5	70–90	65–85	50–75	40–65	0.6–2.0	0.10–0.17	6.1–7.8	Low.
A–4	10–15	65–85	55–75	45–70	40–65	<0.2	(1)	7.9–8.4	Low.
A–7	----------	85–95	85–95	80–90	65–75	0.6–2.0	0.18–0.20	5.6–7.3	Low.
A–6	----------	90–100	90–100	85–95	75–95	<0.2	0.12–0.17	5.6–7.8	Moderate.
A–4	----------	65–75	65–75	60–75	55–75	<0.2	0.08–0.13	7.4–8.4	Low.
A–7	----------	100	100	95–100	80–100	0.2–0.6	0.16–0.18	6.1–7.3	Moderate.
A–6, A–7	----------	100	95–100	90–100	80–100	<0.2	0.12–0.14	6.1–8.4	Moderate.
A–6	----------	100	95–100	90–100	90–100	<0.2	(1)	7.9–8.4	Moderate.
A–4	----------	95–100	95–100	90–100	60–75	0.6–2.0	0.16–0.17	5.6–7.3	Low.
A–4	----------	95–100	95–100	75–85	45–55	0.6–2.0	0.14–0.15	5.6–7.8	Low.
A–4	----------	95–100	95–100	85–95	45–60	0.6–2.0	(1)	6.6–8.4	Low.
A–4	----------	75–90	70–85	65–80	51–70	0.6–2.0	0.15–0.18	5.1–6.0	Low.
A–4, A–6	<1	65–85	60–80	50–70	40–65	0.6–2.0	0.10–0.16	5.6–7.3	Low.
A–4	<2	60–75	55–65	45–60	35–55	<0.2	0.08–0.12	6.6–8.4	Low.
A–7, A–6	<2	90–100	85–95	80–90	70–80	0.6–2.0	0.18–0.20	5.6–7.3	Low.
A–6	2–10	85–95	80–90	70–80	60–70	0.6–2.0	0.14–0.18	6.1–7.8	Low.
A–4	10–15	65–80	60–70	50–60	40–55	<0.2	0.10–0.14	6.1–8.4	Low.
A–7, A–6	----------	95–100	90–100	85–100	75–95	0.2–0.6	0.16–0.18	5.6–7.3	Moderate.
A–7, A–6	----------	90–100	90–100	85–95	75–95	<0.2	0.12–0.14	6.1–7.8	Moderate.
A–4	----------	70–80	65–75	60–75	55–75	<0.2	(1)	7.4–7.8	Moderate.

TABLE 7.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification
	Bedrock	Seasonal high water table			Unified
	Feet	*Feet*	*Inches*		
*Lordstown: LWC, LXD	1½–3½	>1½–3½	0–10	Channery silt loam	GM, ML, OL
			10–15	Channery silt loam or loam	GM
			15–22	Channery silt loam or loam	GM
			22	Fractured shale and siltstone bedrock interspersed with silty fines to a depth of 39 inches. Massive below a depth of 39 inches.	
For Arnot part of LXD, see Arnot series.					
Lyons: Ly	>3½	0–½	0–7	Silt loam	ML, OL, CL
			7–22	Silt loam	CL, ML
			22–34	Gravelly loam, silt loam, fine sandy loam, or clay loam.	ML, CL, GC, SC
			34–50	Gravelly loam, silt loam, or fine sandy loam.	ML, CL, GC, SC
Made land, chemical waste: Ma. Too variable for valid estimate.					
Madrid: MdB, MdC, MdC2, MdCK, MgB, MgC.	>3½	>3	0–9	Fine sandy loam, gravelly loam	ML, CL, SM
			9–42	Fine sandy loam, gravelly loam	SM, ML, CL
			42–74	Fine sandy loam, gravelly loam	ML, CL, SM
Manheim: MhA, MhB	>3½	½–1	0–13	Silt loam	ML, CL
			13–36	Heavy loam or light silty clay loam, or their gravelly analogs.	ML, CL
			36–60	Gravelly silt loam or loam, or their very gravelly analogs.	GC, SC
Manlius: MnB, MnC, MnD	1½–3½	>3	0–10	Shaly silt loam	ML, CL
			10–19	Very shaly silt loam	SM, SC, GM, GC
			19–23	Shale fragments interspersed with silt loam.	GM, GC
			23	Shale bedrock.	
Mardin: MoB, MoC, MoD, MPE	>3½	1–2	0–4	Channery silt loam	ML, OL
			4–21	Channery silt loam or loam	ML, CL
			21–72	Very channery silt loam or loam	GC, GM, SM, SC
Mardin, moderately shallow variant: MrB, MrC.	1½–3½	1–2	0–7	Channery silt loam	ML, OL
			7–19	Channery silt loam or loam	ML, CL
			19–28	Channery or very channery silt loam or loam.	GM, GC, SM, SC
			28	Gray sandstone bedrock.	
*Martisco: Ms	>3½	0	13–0	Decomposed organic material	Pt
			0–40	Marl	
For Warners part of Ms, see Warners series.					
Minoa: MtA, MtB	>3½	½–1	0–10	Fine sandy loam	ML, SM, OL, SC
			10–38	Loamy very fine sand, very fine sandy loam.	ML, SM, SC
			38–60	Stratified very fine sand, fine sand and silt.	ML, SM
Mohawk: MwB, MwC, MwD	>3½	>1	0–19	Silt loam	ML, CL
			19–40	Shaly silt loam or loam	CL, SC, ML
			40–60	Shaly loam or silt loam	ML, CL, SC
Naumburg: Na	>3½	½–1	0–9	Loamy fine sand	SM
			9–50	Fine sand, loamy fine sand	SP, SM
Niagara: NgA	>3½	½–1	0–23	Silt loam, very fine sandy loam	ML, OL
			23–39	Silt loam, silty clay loam	ML, CL
			39–50	Stratified silt loam and very fine sandy loam with thin layers of loamy very fine sand.	CL, ML

significant to engineering—Continued

Classification—con.	Coarse fraction greater than 3 inches	Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
AASHO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)				
	Percent					*Inches per hour*	*Inches per inch of soil*	*pH*	
A–4	<2	65–75	60–70	50–60	45–60	0.6–2.0	0.13–0.15	4.5–5.5	Low.
A–4	5–10	60–70	55–65	45–55	40–50	0.6–2.0	0.09–0.13	4.5–5.5	Low.
A–2, A–4	10–25	50–60	45–55	35–45	30–40	0.6–2.0	0.08–0.11	4.5–6.0	Low.
A–7	----------	90–100	90–100	85–95	75–85	0.6–2.0	0.19–0.21	5.6–7.3	Low.
A–6	----------	80–95	75–95	70–90	60–80	0.6–2.0	0.15–0.19	6.1–7.8	Low.
A–4	<5	65–80	60–80	55–75	45–65	0.6–2.0	0.10–0.16	6.1–8.4	Low.
A–4	10–15	60–85	55–75	45–70	40–60	<0.2	(1)	7.9–8.4	Low.
A–4	<5	75–95	70–95	60–90	40–65	0.6–2.0	0.13–0.16	5.1–7.3	Low.
A–4	<5	75–95	70–95	60–90	40–70	0.6–2.0	0.12–0.15	5.1–7.3	Low.
A–4	<5	70–95	65–95	55–90	36–70	0.06–0.6	0.11–0.14	6.1–8.4	Low.
A–4, A–6	----------	85–95	80–90	70–80	55–65	0.6–2.0	0.17–0.19	5.6–7.3	Low.
A–4, A–6	----------	80–95	75–90	65–80	51–65	0.6–2.0	0.13–0.18	5.6–7.8	Low.
A–4	<10	65–75	55–65	45–55	36–45	<0.2	(1)	6.6–8.4	Low.
A–6	----------	80–90	75–85	65–75	51–60	0.6–2.0	0.16–0.18	4.5–6.0	Low.
A–4	----------	65–75	60–70	50–60	36–45	0.6–2.0	0.12–0.14	4.5–6.0	Low.
A–2	----------	45–55	35–45	25–35	20–30	0.6–2.0	0.05–0.07	4.5–6.0	Low.
A–5, A–7, A–4	<2	70–95	65–95	60–95	55–95	0.6–2.0	0.14–0.20	5.1–6.0	Low.
A–4	2–5	70–100	65–100	60–95	55–95	0.6–2.0	0.11–0.20	5.1–7.3	Low.
A–4, A–2	5–15	55–75	50–65	40–55	30–50	<0.2	(1)	5.6–8.4	Low.
A–4, A–5, A–7	<2	70–95	65–95	60–95	55–95	0.6–2.0	0.14–0.20	5.1–6.0	Low.
A–4	2–5	70–100	65–100	60–85	55–95	0.6–2.0	0.11–0.20	5.1–6.0	Low.
A–4, A–2	5–15	55–75	50–65	40–55	30–50	<0.2	(1)	5.6–7.3	Low.
----------	----------	----------	----------	----------	----------	0.6–6.0	0.25–0.35	6.1–8.4	----------
----------	----------	----------	----------	----------	----------	<0.2	----------	7.9–8.4	----------
A–4	----------	95–100	95–100	70–85	40–55	0.6–2.0	0.15–0.16	5.1–7.3	Low.
A–4	----------	95–100	95–100	85–95	36–60	0.6–2.0	0.14–0.17	5.1–7.3	Low.
A–4, A–2	----------	95–100	95–100	85–95	30–60	0.6–2.0	(1)	5.6–8.4	Low.
A–6	<2	90–95	80–95	70–90	60–80	0.6–2.0	0.17–0.20	5.6–7.3	Low.
A–4	<10	70–80	60–75	50–65	40–60	0.6–2.0	0.11–0.15	5.6–7.3	Low.
A–4	<10	70–80	55–70	45–60	40–55	<0.2	(1)	6.6–8.4	Low.
A–2	----------	95–100	95–100	90–100	15–20	>6.0	0.07–0.11	4.5–5.5	Low.
A–3, A–2	----------	95–100	95–100	90–100	5–15	>6.0	0.05–0.07	4.5–6.0	Low.
A–4, A–7, A–6	----------	95–100	95–100	90–100	55–100	0.6–2.0	0.16–0.21	5.6–7.3	Low.
A–4, A–6	----------	95–100	95–100	90–100	70–95	0.2–0.6	0.16–0.20	5.6–7.8	Low.
A–4	----------	95–100	95–100	85–100	55–100	<0.6	(1)	6.6–8.4	Low.

TABLE 7.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification
	Bedrock	Seasonal high water table			Unified
	Feet	*Feet*	*Inches*		
Odessa: OdA, OdB	>3½	½–1	0–10	Silty clay loam	ML, CL, OL
			10–28	Silty clay, clay, silty clay loam	CH, ML, CL
			28–60	Silty clay, silty clay loam, or layers of clay with thin lenses of silt and very fine sand.	CL, MH, CH
*Ontario: OgB, OnC, OnC2, OnCK, OpD. For Madrid part of OpD, see Madrid series.	>3½	>2½	0–19	Loam, gravelly loam, very fine sandy loam.	ML, CL, SM
			19–28	Gravelly heavy loam	ML, CL, SM, SC, GM, GC
			28–60	Gravelly loam or very gravelly loam.	SM, SC, GM, GC
Otisville: OtB, OtC	>3½	>3	0–14	Gravelly loamy sand	GM–SM
			14–33	Very gravelly loamy sand, loamy fine sand, or sand.	GW, GP, GM, SW, SP, SM
			33–96	Stratified very gravelly sand, variable.	
Ovid: OvA, OvB	>3½	½–1	0–13	Silt loam	ML, CL, OL
			13–30	Silty clay loam or clay loam, or their shaly analogs.	CL
			30–76	Silty clay loam or clay loam to fine sandy loam in places, or their shaly, gravelly or very shaly, or very gravelly analogs.	CL, ML, SC, GC
Palatine: PaB, PaC	1½–3½	>3	0–9	Shaly silt loam	ML, OL
			9–20	Very shaly silt loam	ML
			20–28	Fractured shale interspersed with silt loam.	GC
			28–60	Soft shale bedrock.	
Palms: Pb	>3½	0	0–24	Muck	Pt
			24–50	Clay loam, fine sandy loam, loam, silt loam, variable.	
*Palmyra: PgA, PgB, PgC, PHD, PHE, PHF. For Howard parts of PHD, PHE, and PHF, see Howard series.	>3½	>3	0–9	Gravelly loam	ML
			9–19	Gravelly loam, gravelly sandy loam, gravelly silt loam.	ML, CL, SC, SM, GC, GM
			19–31	Gravelly heavy loam, clay loam, or heavy fine sandy loam.	GM, GC, CL, ML, SC, SM
			31–60	Stratified gravel and sand	GW, GC, SW, SM
Phelps: PpA, PpB	>3½	1–2	0–12	Gravelly loam	ML, OL
			12–28	Gravelly heavy loam, sandy loam, or clay loam.	GM, GC, ML, CL, SC, SM
			28–50	Stratified very gravelly sand, thin layers of silt in places.	GW, GC, SW, SM
Rhinebeck: Rh	>3½	½–1	0–8	Silt loam	CL, ML
			8–36	Silty clay, silty clay loam, clay	CL, ML
			36–50	Silty clay loam, silty clay with lenses of silt, very fine sand and fine sand.	CL
Saprists and Fluvaquents, ponded: SA. Too variable for valid estimates.					
Schoharie: ScB, ScC, SdD, SEE	>3½	1½–3	0–12	Silt loam, silty clay loam	CL, ML, OL
			12–26	Silty clay, silty clay loam	CL
			26–55	Silty clay with varves of silt and very fine sand.	CL
Teel: Te	>3½	21–2	0–10	Silt loam	ML, CL, OL
			10–60	Silt loam	ML, CL

significant to engineering—Continued

Classification—con.	Coarse fraction greater than 3 inches	Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
AASHO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)				
	Percent					*Inches per hour*	*Inches per inch of soil*	*pH*	
A–7, A–6		95–100	95–100	95–100	90–100	0.2–0.6	0.17–0.18	6.1–7.3	Moderate.
A–7, A–6		95–100	95–100	95–100	90–100	<0.2	0.12–0.17	6.1–7.8	Moderate.
A–4, A–7, A–6		95–100	95–100	90–100	80–100	<0.06	(1)	7.4–8.4	Moderate.
A–4	0–5	75–95	70–95	65–85	40–60	0.6–2.0	0.13–0.17	5.1–7.3	Low.
A–4, A–2	0–10	70–90	65–85	60–80	30–55	0.6–2.0	0.11–0.14	5.6–7.8	Low.
A–4, A–2	0–15	60–90	55–85	45–75	20–50	<0.2	0.06–0.10	7.4–8.4	Low.
A–1, A–2	0–10	65–85	60–80	35–55	15–30	>20.0	0.06–0.07	4.5–5.5	Low.
A–1, A–2	5–10	45–65	40–60	20–30	0–10	>20.0	0.02–0.05	4.5–5.5	Low.
A–6, A–7		95–100	95–100	90–100	75–85	0.6–2.0	0.20–0.21	5.6–7.3	Low.
A–7, A–6		80–100	75–100	70–100	65–95	0.06–0.2	0.11–0.17	5.6–7.8	Moderate.
A–6, A–4	<5	60–95	55–95	50–95	40–90	<0.2	(1)	7.4–8.4	Low to moderate.
A–7		90–100	80–90	75–85	70–85	0.6–2.0	0.17–0.19	5.6–7.3	Low.
A–7, A–6, A–4		65–75	65–75	60–75	55–75	0.6–2.0	0.13–0.15	5.6–7.8	Low.
A–2		25–35	20–30	15–25	15–25		0.04–0.06	6.6–8.4	Low.
						2.0–6.0	0.25–0.35	5.6–7.8	
A–4	0–5	75–85	70–80	65–75	51–65	0.6–6.0	0.13–0.15	5.6–7.3	Low.
A–4	0–5	70–85	65–80	55–70	40–60	0.6–6.0	0.09–0.17	5.6–7.3	Low.
A–2, A–4	0–10	55–85	50–75	40–65	30–55	0.6–6.0	0.07–0.13	6.1–7.8	Low.
A–2, A–1	0–15	30–55	20–35	10–20	5–10	>6.0	0.01–0.04	7.9–8.4	Low.
A–4	0–5	70–85	65–80	60–75	51–65	0.6–2.0	0.12–0.15	5.6–7.3	Low.
A–4	0–5	60–75	55–70	45–65	40–55	0.6–2.0	0.08–0.12	6.1–7.8	Low.
A–2, A–1	0–15	30–55	20–35	10–20	5–10	>2.0	(1)	7.9–8.4	Low.
A–6, A–7, A–4		95–100	95–100	90–100	80–95	0.6–2.0	0.20–0.21	6.1–7.3	Low.
A–7, A–6		95–100	95–100	95–100	85–95	<0.2	0.12–0.17	6.1–7.8	Moderate.
A–7, A–6		95–100	95–100	95–100	80–100	<0.2	(1)	7.4–8.4	Moderate.
A–6, A–7		95–100	95–100	95–100	90–100	0.2–2.0	0.17–0.21	6.1–7.3	Low to moderate.
A–7, A–6		95–100	95–100	95–100	90–100	<0.2	0.13–0.17	6.6–7.8	Moderate.
A–7, A–6		95–100	95–100	90–100	80–100	<0.06	0.13–0.14	7.4–8.4	Moderate.
A–6		100	100	95–100	80–95	0.6–2.0	0.19–0.21	6.1–7.3	Low.
A–6		95–100	95–100	95–100	75–100	0.6–2.0	0.19–0.20	6.1–7.8	Low.

TABLE 7.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification
	Bedrock	Seasonal high water table			Unified
	Feet	*Feet*	*Inches*		
Urban land: Ub. Too variable for valid estimates.					
Varick: Va	1½–3½	0–½	0–8	Silt loam	ML, CL, OL
			8–30	Silt loam, loam, or silty clay loam, or their shaly analogs.	ML, CL
			30–34	Shaly silt loam, loam, or silty clay loam.	ML, CL, GC, SC
			34–50	Shale bedrock.	
Volusia: VoB, VoC	>3½	½–1	0–7	Channery silt loam	ML, OL
			7–15	Channery silt loam	ML, CL
			15–46	Channery silt loam	GM, GC
			46–53	Very channery silt loam or loam, or their channery analogs.	GM, GC
Volusia, moderately shallow variant: VuB.	1½–3½	½–1	0–9	Channery silt loam	ML, OL
			9–14	Channery silt loam or loam	ML, CL
			14–26	Channery silt loam or loam	GM, GC, ML, CL
			26	Sandstone bedrock.	
Wampsville: WaA, WaB, WaC	>3½	>3	0–13	Gravelly silt loam	CL, ML, SC
			13–36	Gravelly silty clay loam, clay loam, or sandy clay loam.	CL, ML, SC, SM
			36–72	Stratified sand, gravel, very gravelly silty clay loam, sandy loam, silt loam, or loam.	SC, SM, GC, GM
Wareham: Wb	>3½	0–1	0–8	Loamy fine sand	SM, SW
			8–50	Loamy fine sand, fine sand, sand	SP, SM, SW
Warners Mapped only in an undifferentiated unit with Martisco soils.	>5	[2]0	0–12	Silt loam, loam	CL, ML
			12–30	Fine marl	
			30–75	Silt loam, silty clay loam, silty clay.	CL, MH
*Wassaic: WcB, WcC, WDD For Benson part of WDD, see Benson series.	1½–3½	1½–3½	0–9	Silt loam	ML, CL
			9–23	Silt loam, loam, or silty clay loam, or their channery analogs.	ML, CL, SC, SM
			23–35	Channery loam, fine sandy loam, silt loam, or silty clay loam.	GM, GC
			35	Limestone bedrock.	
Wayland: Wn	>3½	[2]0–½	0–9	Silt loam	OL
			9–42	Silt loam, silty clay loam	ML, CL
			42–50	Gravelly silt loam	ML
Weaver: Wv	>5	[2]1–2	0–12	Silt loam	ML, CL, OL
			12–29	Silt loam, loam, silty clay loam	ML, CL
			29–50	Silt loam, rich in soft marl material.	ML, CL
Williamson: WwA, WwB, WwC, WwC2	>5	1–2	0–9	Silt loam	ML, CL
			9–22	Silt loam, very fine sandy loam	ML, CL
			22–45	Very fine sandy loam, silt loam	ML, CL
			45–60	Very fine sandy loam or stratified silts and very fine sands with thin layers of sand, clay, or gravel; variable.	

[1] Roots of most plants do not penetrate this layer, so water in it is not available to plants.

significant to engineering—Continued

Classification—con.	Coarse fraction greater than 3 inches	Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
AASHO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)				
	Percent					*Inches per hour*	*Inches per inch of soil*	*pH*	
A–4, A–6, A–7		85–100	80–95	75–90	65–80	0.6–2.0	0.17–0.20	5.6–7.3	Low.
A–4, A–6		80–95	70–95	60–85	51–60	<0.2	0.12–0.19	5.6–7.8	Low.
A–4		55–80	50–75	45–75	35–60	<0.2	0.08–0.15	7.4–8.4	Low.
A–4, A–6	2–5	75–85	70–80	65–75	55–65	0.6–2.0	0.15–0.17	5.1–6.5	Low.
A–4	2–5	75–85	70–80	65–75	55–65	0.6–2.0	0.14–0.16	5.1–6.5	Low.
A–4	5–10	65–75	55–65	45–55	40–50	<0.06	(1)	5.6–7.8	Low.
A–4, A–2	10–15	55–65	45–55	35–45	30–40	<0.06	(1)	7.4–8.4	Low.
A–4, A–6	0–5	75–85	70–80	65–75	55–65	0.6–2.0	0.15–0.17	5.1–6.0	Low.
A–4	0–5	75–85	70–80	65–75	55–65	0.6–2.0	0.14–0.16	5.1–6.0	Low.
A–4	5–10	65–75	60–70	50–60	45–55	<0.06	(1)	5.6–7.3	Low.
A–4	<5	75–85	70–80	60–70	45–55	0.6–2.0	0.15–0.17	5.6–7.3	Low.
A–4	<5	75–90	70–80	60–70	45–60	0.6–2.0	0.09–0.14	6.1–7.8	Low.
A–4, A–2	5–10	55–75	45–65	35–55	25–45	0.6–20	0.07–0.13	6.6–8.4	Low.
A–2		95–100	95–100	85–95	10–20	>20	0.10–0.11	4.5–6.0	Low.
A–3, A–2		95–100	95–100	85–100	0–20	>20	0.04–0.10	5.1–6.0	Low.
A–6, A–7		100	100	85–100	60–90	0.6–2.0	0.18–0.21	7.4–8.4 7.9–8.4	Low.
A–7, A–7		100	100	90–100	80–95	0.06–2.0		7.9–8.4	Low.
A–4	<5	85–95	80–90	70–80	51–60	0.6–2.0	0.17–0.20	5.6–7.3	Low.
A–4	0–10	75–95	70–95	65–85	45–65	0.6–2.0	0.12–0.17	5.6–7.8	Low.
A–2, A–4	5–10	60–70	55–65	45–55	30–40	0.6–2.0	0.08–0.13	7.4–8.4	Low.
A–5, A–4		100	100	95–100	95–100	0.6–2.0	0.20–0.21	6.6–7.8	Low.
A–4, A–6		100	95–100	90–100	85–95	0.06–0.2	0.16–0.20	6.6–8.4	Low.
A–4		80–90	75–85	70–80	60–70	0.06–0.2	(1)	7.4–8.4	Low.
A–4, A–7, A–6		100	100	90–100	75–90	0.6–2.0	0.18–0.21	6.6–8.4	Low.
A–4, A–6		100	100	85–100	65–95	0.6–2.0	0.17–0.20	7.9–8.4	Low.
A–4, A–6		100	100	90–100	75–100	0.6–2.0	(1)	7.9–8.4	Low.
A–4, A–7		95–100	95–100	90–100	85–95	0.6–2.0	0.20–0.21	4.5–6.0	Low.
A–4		95–100	95–100	80–100	60–100	0.6–2.0	0.16–0.20	4.5–6.0	Low.
A–4		95–100	95–100	90–100	65–100	<0.6	0.08–0.12	4.5–6.5	Low.

[2] Subject to flooding.

TABLE 8.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in for referring to other series that appear

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Fill material	Highway location	Embankment foundations	Foundations for low buildings
Alton: AlA, AlB, AlC	Poor: too gravelly; low volume.	Good	Good	Highway grade location not critical above seasonal high water table, which is normally several feet below surface but in places is at a depth of 5 feet; local seepage and some sloughing in cuts; subgrade in cuts subject to differential frost heave; trafficability generally good.	Generally adequate strength for moderately high embankments; underlain by wet compressible materials in places.	Adequate strength; seasonal high water table at a depth of 5 feet in places.
*Angola: AnB, AnC — For Darien part of AnB and AnC, see Darien series.	Poor: low volume.	Unsuited: none present.	Poor: bedrock at a depth of 20 to 40 inches.	Bedrock at a depth of 20 to 40 inches; seasonal water table at a depth of 1/2 to 1 foot; rock in most cuts; subject to seepage.	Adequate strength for high embankments; bedrock at a depth of 20 to 40 inches.	Adequate strength; seasonal high water table at a depth of 1/2 to 1 foot; bedrock at a depth of 20 to 40 inches.
Appleton: AoA, ApA, ApB.	AoA fair: limited volume. ApA and ApB poor: many channery fragments.	Unsuited: none present.	Good to fair: excessive fines in places; few large stones.	Seasonal water table at a depth of 1/2 to 1 foot; seepage and sloughing in cuts; subgrade in cuts generally good but seasonally wet; subject to boulder heave in places; trafficability is poor when wet.	Adequate strength for embankments.	Adequate strength; seasonal high water table at a depth of 1/2 to 1 foot.
Arkport: ArB, ArC, ArD.	Good to fair: sandy and limited volume in places.	Poor: excessive fines.	Fair: excessive fines in places; highly erodible and subject to soil blowing.	Highway grade location not critical above seasonal high water table which is normally below a depth of 3 feet; cut slopes are highly erodible and subject to soil blowing; subgrade in cuts subject to differential frost heave because of stratification; trafficability generally good.	Generally adequate for low embankments; underlain by wet compressible soil material in places.	Generally adequate strength; underlain by wet compressible soil material in places; large settlement possible under vibratory loads.
*Arnot: ATB, AVF — For the Lordstown part of AVF, see Lordstown series for interpretations other than those involving slope.	Poor: too many channery fragments and low volume; AVF is very steep.	Unsuited: none present.	Poor: association AVF is very steep; few large stones; bedrock at a depth of 10 to 20 inches.	Sandstone bedrock at a depth of 10 to 20 inches; seasonal high water table perched on rock in places; rock in most cuts; seepage above and through rock strata; trafficability generally good on unit ATB and poor on association AVF, which is very steep.	Adequate strength for high embankments; sandstone bedrock at a depth of 10 to 20 inches; association AVF is very steep and generally requires bonding measures.	Adequate strength; sandstone bedrock at a depth of 10 to 20 inches; seasonal high water table perched on rock in places; association AVF has very steep slopes.
*Aurora: AwB, AwC, AwD, AwD2, AXE. For Farmington part of AXE, see Farmington series for interpretations other than those involving slope. Rock outcrop part of AXE is not rated in the table.	Poor to fair: shaly and limited volume; association AXE has steep and very steep, unfavorable slopes.	Unsuited: none present.	Poor: bedrock at a depth of 20 to 40 inches; low volume; association AXE has very steep, unfavorable slopes.	Shale bedrock at a depth of 20 to 40 inches; seasonal high water table at a depth of 1 1/2 to 2 feet; rock in most cuts; seepage above and through rock strata; subject to differential frost heave in places; trafficability poor on association AXE, which is very steep, and all other units when wet.	Adequate strength for high embankments; shale bedrock at a depth of 20 to 40 inches; association AXE is very steep and generally requires bonding measures.	Adequate strength; shale bedrock at a depth of 20 to 40 inches; seasonal high water table at a depth of 1 1/2 to 2 feet; association AXE has very steep, unfavorable slopes.

interpretations

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions in the first column of this table]

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
Rapidly permeable or very rapidly permeable throughout; seasonal high water table at a depth of 5 feet in places; unit AlC has unfavorable rolling slopes.	High permeability; low compressibility; good to fair compaction characteristics; good for outside shell.	Drainage not needed; well drained to excessively drained.	Low to moderate available water capacity; rapid intake rate; unit AlC is rolling.	Rapidly or very rapidly permeable throughout; unit AlC is rolling; difficult to vegetate.	Very gravelly below a depth of 17 inches; well drained to somewhat excessively drained; unit AlC is rolling; low to moderate available water capacity; difficult to vegetate.
Slowly permeable or very slowly permeable; seasonal high water table at a depth of 1/2 to 1 foot; bedrock at a depth of 20 to 40 inches.	Bedrock at a depth of 20 to 40 inches; low volume.	Slowly permeable or very slowly permeable; bedrock at a depth of 20 to 40 inches; seasonal high water table at a depth of 1/2 to 1 foot.	Moderate to high available water capacity; slow intake rate; seasonal high water table at a depth of 1/2 to 1 foot; slowly permeable or very slowly permeable; unit AnC is erodible.	Bedrock at a depth of 20 to 40 inches.	Bedrock at a depth of 20 to 40 inches; somewhat poorly drained; subject to prolonged flow.
Slowly permeable or very slowly permeable below a depth of about 30 inches; seasonal high water table at a depth of 1/2 to 1 foot; bedrock below a depth of 3 1/2 feet in places.	Slowly permeable or very slowly permeable below a depth of 30 inches; low to medium compressibility; good to fair compaction characteristics; few large stones in places.	Slowly permeable or very slowly permeable below a depth of 30 inches; seasonal high water table at a depth of 1/2 to 1 foot; ditchbanks unstable in places.	Low to moderate available water capacity; moderate to slow intake rate; seasonal high water table at a depth of 1/2 to 1 foot; rooting depth is mainly in top 18 to 24 inches.	Units AoA and ApA nearly level; unit ApB subject to seepage in places; otherwise no adverse features.	Units AoA and ApA are nearly level; somewhat poorly drained; subject to prolonged waterflow.
Very pervious layers; seasonal high water table is normally below a depth of 3 feet; unit ArD has unfavorable relief.	Medium to low permeability and compressibility; fair to good compaction characteristics; susceptible to piping; highly erodible.	Not applicable; well drained.	Moderate to high available water capacity; rooting depth is unrestricted but is mainly in top 30 to 40 inches; moderate intake rate; highly erodible and subject to soil blowing.	Undulating to hilly relief in most places; permeability is variable; subject to channel siltation; highly erodible and subject to soil blowing.	Highly erodible and subject to soil blowing; well drained; undulating to hilly relief in most places; subject to channel siltation.
Not applicable; sandstone bedrock at a depth of 10 to 20 inches.	Sandstone bedrock at a depth of 10 to 20 inches; low volume; large stones in places.	Generally not applicable; sandstone bedrock at a depth of 10 to 20 inches; association AVF has very steep, unfavorable slopes.	Low or very low available water capacity; moderate intake rate; rooting is confined to the 10- to 20-inch zone above the bedrock; association AVF has very steep, unfavorable slopes.	Not applicable; sandstone bedrock at a depth of 10 to 20 inches.	Sandstone bedrock at a depth of 10 to 20 inches; well drained to moderately well drained; association AVF has very steep, unfavorable slopes.
Shale bedrock at a depth of 20 to 40 inches; slowly permeable below a depth of about 18 inches; seasonal high water table at a depth of 1 1/2 to 2 feet; units AwD, AwD2, and association AXE have moderately steep to very steep, unfavorable slopes.	Shale bedrock at a depth of 20 to 40 inches; low volume.	Slowly permeable below a depth of about 18 inches; seasonal high water table at a depth of 1 1/2 to 2 feet; units AwD and AwD2 are moderately steep; association AXE has very steep, unfavorable slopes.	Moderate to high available water capacity; moderate intake rate; rooting depth confined mainly to 20- to 40-inch zone above the bedrock; seasonal high water table at depth of 1 1/2 to 2 feet; units AwC, AwD, and AwD2 are sloping to moderately steep and erodible; association AXE has very steep, unfavorable slopes.	Shale bedrock at a depth of 20 to 40 inches; slowly permeable below a depth of about 18 inches; association AXE has very steep, unfavorable slopes.	Shale bedrock at a depth of 20 to 40 inches; moderately well drained; association AXE has very steep, unfavorable slopes.

TABLE 8.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Fill material	Highway location	Embankment foundations	Foundations for low buildings
*Benson: BeB, BeC, BNC, BNF. For Wassaic part of BNC and BNF, see Wassaic series. Rock outcrop part of BNC and BNF is not rated in the table.	Poor: low volume; many channery fragments in places; unit BeC and associations BNC and BNF include or have moderately steep to very steep, unfavorable slopes.	Unsuited: none present.	Poor: limestone bedrock at a depth of 10 to 20 inches.	Limestone bedrock at a depth of 10 to 20 inches; rock in most cuts; seepage above rock; Benson soils are very rocky in associations BNC and BNF, which are level to moderately steep, and steep and very steep, respectively; trafficability is poor in association BNF and in places in association BNC.	Adequate strength for high embankments; limestone bedrock at a depth of 10 to 20 inches; association BNF has very steep slopes that require bonding measures in places.	Limestone bedrock at a depth of 10 to 20 inches; adequate strength; association BNF has very steep, unfavorable slopes.
Bombay: BoB	Poor: too gravelly.	Unsuited: none present.	Good to fair: excessive fines in places; large stones in places.	Seasonal high water table at a depth of 1½ to 2 feet; cut slopes subject to seepage and sloughing; subgrade in cuts generally good but seasonally wet; subject to boulder heave; trafficability generally good.	Adequate strength for high embankments.	Adequate strength; seasonal high water table at a depth of 1½ to 2 feet.
Brockport Mapped only in an undifferentiated unit with Lockport soils.	Poor to fair: limited volume; high content of clay; shaly in places.	Unsuited: none present.	Poor: shale bedrock at a depth of 20 to 40 inches; low volume; excessive fines; moderate shrink-swell potential.	Shale bedrock at a depth of 20 to 40 inches; seasonal high water table at a depth of ½ to 1 foot; rock in most cuts; excessive seepage in cuts; subject to differential frost heave; trafficability poor when wet.	Generally adequate strength for moderate to high embankments; shale bedrock at a depth of 20 to 40 inches; moderate shrink-swell potential.	Adequate strength; shale bedrock at a depth of 20 to 40 inches; seasonal high water table at a depth of ½ to 1 foot; moderate shrink-swell potential.
*Camillus: CaB, CaC, CaC2, CaD2, CBE. For Lairdsville part of CBE, see Lairdsville series for interpretations other than those involving slope.	Fair to poor: shaly in places; limited volume; unit CBE has steep, unfavorable slopes.	Unsuited: none present.	Poor: shale bedrock at a depth of 20 to 40 inches; low volume.	Shale bedrock at a depth of 20 to 40 inches; rock in most cuts; seepage above and through the rock strata; trafficability is generally good except on unit CBE, which is steep.	Adequate strength for high embankments; shale bedrock at a depth of 20 to 40 inches; unit CBE is steep and requires bonding measures in places.	Adequate strength; shale bedrock at a depth of 20 to 40 inches; unit CBE has steep, unfavorable slopes.
Canandaigua: Cd	Good to fair: normally wet in natural state.	Unsuited: none present.	Poor: excessive fines; normally wet; highly erodible.	Prolonged high water table at or near surface; depressional topography; subgrade unstable; poor trafficability.	Generally adequate strength for low embankments; commonly underlain by wet, compressible soil material.	Low strength; prolonged high water table at or near the surface; commonly underlain by wet, compressible soil material; highly susceptible to caving.
Carlisle: Ce	Unsuited: muck; possibly can be used as amendment for mineral soil.	Unsuited: none present.	Unsuited: organic soil.	Prolonged high water table at or near surface; wet compressible organic material 51 inches or more thick over variable mineral soils; suitable drainage outlets difficult to locate; very poor to no trafficability.	Compressible organic material 51 inches or more thick over variable mineral soils.	Prolonged high water table at or near the surface; compressible organic material 51 inches thick or more over variable mineral soils.

interpretations—Continued

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
Limestone bedrock at a depth of 10 to 20 inches.	Limestone bedrock at a depth of 10 to 20 inches; low volume.	Somewhat excessively drained or excessively drained.	Very low to moderate available water capacity; moderate intake rate; rooting depth is confined to the 10- to 20-inch zone above the bedrock; not applicable on Benson soils in associations BNC and BNF, which are very rocky and include or have unfavorable slopes.	Limestone bedrock at a depth of 10 to 20 inches; associations BNC and BNF are very rocky and include or have slopes of more than 20 percent.	Limestone bedrock is at a depth of 10 to 20 inches; somewhat excessively drained or excessively drained; Benson soils in associations BNC and BNF are very rocky and include or have slopes of more than 15 percent.
Moderately permeable; seasonal high water table at a depth of 1½ to 2 feet; bedrock below a depth of 3½ feet in places.	Low to medium compressibility; generally low permeability; medium susceptibility to piping; good to fair compaction characteristics; large stones in places.	Moderately permeable; seasonal high water table at a depth of 1½ to 2 feet.	Moderate to high available water capacity; rooting depth is mainly in top 18 to 24 inches; moderate intake rate; seasonal high water table at a depth of 1½ to 2 feet.	Moderately permeable; subject to seepage in places; channel siltation in places.	Moderately well drained; channel siltation in places.
Shale bedrock at a depth of 20 to 40 inches; very slowly permeable below a depth of about 16 inches; seasonal high water table at a depth of ½ to 1 foot.	Shale bedrock at a depth of 20 to 40 inches; low volume; excessive fines.	Very slowly permeable below a depth of about 16 inches; shale bedrock at a depth of 20 to 40 inches; seasonal high water table at a depth of ½ to 1 foot.	Moderate to high available water capacity; slow intake rate; rooting depth is mainly in top 18 to 24 inches; seasonal high water table at a depth of ½ to 1 foot.	Shale bedrock at a depth of 20 to 40 inches; very slowly permeable below a depth of about 16 inches; dense, clayey subsoil.	Shale bedrock at a depth of 20 to 40 inches; somewhat poorly drained; dense, clayey subsoil.
Shale bedrock at a depth of 20 to 40 inches.	Shale bedrock at a depth of 20 to 40 inches; low volume.	Moderately permeable; shale bedrock at a depth of 20 to 40 inches; seasonal high water table at a depth of 1½ feet in very few places; unit CBE has steep, unfavorable slopes.	Moderate to high available water capacity; moderate intake rate; rooting depth is mainly in the 20- to 40-inch zone above the bedrock; hazard of erosion on all units; unit CBE has steep, unfavorable slopes.	Shale bedrock at a depth of 20 to 40 inches; moderately permeable; unit CBE has steep, unfavorable slopes.	Shale bedrock at a depth of 20 to 40 inches; dominantly well drained; hazard of erosion; unit CBE has steep, unfavorable slopes.
Pervious layers; prolonged high water table at or near surface; depressional topography.	Medium compressibility; low permeability; susceptible to piping; fair to poor compaction characteristics; normally wet in natural state; highly erodible.	Slowly permeable below a depth of about 31 inches; prolonged high water table at or near the surface; depressional topography; unstable ditchbanks; natural outlets are inadequate in places.	Generally not applicable; prolonged high water table at or near surface.	Depressional topography.	Depressional topography.
Prolonged high water table at or near the surface; 51 inches or more of organic material that is moderately rapidly permeable over mineral soils of variable permeability.	Not suitable for embankments; organic material.	Prolonged high water table at or near the surface; subject to subsidence and soil blowing; outlets difficult to locate.	Drainage needed; water level control needed for subirrigation.	Flat or depressional topography.	Flat or depressional topography.

TABLE 8.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Fill material	Highway location	Embankment foundations	Foundations for low buildings
Cazenovia: CfB, CfC, CfC2, CgD.	CfB, CfC, and CfC2 fair: limited volume; contains some gravel. CgD poor: moderately steep, unfavorable slopes.	Unsuited: none present.	Good to fair below a depth of 36 inches; excessive fines in places.	Seasonal high water table at a depth of 1½ feet in places; cut slopes subject to seepage and sloughing; subgrade in cuts subject to differential frost heave; unit CgD is moderately steep; trafficability poor on all units when wet.	Adequate strength for high embankments; unit CgD is moderately steep and requires bonding measures in places.	Adequate strength; low compressibility; seasonal high water table at a depth of 1½ feet in places; unit CgD is moderately steep.
Collamer: ChA, ChB	Good	Unsuited: none present.	Fair: excessive fines; highly erodible.	Seasonal high water table at a depth of 1 to 1½ feet; cut slopes unstable and highly erodible; subject to seepage; subgrade in cuts unstable; trafficability poor when wet.	Generally adequate strength for low embankments; underlain by wet, compressible soil material.	Variable strength and compressibility; large settlement possible under heavy or vibratory loads; seasonal high water table at a depth of 1 to 1½ feet; subject to caving.
Colonie: ClB, ClC	Poor: sandy	Poor: fine sand.	Good: erodible and subject to soil blowing.	Highway grade location not critical above the high water table which is seasonally at a depth of 3½ feet in a few places; subgrade in cuts generally good but subject to differential frost heave in places; trafficability is poor in noncohesive sands.	Generally adequate strength for low embankments; underlain by wet compressible soil material in places.	Variable strength; underlain by wet compressible soil material in places; large settlement possible under heavy or vibratory loads.
Conesus: CoA, CoB	Poor: too gravelly.	Unsuited: none present.	Generally good: excessive fines in places.	Seasonal high water table at a depth of 1 to 2 feet; seepage in cuts; subgrade in cuts generally good but seasonally wet; trafficability generally good except when wet.	Adequate strength for high embankments.	Adequate strength; low compressibility; seasonal high water table at a depth of 1 to 2 feet.
Croghan: CrB	Poor: sandy	Poor to fair for sand; sand too fine in most places; unsuited for gravel.	Good: erodible and subject to soil blowing.	Seasonal high water table at a depth of 1½ to 2 feet; cut slopes unstable and subject to seepage; subgrade in cuts subject to differential frost heave; fine sands hinder hauling operations.	Generally adequate strength for low embankments; underlain by wet compressible soil material in places.	Generally adequate strength; underlain by wet compressible soil material in places; large settlement possible under heavy vibratory loads; seasonal high water table at a depth of 1½ to 2 feet; subject to caving.
Darien: Da	Fair to poor: contains gravel in places; low volume.	Unsuited: none present.	Fair: excessive fines; seasonally wet; low volume in places.	Seasonal high water table at a depth of ½ to 1 foot; seepage and sloughing in cuts; subject to differential frost heave; trafficability poor when wet.	Generally adequate strength for high embankments.	Adequate strength; low to medium compressibility; seasonal high water table at a depth of ½ to 1 foot.

interpretations—Continued

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
Slowly permeable below a depth of about 15 inches; seasonal high water table at a depth of 1½ feet in places; bedrock is below a depth of 3½ feet in places; units CfC and CgD have sloping and moderately steep, unfavorable slopes.	Low to medium compressibility; low permeability; fair to good compaction characteristics.	Slowly permeable below a depth of about 15 inches; seasonal high water table at a depth of 1½ feet in places; units CfC and CgD have sloping and moderately steep, unfavorable slopes.	High available water capacity; moderate to slow intake rate; rooting depth is mainly in top 24 to 36 inches; slowly permeable below a depth of 15 inches; all units are subject to erosion.	Unit CgD has some slopes of more than 20 percent; otherwise no unfavorable features.	Well drained to moderately well drained; unit CgD has moderately steep, unfavorable slopes.
Pervious layers; seasonal high water table at a depth of 1 to 1½ feet.	Medium compressibility; low permeability; susceptible to piping; fair to good compaction characteristics; highly erodible.	Slowly permeable below a depth of 42 inches; seasonal high water table at a depth of 1 to 1½ feet; unstable ditchbanks.	High available water capacity; moderate intake rate; rooting depth is mainly in top 24 to 36 inches; unit ChB is highly erodible.	Unit ChA is nearly level; unit ChB is susceptible to channel siltation; highly erodible; subject to seepage.	Unit ChA is nearly level; unit ChB is moderately well drained; highly erodible; subject to channel siltation.
Rapidly permeable or very rapidly permeable sands.	Low to medium compressibility; medium to high permeability; susceptible to piping; good to fair compaction characteristics; erodible.	Well drained to excessively drained.	Low to moderate available water capacity; rapid intake rate; rooting depth is mainly in top 24 to 36 inches; unit CIC is erodible and all units are subject to soil blowing.	Undulating or rolling topography in most places; rapidly permeable or very rapidly permeable sand; subject to soil blowing; channel siltation; difficult to vegetate.	Undulating or rolling topography; sandy material; subject to erosion and soil blowing; channel siltation; difficult to vegetate.
Slowly permeable or very slowly permeable below a depth of 40 inches; seasonal high water table at a depth of 1 to 2 feet.	Low to medium compressibility; low permeability; good to fair compaction characteristics.	Moderately permeable above a depth of about 40 inches; seasonal high water table at a depth of 1 to 2 feet.	Moderate to high available water capacity; moderate intake rate; rooting depth is in top 24 to 36 inches; unit CoB is erodible.	Unit CoA is nearly level; unit CoB generally has no unfavorable features.	Unit CoA is nearly level; unit CoB is erodible and moderately well drained.
Rapid permeability; seasonal high water table at a depth of 1½ to 2 feet.	Low compressibility; high to medium permeability; susceptible to piping; good to fair compaction characteristics; erodible.	Rapidly permeable sand; seasonal high water table at a depth of 1½ to 2 feet; ditchbanks unstable.	Low to moderate available water capacity; rapid intake rate; rooting depth is mainly in top 24 to 36 inches; subject to soil blowing; rapidly permeable.	Rapidly permeable sand; subject to seepage, channel siltation and soil blowing; difficult to vegetate.	Sandy material; subject to soil blowing; moderately well drained; subject to channel siltation; difficult to vegetate.
Slowly permeable or very slowly permeable below a depth of about 16 inches; seasonal high water table at a depth of ½ to 1 foot; bedrock below a depth of 3½ feet in places.	Medium compressibility; low permeability; fair to good compaction characteristics; limited volume in places.	Slowly permeable or very slowly permeable below a depth of about 16 inches; seasonal high water table at a depth of ½ to 1 foot; ditchbanks unstable.	Moderate to high available water capacity; slow intake rate; rooting depth is mainly in top 24 to 36 inches; seasonal high water table at a depth of ½ to 1 foot.	Unit Da is nearly level; bedrock at a depth of 3½ feet in places; slowly permeable or very slowly permeable below a depth of about 16 inches.	Unit Da is nearly level; bedrock at a depth of 3½ feet in places; somewhat poorly drained; subject to prolonged waterflow.

TABLE 8.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Fill material	Highway location	Embankment foundations	Foundations for low buildings
Dunkirk: DuC	Good	Unsuited: none present.	Fair: excessive fines; highly erodible.	Seasonal high water table at a depth of 2 feet in places; cut slopes are unstable and highly erodible; subject to seepage in places; subgrade in cuts is unstable; trafficability poor when wet.	Generally adequate strength for low embankments; underlain by wet compressible soil material in places.	Variable strength and compressibility; underlain by wet, compressible soil material in places; large settlement possible under heavy or vibratory loads; seasonal high water table at a depth of 2 feet in places.
Edwards: Ed	Unsuited: muck; possible use as amendment to mineral soils.	Unsuited: none present.	Unsuited: 16 to 50 inches of muck over marl.	Prolonged high water table at or near the surface; 16 to 50 inches of wet, compressible organic material over marl; suitable drainage outlets difficult to locate; very poor to no trafficability.	Compressible organic material 16 to 50 inches thick over marl.	Prolonged high water table at or near the surface; compressible organic material 16 to 50 inches thick over marl.
*Farmington: FAC — For Aurora part of FAC, see Aurora series.	Poor: low volume; gravelly in places.	Unsuited: none present.	Poor: limestone or hard calcareous sandstone and shale bedrock at a depth of 10 to 20 inches; low volume.	Limestone or hard calcareous sandstone and shale bedrock at a depth of 10 to 20 inches; seasonal high water table perched above the rock in places; rock in cuts; seepage above and through rock strata; trafficability generally good except in steeper areas.	Adequate strength for high embankments; association FAC includes some moderately steep slopes which require bonding measures in places.	Limestone or hard calcareous sandstone and shale bedrock at a depth of 10 to 20 inches; adequate strength; association FAC includes some moderately steep, unfavorable slopes.
Fluvaquents, frequently flooded: FL.	Variable: wet in places.	Generally unsuitable.	Variable	Subject to flooding; seasonal high water table; cut slopes are unstable.	Variable strength; underlain in places by wet compressible material.	Subject to flooding; seasonal high water table; variable compressibility.
Fonda: Fo	Poor: prolonged high water table at or near the surface.	Unsuited: none present.	Poor: prolonged high water table at or near the surface; unfavorable textures.	Prolonged high water table at or near the surface; mucky surface layer; depressional or nearly level topography; natural drainage outlets inadequate; trafficability poor when wet.	Variable strength; normally underlain by wet, compressible soil material.	Variable strength; underlain by wet, compressible soil material; prolonged high water table at or near the surface.
Fredon: Fr	Fair to poor: contains some gravel; poorly drained in places.	Good to fair below a depth of 27 inches; excessive fines in places; wet in places.	Good to fair: wet in places.	Seasonal high water table at a depth of ½ to 1 foot; nearly level topography; trafficability poor when wet.	Generally adequate strength for low embankments; underlain by wet, compressible soil material in places.	Generally adequate strength; underlain by wet, compressible soil material in places; seasonal high water table at a depth of ½ to 1 foot; subject to caving.

interpretations—Continued

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
Permeability variable; sandy layers subject to excessive seepage; rolling topography.	Medium compressibility; low permeability; susceptible to piping; fair to good compaction characteristics; highly erodible.	Well drained ------	High available water capacity; moderate to low intake rate; rooting depth is mainly in top 30 to 40 inches; undulating or rolling topography in most places; highly erodible.	Undulating or rolling topography in most places; susceptible to channel siltation; highly erodible; subject to seepage.	Undulating or rolling topography in most places; well drained; highly erodible; subject to channel siltation.
Prolonged high water table at or near the surface; 16 to 50 inches of organic material that is moderately rapidly permeable over marl that has variable permeability.	Not suitable for embankments; 16 to 50 inches of organic material over marl.	Prolonged high water table at or near the surface; 16 to 50 inches of organic material over marl; subject to subsidence and soil blowing; outlets difficult to locate.	Drainage needed; water level control needed for subirrigation.	Flat or depressional topography.	Flat or depressional topography.
Limestone or hard calcareous sandstone and shale bedrock at a depth of 10 to 20 inches.	Limestone or hard calcareous sandstone shale bedrock at a depth of 10 to 20 inches; low volume.	Well drained ------	Low to moderate available water capacity; moderate intake rate; rooting depth is confined to the 10- to 20-inch zone above bedrock; association FAC includes gently sloping to moderately steep slopes that are erodible.	Limestone or hard calcareous sandstone and shale bedrock at a depth of 10 to 20 inches; association FAC has slopes of more than 20 percent in places.	Limestone or calcareous sandstone and shale bedrock at a depth of 10 to 20 inches; well drained; association FAC has slopes of more than 15 percent in places.
Subject to frequent flooding; variable permeability.	Variable soil material.	Cut slopes unstable; natural outlets inadequate.	Generally not irrigated; variable soil material.	Nearly level --------	Nearly level; variable soil material.
Slowly permeable or very slowly permeable below a depth of about 9 inches; prolonged high water table at or near the surface; bedrock at a depth of 3½ feet in a few places.	Mucky surface layer; prolonged high water table at or near the surface; low to medium shear strength; high to medium compressibility; fair to poor compaction characteristics; moderate shrink-swell potential.	Slowly permeable or very slowly permeable below a depth of about 9 inches; prolonged high water table at or near the surface; depressional or nearly level topography; natural drainage outlets inadequate; subject to ponding.	Very poorly drained--	Depressional or nearly level topography.	Depressional or nearly level topography.
Pervious subsoil and substratum; seasonal high water table at a depth of ½ to 1 foot.	Low compressibility; variable permeability; good to fair compaction characteristics; wet in places.	Seasonal high water table at a depth of ½ to 1 foot; ditchbanks unstable; rapidly permeable or moderately rapidly permeable below a depth of about 27 inches.	Seasonal high water table at a depth of ½ to 1 foot; adequate moisture normally available.	Nearly level topography.	Nearly level topography.

TABLE 8.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Fill material	Highway location	Embankment foundations	Foundations for low buildings
Galen: GaA, GaB	Good	Unsuited for gravel; poor for sand; excessive fines.	Fair: excessive fines in places; highly erodible and subject to soil blowing.	Seasonal high water table at a depth of 1 to 2 feet; cut slopes subject to seepage and sloughing; subgrade in cuts unstable; subject to differential frost heave; sandy material hinders hauling operations.	Variable strength; underlain by wet, compressible soil material in places.	Variable strength; underlain by wet, compressible soil material in places; large settlement possible under heavy or vibratory loads; seasonal high water table at a depth of 1 to 2 feet; subject to caving.
Halsey: Ha	Poor: very poorly drained.	Good to fair below a depth of about 27 inches; excessive fines in places; normally under water.	Poor: very poorly drained; (material below a depth of 27 inches is generally good but under water).	Prolonged high water table at or near the surface; mucky surface layer; nearly level or depressional topography; trafficability poor when wet.	Generally adequate strength for low enbankments; underlain by wet, compressible soil material in places.	Generally adequate strength; underlain by wet, compressible soil material in places; large settlement possible under heavy or vibratory loads; prolonged high water table at or near the surface; subject to caving.
Hamlin: Hb, Hc	Good	Unsuited: none present.	Fair: highly erodible silty material.	Subject to flooding; water table below a depth of 24 inches in places; subgrade unstable; trafficability is seasonally poor.	Generally adequate strength but onsite investigation needed.	Subject to flooding; water table below a depth of 24 inches in places.
Herkimer: He	Fair to poor: shale fragments and low volume in places.	Poor: high shale content; excessive fines.	Fair to a depth of 40 to 60 inches; excessive fines; good below a depth of 60 inches.	Water table at a depth of 2 feet in places; subject to flash flooding; cut slopes subject to seepage and sloughing; subgrade in cuts subject to differential frost heave; trafficability generally good except when wet.	Generally adequate strength for moderately high embankments; underlain by wet compressible soil material in a few places.	Generally adequate strength; underlain by wet compressible soil material in a few places; water table at a depth of 2 feet in places; subject to flash flooding.
Hilton: HIA, HIB	Fair: contains some gravel.	Unsuited: none present.	Good to fair: excessive fines in places; some large stones.	Seasonal high water table at a depth of 1 to 2 feet; cut slopes subject to seepage and sloughing; subgrade in cuts is generally good but is seasonally wet and subject to boulder heave in places; trafficability good except when wet.	Adequate strength for high embankments.	Adequate strength; seasonal high water at a depth of 1 to 2 feet.

interpretations—Continued

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
Pervious layers; seasonal high water table at a depth of 1 to 2 feet.	Medium to low compressibility; low to medium permeability; susceptible to piping; fair compaction characteristics; highly erodible.	Moderately permeable to rapidly permeable; seasonal high water table at a depth of 1 to 2 feet; ditchbanks unstable; subject to channel siltation.	Moderate to high available water capacity; moderate to high intake rate; rooting depth is mainly in top 24 to 30 inches; seasonal high water table at a depth of 1 to 2 feet; unit GaB is erodible.	Unit GaA is nearly level; sandy material; subject to seepage, erosion, soil blowing, and channel siltation; difficult to vegetate.	Unit GaA is nearly level; sandy material; subject to erosion, soil blowing and channel siltation; moderately well drained; difficult to vegetate.
Pervious material; prolonged high water table at or near the surface.	Permeability variable; low compressibility; good to fair compaction characteristics; normally under water.	Prolonged high water table at or near the surface; ditchbanks unstable; rapidly permeable below a depth of about 27 inches; outlets difficult to establish in places.	Prolonged high water table at or near the surface.	Not applicable; nearly level or depressional topography.	Nearly level or depressional topography.
Subject to flooding; moderately permeable; water table below a depth of 24 inches in places.	Low to medium compressibility; low to medium permeability: good to poor compaction characteristics; susceptible to piping; highly erodible; wet in places.	Subject to flooding but drainage is generally not needed; water table below a depth of 24 inches for brief periods.	High available water capacity; moderate to slow intake rate; rooting depth is mainly in upper 40 inches; subject to flooding; unit Hc rarely floods during growing season.	Nearly level flood plain.	Nearly level flood plain.
Pervious layers; water table at a depth of 2 feet in places; subject to flash flooding.	Low to medium compressibility; medium to low permeability; fair to good compaction characteristics.	Generally not needed; well drained.	Moderate available water capacity; moderate intake rate; rooting depth is mainly in upper 40 inches; subject to flash flooding.	Permeability is moderate to a depth of 40 to 60 inches and moderately rapid or rapid below; subject to seepage.	Subject to erosion; well drained; subject to channel siltation in places.
Slowly permeable or very slowly permeable below a depth of about 24 to 48 inches; seasonal high water table at a depth of 1 to 2 feet; bedrock below a depth of 3½ feet in places.	Low to medium compressibility; low to medium permeability; good to fair compaction characteristics.	Moderately permeable to a depth of 24 to 48 inches and slowly permeable or very slowly permeable below; seasonal high water table at a depth of 1 to 2 feet.	High available water capacity; moderate intake rate; rooting depth is mainly in top 24 to 36 inches; moderately permeable to a depth of 24 to 48 inches; seasonal high water table at a depth of 1 to 2 feet.	Unit HlA is nearly level; unit HlB is subject to seepage in places.	Unit HlA is nearly level; unit HlB is moderately well drained; slight hazard of erosion on steeper parts.

TABLE 8.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Fill material	Highway location	Embankment foundations	Foundations for low buildings
*Honeoye: HnB, HnC, HnCK, HoD, HSC, HTE, HTF. For interpretations of Lansing parts of units HoD, HTE and HTF, and Ontario parts of HTE and HTF, other than slope, see Lansing and Ontario series.	HnB, HnC, and HnCK fair: contain some gravel; limited volume. HoD, HSC, HTE, and HTF are either too stony or have unfavorable slopes.	Unsuited: none present.	HnB, HnC, HnCK, HoD, and HSC good to fair: excessive fines in places, some large stones. HTE and HTF poor: steep and very steep unfavorable slopes.	Seasonal high water table below a depth of 2 feet in places; cut slopes subject to seepage and sloughing; subgrade in cuts is generally good but is subject to boulder heave in places; units HTE and HTF are steep and very steep; trafficability is generally good except on these steeper slopes.	Adequate strength for high embankments; units HTE and HTF have steep and very steep slopes that require bonding measures in places.	Adequate strength; seasonal high water table below a depth of 2 feet in places; units HoD, HTE, and HTF have moderately steep to very steep, unfavorable slopes; units HSC and parts of units HTE and HTF are very stony.
Howard: HwA, HwB, HwC, HxA, HxB, HxC, HyA, HyB.	Poor: too gravelly.	Good	Good	Highway grade location not critical above the water table; local seepage and some sloughing in cuts; subgrade in cuts subject to differential frost heave; trafficability is generally good; cobbles dislodged in cuts in places because of frost action.	Generally adequate strength for moderately high embankments; underlain by wet, compressible soil material in places.	Generally adequate strength; underlain by wet, compressible soil material in places; large settlement possible under heavy or vibratory loads; seasonal high water table at a depth of 3 feet in a few places; subject to caving.
Kendaia: KeA, KeB	Fair to poor: low volume; too gravelly in places.	Unsuited: none present.	Fair below surface layer; excessive fines; wet in places; some large stones.	Seasonal high water table at a depth of 1/2 to 1 foot; cut slopes subject to seepage and sloughing; subgrade in cuts generally good, but seasonally wet and subject to boulder heave in places; trafficability is poor when wet.	Adequate strength for high embankments.	Adequate strength; seasonal high water table at a depth of 1/2 to 1 foot.
Lairdsville: LaB, LbC2.	Fair to poor: low volume; medium to high content of clay.	Unsuited: none present.	Poor: shale bedrock at a depth of 20 to 40 inches; low volume; clayey material.	Seasonal high water table at a depth of 1 to 2 feet in most places; shale bedrock at a depth of 20 to 40 inches; rock in most cuts; subject to seepage above and through rock strata; trafficability poor on sticky, plastic, clayey soil material when wet.	Adequate strength for high embankments.	Adequate strength; seasonal high water table at a depth of 1 to 2 feet in most places; shale bedrock at a depth of 20 to 40 inches.
Lakemont: Lk	Poor: high content of clay; limited volume; wet for long periods.	Unsuited: none present.	Poor: plastic clayey material; wet for long periods.	Prolonged high water table at or near the surface; some ponding; nearly level or depressional topography; natural drainage outlets are inadequate; trafficability is very poor because of the plastic and sticky clays that are wet for long periods.	Onsite investigation needed; wet, compressible clayey material that has low shear strength.	Prolonged high water table at or near the surface; some ponding; soft, wet, compressible, sticky clays; moderate shrink-swell potential.

interpretations—Continued

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
Slowly permeable or very slowly permeable below a depth of about 29 inches; seasonal high water table below a depth of 2 feet in places; bedrock at a depth of 3½ feet in places; all units but HnB and parts of HSC have sloping to very steep unfavorable slopes.	Low to medium compressibility; low permeability; good to fair compaction characteristics; few to many large stones.	Generally not needed; well drained.	High available water capacity; moderate intake rate; rooting depth is mainly in top 24 to 36 inches; units HnB, HnC, HnCK, and HoD are gently sloping to moderately steep and erodible; not applicable on units HSC, HTE, or HTF, which are either too stony or have steep and very steep unfavorable slopes.	All but units HnB, HnC, and HnCK have or include areas that have slopes of more than 20 percent; unit HSC and parts of units HTE and HTF are very stony.	Erodible on steeper slopes; all but units HnB, HnC, and HnCK have or include slopes of more than 15 percent; unit HSC and parts of units HTE and HTF are very stony; well drained.
Pervious material; seasonal high water table at a depth of 3 feet in a few places; units HwC and HxC have unfavorable slopes.	Rapidly permeable; low compressibility; good to fair compaction characteristics; good for outside shell.	Well drained to somewhat excessively drained.	Moderate to low available water capacity; moderate to rapid intake rate; rooting depth not restricted but is mainly in the top 30 to 40 inches; units HwC and HxC have rolling topography and are erodible.	Rapidly permeable or very rapidly permeable with increasing depth; gravel content increases with increasing depth; difficult to vegetate; units HwC and HxC have rolling topography.	Rapidly permeable or very rapidly permeable with increasing depth; gravel content increases with increasing depth; difficult to vegetate; units HwC and HxC have rolling topography; well drained to somewhat excessively drained.
Slowly permeable or very slowly permeable below a depth of about 22 inches; seasonal high water table at a depth of ½ to 1 foot; bedrock below a depth of 3½ feet in places.	Low to medium compressibility; low permeability; fair to good compaction characteristics; wet in places.	Slowly permeable or very slowly permeable below a depth of about 22 inches; seasonal high water table at a depth of ½ to 1 foot; ditchbanks unstable in places.	Moderate to high available water capacity; moderate to slow intake rate; rooting depth is mainly in the top 18 to 24 inches.	Unit KeA is nearly level; unit KeB is subject to prolonged flow; seepage in places.	Unit KeA is nearly level; unit KeB is erodible in steeper areas; subject to channel siltation in places; somewhat poorly drained; subject to prolonged waterflow.
Shale bedrock at a depth of 20 to 40 inches; slowly permeable or very slowly permeable soil below the surface layer; seasonal high water table at a depth of 1 to 2 feet in most places.	Shale bedrock at a depth of 20 to 40 inches; low volume; excessive fines.	Slowly permeable or very slowly permeable below the surface layer; seasonal high water table at a depth of 1 to 2 feet in most places; shale bedrock at a depth of 20 to 40 inches; unit LbC2 is sloping.	Moderate to high available water capacity; slow intake rate; rooting depth is mainly in top 24 to 30 inches; seasonal high water table at a depth of 1 to 2 feet in most places; all units are erodible.	Shale bedrock at a depth of 20 to 40 inches; poor workability when wet.	Shale bedrock at a depth of 20 to 40 inches; moderately well drained and well drained; unit LbC2 is sloping and erodible.
Slowly permeable or very slowly permeable below surface layer; prolonged high water table at or near the surface.	Medium to low shear strength; medium compressibility; low permeability; fair compaction characteristics; moderate shrink-swell potential; poor workability when wet; wet for long periods.	Slowly permeable or very slowly permeable below the surface layer; prolonged high water table at or near the surface; ditchbanks unstable; natural drainage outlets inadequate.	Poorly drained and very poorly drained; prolonged high water table at or near the surface.	Nearly level or depressional topography.	Nearly level or depressional topography; poorly drained and very poorly drained.

TABLE 8.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Fill material	Highway location	Embankment foundations	Foundations for low buildings
Lamson: Lm	Poor: texture is good but soil is wet for long periods.	Unsuited: none present.	Poor: excessive fines; wet for long periods; highly erodible.	Prolonged high water table at or near the surface; nearly level or depressional topography; natural drainage outlets are inadequate; unstable subgrade; trafficability is poor during long periods of wetness.	Generally adequate strength for low embankments; underlain by wet, compressible soil material in most places.	Prolonged high water table at or near the surface; underlain by wet, compressible soil material in most places; subject to caving.
Lansing: LsB, LsC, LsCK.	Poor: too gravelly.	Unsuited: none present.	Good to fair: excessive fines in places.	Seasonal high water table below a depth of 2 feet in places; cut slopes subject to seepage and sloughing; subgrade in cuts is generally good; trafficability good except when wet.	Adequate strength for high embankments.	Adequate strength; seasonal high water table below a depth of 2 feet in places.
Lima: LtA, LtB	Fair: contains some gravel or shale.	Unsuited: none present.	Good to fair: excessive fines in places; few large stones.	Seasonal high water table at a depth of 1 to 2 feet; cut slopes subject to seepage and sloughing; subgrade in cuts is generally good but is seasonally wet and subject to boulder heave in places; trafficability good except when wet.	Adequate strength for high embankments.	Adequate strength; seasonal high water table at a depth of 1 to 2 feet.
*Lockport: LvB For Brockport part of LvB, see Brockport series.	Poor: low volume; high content of clay.	Unsuited: none present.	Poor: shale bedrock at a depth of 20 to 40 inches; low volume; excessive fines; moderate shrink-swell potential.	Shale bedrock at a depth of 20 to 40 inches; seasonal high water table at a depth of 1/2 to 1 foot; rock in most cuts; excessive seepage in cuts; subject to differential frost heave; trafficability poor when wet.	Generally adequate strength for moderate to high embankments; shale bedrock at a depth of 20 to 40 inches; moderate shrink-swell potential.	Adequate strength; shale bedrock at a depth of 20 to 40 inches; seasonal high water table at a depth of 1/2 to 1 foot; moderate shrink-swell potential.
*Lordstown: LWC, LXD. For Arnot part of LXD, see Arnot series for interpretations other than those involving slope.	Poor: many channery fragments.	Unsuited: none present.	Poor: layered shale, siltstone, and sandstone bedrock at a depth of 20 to 40 inches; low volume.	Layered shale, siltstone, and sandstone bedrock at a depth of 20 to 40 inches; rock in most cuts; seepage above and through rock strata in cuts; subject to differential frost heave; trafficability is generally good except on the steeper parts of unit LXD.	Adequate strength for high embankments; bonding measures are needed on the steeper parts of unit LXD in places.	Adequate strength; layered shale, siltstone, and sandstone bedrock at a depth of 20 to 40 inches; seepage above and through rock strata; unit LXD has moderately steep, unfavorable slopes.
Lyons: Ly	Poor: texture of material is fair but is wet for long periods.	Unsuited: none present.	Poor: material is fair to good below a depth of 22 inches but is wet for long periods; some large stones.	Prolonged high water table at or near the surface; depressional or nearly level topography; natural drainage outlets inadequate; trafficability poor when wet.	Adequate strength for high embankments.	Adequate strength; prolonged high water table at or near the surface.

interpretations—Continued

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
Pervious layers; prolonged high water table at or near the surface.	Medium to low shear strength; low to medium compressibility; low to medium permeability; susceptible to piping; good to poor compaction characteristics; wet for long periods; highly erodible.	Moderately permeable; prolonged high water table at or near the surface; ditchbanks unstable; natural drainage outlets inadequate.	Poorly drained and very poorly drained; prolonged high water table at or near the surface.	Not applicable; nearly level or depressional topography.	Nearly level or depressional topography; poorly drained or very poorly drained.
Slowly permeable or very slowly permeable below a depth of about 35 inches; seasonal high water table below a depth of 2 feet in places; bedrock at a depth of 3½ feet in places; units LsC and LsCK have sloping and rolling unfavorable slopes.	Low to medium compressibility; low to medium permeability; good to fair compaction characteristics.	Well drained ------	Moderate to high available water capacity; moderate intake rate; rooting depth is mainly in the top 24 to 36 inches; all units are subject to erosion.	Moderately permeable to a depth of about 35 inches and slowly permeable or very slowly permeable below this depth; subject to seepage; unit LsCK has rolling topography.	Erodible; well drained; unit LsCK has rolling topography.
Slowly permeable or very slowly permeable below a depth of about 22 inches; seasonal high water table at a depth of 1 to 2 feet; bedrock at a depth of 3½ feet in places.	Low to medium compressibility; low to medium permeability; good to fair compaction characteristics; few large stones.	Slowly permeable or very slowly permeable below a depth of about 22 inches; seasonal high water table at a depth of 1 to 2 feet.	Moderate to high available water capacity; moderate to slow intake rate; rooting depth is mainly in the top 24 to 30 inches; slowly permeable or very slowly permeable below a depth of about 22 inches; unit LtB is subject to erosion.	Unit LtA is nearly level; unit LtB is slowly permeable or very slowly permeable at a depth of about 22 inches; seepage in places.	Unit LtA is nearly level; unit LtB has slight hazard of erosion; moderately well drained.
Shale bedrock at a depth of 20 to 40 inches; slowly permeable or very slowly permeable below the surface layer; seasonal high water table at a depth of ½ to 1 foot.	Shale bedrock at a depth of 20 to 40 inches; low volume; excessive fines.	Slowly permeable or very slowly permeable below the surface layer; shale bedrock at a depth of 20 to 40 inches; seasonal high water table at a depth of 20 to 40 inches.	Moderate to high available water capacity; slow intake rate; rooting depth is mainly in the top 18 to 24 inches; seasonal high water table at a depth of ½ to 1 foot.	Shale bedrock at a depth of 20 to 40 inches; slowly permeable or very slowly permeable below the surface layer; dense clayey subsoil.	Shale bedrock at a depth of 20 to 40 inches; somewhat poorly drained; dense clayey subsoil.
Layered shale, siltstone, and sandstone bedrock at a depth of 20 to 40 inches; unfavorable slopes.	Layered shale, siltstone, and sandstone bedrock at a depth of 20 to 40 inches; low volume.	Well drained ------	Moderate to high available water capacity; moderate intake rate; rooting depth is confined mainly to the top 20 to 30 inches above the bedrock; all units are subject to erosion.	Layered shale, siltstone, and shale bedrock at a depth of 20 to 40 inches; unit LXD includes slopes of more than 20 percent.	Layered shale, siltstone, and sandstone bedrock at a depth of 20 to 40 inches; well drained; unit LXD has slopes of more than 15 percent.
Slowly permeable or very slowly permeable below a depth of about 34 inches; prolonged high water table at or near the surface; bedrock at a depth of 3½ feet in places.	Surface layer high in content of organic matter; material below has low to medium compressibility; low permeability; fair to good compaction characteristics; wet for long periods; some large stones.	Slowly permeable or very slowly permeable below a depth of about 34 inches; prolonged high water table at or near the surface; ditchbanks unstable; natural drainage outlets inadequate.	Poorly drained; prolonged high water table at or near the surface.	Depressional or nearly level topography.	Not applicable; depressional or nearly level topography.

TABLE 8.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Fill material	Highway location	Embankment foundations	Foundations for low buildings
Made land, chemical waste: Ma. Requires onsite investigation for interpretations.						
Madrid: MdB, MdC, MdC2, MdCK, MgB, MgC.	MdB, MdC, MdC2 and MdCK fair: contain some gravel; limited volume. MgB and MgC poor: too gravelly.	Unsuited: none present.	Good: few large stones.	Cut slopes erodible; local seepage and sloughing at a depth of 3 feet in places; subgrade in cuts is generally good; trafficability is generally good.	Adequate strength for high embankments.	Generally few unfavorable features; seasonal high water table at a depth of 3 feet in a few places.
Manheim: MhA, MhB	Fair: contains some coarse fragments.	Unsuited: none present.	Fair below a depth of 36 inches; excessive fines.	Seasonal high water table at a depth of ½ to 1 foot; cut slopes subject to seepage and sloughing; subgrade in cuts is fair but seasonally wet; trafficability poor when wet.	Adequate strength for high embankments.	Adequate strength; seasonal high water table at a depth of ½ to 1 foot.
Manlius: MnB, MnC, MnD.	Poor: too shaly.	Unsuited: none present.	Poor: shale bedrock at a depth of 20 to 40 inches; low volume.	Shale bedrock at a depth of 20 to 40 inches; bedrock in most cuts; seepage above and through rock strata; subgrade in rock cuts is good; trafficability is generally good.	Adequate strength for high embankments.	Shale bedrock at a depth of 20 to 40 inches.
Mardin: MoB, MoC, MoD, MPE.	Poor: many channery fragments.	Unsuited: none present.	Good to fair: excessive fines in places; some large stones.	Seasonal high water table at a depth of 1 to 2 feet; excessive seepage and sloughing above the fragipan which is at a depth of about 21 inches; subgrade in cuts is generally good but is seasonally wet and subject to boulder heave in places; trafficability is generally good except when wet. Unit MPE is steep.	Adequate strength for high embankments.	Adequate strength; seasonal high water table at a depth of 1 to 2 feet; unit MoD has moderately steep, unfavorable slopes. Unit MPE is steep.
Mardin, moderately shallow variant: MrB, MrC.	Poor: many channery fragments.	Unsuited: none present.	Poor: layered sandstone, siltstone, and shale bedrock at a depth of 20 to 40 inches; low volume.	Seasonal high water table at a depth of 1 to 2 feet; layered sandstone, siltstone, and shale bedrock at a depth of 20 to 40 inches; rock in most cuts; seepage above fragipan and through rock strata in cuts; subject to differential frost heave; trafficability is generally good except when wet.	Adequate strength for high embankments.	Adequate strength; seasonal high water table at a depth of 1 to 2 feet; layered sandstone, siltstone, and shale bedrock at a depth of 20 to 40 inches.

interpretations—Continued

		Soil features affecting—Continued			
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
Pervious layers subject to excess seepage; units MdC, MdC2, MdCK, and MgC have unfavorable slopes.	Low to medium compressibility; low to medium permeability; medium to high susceptibility to piping; fair to good compaction characteristics; few large stones.	Well drained	Moderate to high available water capacity; moderate to rapid intake rate; rooting depth is mainly in top 30 to 40 inches; all units are subject to erosion.	Moderately permeable to depth of about 42 inches; subject to seepage; unit MdCK has rolling topography.	Well drained; erodible; subject to channel siltation; unit MdCK has rolling topography.
Slowly permeable below a depth of 36 inches; seasonal high water table at a depth of 1/2 to 1 foot.	Medium to low shear strength; low to medium compressibility; low permeability; good to fair compaction characteristics.	Moderately permeable to a depth of 36 inches and slowly permeable below; seasonal high water table at a depth of 1/2 to 1 foot; ditchbanks unstable.	Moderate to high available water capacity; slow intake rate; rooting depth is mainly in top 18 to 30 inches; seasonal high water table at a depth of 1/2 to 1 foot.	Unit MhA is nearly level; unit MhB is moderately permeable to a depth of about 36 inches; subject to seepage.	Unit MhA is nearly level; unit MhB is somewhat poorly drained; subject to prolonged waterflow; erodible.
Shale bedrock at a depth of 20 to 40 inches; units MnC and MnD have unfavorable slopes.	Shale bedrock at a depth of 20 to 40 inches; low volume.	Well drained to excessively drained.	Low to high available water capacity; moderate intake rate; rooting depth is confined to the 20- to 40-inch zone above the shale bedrock; all units are erodible.	Shale bedrock at a depth of 20 to 40 inches; subject to seepage; difficult to vegetate.	Shale bedrock at a depth of 20 to 40 inches; well drained to excessively drained; erodible; difficult to vegetate.
Very slowly permeable fragipan below a depth of about 21 inches; seasonal high water table at a depth of 1 to 2 feet; bedrock below a depth of 3 1/2 feet in places; units MoC and MoD have sloping and moderately steep, unfavorable slopes. Unit MPE is steep.	Low to medium compressibility; low permeability; good to fair compaction characteristics; some large stones.	Very slowly permeable fragipan below a depth of about 21 inches; seasonal high water table at a depth of 1 to 2 feet; units MoC and MoD are sloping and moderately steep; unit MPE is steep and very steep.	Low to moderate available water capacity; moderate to slow intake rate; rooting depth confined to the zone above the fragipan which is at a depth of about 21 inches; all units are subject to erosion.	Very slowly permeable fragipan below a depth of about 21 inches; seepage above the pan in places; units MoD and MPE include areas that slope more than 20 percent.	Very slowly permeable fragipan at a depth of about 21 inches; moderately well drained; subject to prolonged waterflow; units MoD and MPE slope more than 15 percent.
Very slowly permeable fragipan below a depth of 19 inches; seasonal high water table at a depth of 1 to 2 feet; layered sandstone and shale bedrock at a depth of 20 to 40 inches; unit MrC is sloping.	Layered sandstone, siltstone, and shale bedrock at a depth of 20 to 40 inches; low volume.	Very slowly permeable fragipan below a depth of about 19 inches; seasonal high water table at a depth of 1 to 2 feet; layered sandstone and shale bedrock at a depth of 20 to 40 inches; unit MrC is sloping.	Moderate to high available water capacity; moderate to slow intake rate; rooting depth is confined to the zone above the fragipan, which is at a depth of about 19 inches; all units are subject to erosion.	Very slowly permeable fragipan below a depth of about 19 inches; seepage above the pan in places; layered sandstone, siltstone, and shale bedrock at a depth of 20 to 40 inches.	Very slowly permeable fragipan at a depth of 19 inches; layered sandstone, siltstone, and shale bedrock at a depth of 20 to 40 inches; moderately well drained; subject to prolonged waterflow.

TABLE 8.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Fill material	Highway location	Embankment foundations	Foundations for low buildings
*Martisco: Ms ------- For Warners part of Ms, see Warners series.	Unsuited: 8 to 16 inches of muck over marl.	Unsuited: none present.	Unsuited: 8 to 16 inches of muck over marl.	Prolonged high water table at or near the surface; depressional or nearly level topography; natural drainage outlets inadequate; 8 to 16 inches of muck over marl; very poor to no trafficability when wet.	Must be removed and replaced with suitable underwater backfill.	Prolonged high water table at or near the surface; 8 to 16 inches of muck over marl.
Minoa: MtA, MtB ----	Good: seasonally wet.	Unsuited: none present.	Fair: excessive fines; highly erodible; seasonally wet.	Seasonal high water table at a depth of 1/2 to 1 foot; unit MtA is nearly level; cut slopes unstable and subject to seepage; subgrade unstable below water table; trafficability poor when wet.	Generally adequate strength for low embankments; underlain by wet, compressible soil material in many places.	Generally adequate strength; underlain by wet, compressible soil material in many places; seasonal high water table at a depth of 1/2 to 1 foot; subject to caving.
Mohawk: MwB, MwC, MwD.	Fair: contains shale fragments.	Unsuited: none present.	Fair: excessive fines.	Seasonal high water table at a depth of 1 to 3 feet in most places; cut slopes subject to seepage and sloughing; subgrade in cuts generally good but seasonally wet; trafficability good except when wet.	Adequate strength for high embankments; steep parts of unit MwD require bonding measures in places.	Adequate strength; seasonal high water table at a depth of 1 to 3 feet in most places; unit MwD has moderately steep, unfavorable slopes.
Naumburg: Na ------	Poor: sandy; wet for long periods.	Good to fair for sand, excessive fine sand in places; wet for long periods; unsuited for gravel, none present.	Fair to poor: material good but wet for long periods; subject to erosion and soil blowing.	Water table at a depth of 1/2 to 1 foot for long periods; level or nearly level topography; natural drainage outlets inadequate in places; subgrade unstable below water table; subject to differential frost heave; fine sands hinder hauling operations.	Generally adequate strength for low embankments; underlain by wet, compressible soil material in places.	Generally adequate strength; underlain by wet, compressible soil material in places; water table at a depth of 1/2 to 1 foot for long periods; subject to caving.
Niagara: NgA ------	Good --------	Unsuited: none present.	Fair: excessive fines; wet in places; highly erodible.	Seasonal high water table at a depth of 1/2 to 1 foot; cut slopes unstable and subject to seepage; subgrade unstable; subject to differential frost heave; trafficability poor when wet.	Generally adequate strength for low embankments; underlain by wet, compressible soil material in many places.	Generally adequate strength; underlain by wet, compressible soil material in many places; seasonal high water table at a depth of 1/2 to 1 foot; subject to caving.

interpretations—Continued

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
8 to 16 inches of moderately permeable or moderately rapidly permeable muck over slowly permeable marl; prolonged high water table at or near the surface.	Not applicable; 8 to 16 inches of muck over marl.	Generally not drained; muck deposit too thin; 8 to 16 inches of moderately permeable or moderately rapidly permeable muck over slowly permeable marl; prolonged high water table at or near the surface; natural drainage outlets inadequate; subject to subsidence and shrinkage after drainage; subject to soil blowing.	Generally not applicable; prolonged high water table at or near the surface; drainage needed with water level control for subirrigation.	Not applicable; depressional or nearly level topography.	Not applicable; depressional or nearly level topography.
Pervious layers; seasonal high water table at a depth of 1/2 to 1 foot.	Medium to low shear strength; low to medium compressibility and permeability; susceptible to piping; good to poor compaction characteristics; seasonally wet; surface layer high in organic matter; highly erodible.	Moderately permeable; seasonal high water table at a depth of 1/2 to 1 foot; ditchbanks unstable.	Low to high available water capacity; moderate to rapid intake rate; rooting depth is mainly in top 18 to 30 inches; seasonal high water table at a depth of 1/2 to 1 foot; unit MtB is highly erodible.	Moderately permeable; subject to channel siltation; unit MtA is nearly level.	Highly erodible; subject to channel siltation; somewhat poorly drained; unit MtA is nearly level.
Moderately permeable to a depth of about 40 inches and slowly permeable below; seasonal high water table at a depth of 1 to 3 feet in most places; units MwC and MwD have unfavorable slopes.	Medium to low shear strength; medium to low compressibility; low permeability; good to poor compaction characteristics.	Moderately permeable to a depth of about 40 inches and slowly permeable below; seasonal high water table at a depth of 1 to 3 feet in most places; ditchbanks unstable; units MwC and MwD are sloping and moderately steep.	High available water capacity; moderate intake rate; rooting depth is mainly in top 30 to 36 inches; seasonal high water table at a depth of 1 to 3 feet in most places; all units are erodible.	Moderately permeable to a depth of about 40 inches and slowly permeable below; subject to seepage; unit MwD includes areas that slope more than 20 percent.	Erodible on steeper slopes; unit MwD has slopes of more than 15 percent; moderately well drained to well drained.
Pervious sandy material; water table at a depth of 1/2 to 1 foot for long periods.	Low to medium compressibility; high to low permeability; susceptible to piping; good to fair compaction characteristics; subject to water erosion and soil blowing.	Rapidly permeable sand; water table at a depth of 1/2 to 1 foot for long periods; ditchbanks unstable; natural drainage outlets inadequate in places.	Low available water capacity; rapid intake rate; rooting depth is mainly in top 24 inches; rapidly permeable; subject to soil blowing.	Not applicable; level or nearly level topography.	Not applicable; level or nearly level topography.
Pervious layers; seasonal high water table at a depth of 1/2 to 1 foot.	Medium to low shear strength; medium compressibility; low permeability; susceptible to piping; good to poor compaction characteristics; highly erodible.	Moderately slow permeability at a depth of about 23 inches; seasonal high water table at a depth of 1/2 to 1 foot; ditchbanks unstable.	Moderate to high available water capacity; moderate to slow intake rate; rooting depth is mainly in the top 24 inches; seasonal high water table at a depth of 1/2 to 1 foot.	Subject to seepage; erodible; subject to channel siltation.	Erodible; subject to channel siltation; somewhat poorly drained; subject to prolonged waterflow.

TABLE 8.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Fill material	Highway location	Embankment foundations	Foundations for low buildings
Odessa: OdA, OdB	Fair to poor: high clay content; low volume.	Unsuited: none present.	Poor: clayey material; seasonally wet and sticky; moderate shrink-swell potential.	Seasonal high water table at a depth of 1/2 to 1 foot; nearly level topography in places; cut slopes unstable and subject to excessive seepage; subgrade is compressible clayey material that is very sticky when wet; very poor trafficability when wet.	Generally adequate strength for low embankments; high compressibility and low shear strength.	Generally adequate strength; high compressibility; low shear strength; moderate shrink-swell potential; seasonal high water table at a depth of 1/2 to 1 foot.
*Ontario: OgB, OnC, OnC2, OnCK, OpD. For Madrid part of OpD, see Madrid series for interpretations other than slope.	OgB fair: contains some gravel; limited volume. All other units are poor and too gravelly and unit OpD has moderately steep, unfavorable slopes.	Unsuited: none present.	Generally good below a depth of 28 inches; some large stones.	Highway grade location generally not critical; seasonal high water table at a depth of 2 1/2 feet in a few places; cut slopes subject to local seepage and sloughing; subgrade in cuts is generally good; subject to boulder heave in places; trafficability is generally good except on steeper parts of unit OpD.	Adequate strength for high embankments.	Adequate strength; seasonal high water table at a depth of 2 1/2 feet in a few places; bedrock at a depth of 3 1/2 feet in places.
Otisville: OtB, OtC	Poor: too gravelly and sandy.	Good	Good	Highway grade location not critical above the water table, which is normally several feet below the surface but which in a few places is at a depth of 3 1/2 feet; cut slopes subject to local seepage; subgrade in cuts is generally good; subject to differential frost heave in places; trafficability is generally good.	Generally adequate strength for moderately high embankments; underlain by wet, compressible soil material in places.	Adequate strength; seasonal high water table at a depth of 3 1/2 feet in a few places.
Ovid: OvA, OvB	Fair: high content of clay.	Unsuited: none present.	Fair below a depth of 30 inches; excessive fines; seasonally wet.	Seasonal high water table at a depth of 1/2 to 1 foot; cut slopes subject to seepage and sloughing; subgrade is subject to differential frost heave; trafficability poor when wet.	Generally adequate strength for high embankments.	Adequate strength; seasonal high water table at a depth of 1/2 to 1 foot.
Palatine: PaB, PaC	Poor: shaly fragments; low volume.	Unsuited: none present.	Poor: shale bedrock at a depth of 20 to 40 inches; low volume.	Shale bedrock at a depth of 20 to 40 inches; rock in most cuts; subject to seepage above and through rock strata; subject to differential frost heave; trafficability generally good.	Adequate strength for high embankments.	Adequate strength; shale bedrock at a depth of 20 to 40 inches; seepage above and through rock strata in places.

interpretations—Continued.

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
Slowly permeable or very slow permeable below the surface layer; seasonal high water table at a depth of 1/2 to 1 foot.	Low to medium shear strength; high to medium compressibility; low permeability; poor to good compaction characteristics; sticky and plastic when wet; moderate shrink-swell potential.	Slowly permeable or very slowly permeable below the surface layer; seasonal high water table at a depth of 1/2 to 1 foot; ditchbanks unstable.	Moderate available water capacity; slow intake rate; rooting depth is mainly in top 12 to 24 inches; seasonal high water table at a depth of 1/2 to 1 foot; slowly permeable or very slowly permeable below the surface layer.	Slowly permeable or very slowly permeable below the surface layer; subject to prolonged waterflow; erodible; unit OdA is nearly level.	Erodible; somewhat poorly drained; subject to prolonged waterflow; unit OdA is nearly level.
Slowly permeable or very slowly permeable below a depth of about 28 inches; all units but OgB have sloping and moderately steep, unfavorable slopes.	Low to medium compressibility; low to medium permeability; good to fair compaction characteristics; some large stones.	Well drained	Moderate to high available water capacity; moderate intake rate; rooting depth is mainly in top 30 to 40 inches; units are gently sloping to moderately steep and erodible.	Moderately permeable to a depth of about 28 inches; subject to seepage; unit OnCK has rolling topography and unit OpD has slopes of more than 20 percent.	Erodible where slopes are steeper; well drained; unit OnCK has rolling topography; unit OpD has slopes of more than 15 percent.
Very pervious gravelly and sandy material.	Low compressibility; rapid permeability; good to fair compaction characteristics; good stability; good for outside shell.	Well drained	Low to very low available water capacity; rapid intake rate; rooting depth is mainly in top 30 inches; unit OtC is rolling and subject to erosion.	Very rapidly permeable gravelly and sandy material; excessive seepage; difficult to vegetate; unit OtC has rolling slopes.	Very rapidly permeable gravelly and sandy material; excessively drained; difficult to vegetate; unit OtC has rolling, unfavorable slopes.
Slowly permeable or very slowly permeable below a depth of about 13 inches; seasonal high water table at a depth of 1/2 to 1 foot.	Medium to low shear strength and compressibility; good to fair compaction characteristics; seasonally wet.	Slowly permeable or very slowly permeable below a depth of about 13 inches; seasonal high water table at a depth of 1/2 to 1 foot; ditchbanks unstable.	Moderate to high available water capacity; slow intake rate; slowly permeable or very slowly permeable below a depth of about 13 inches; seasonal high water table at a depth of 1/2 to 1 foot.	Slowly permeable or very slowly permeable below a depth of about 13 inches; subject to prolonged waterflow; unit OvA is nearly level.	Slowly permeable or very slowly permeable below a depth of about 13 inches; somewhat poorly drained; subject to prolonged waterflow; unit OvA is nearly level.
Shale bedrock at a depth of 20 to 40 inches.	Shale bedrock at a depth of 20 to 40 inches; low volume.	Well drained to somewhat excessively drained.	Low to moderate available water capacity; moderate to slow intake rate; rooting depth is mainly in the top 20 to 30 inches; units are gently sloping and sloping and erodible.	Shale bedrock at a depth of 20 to 40 inches; moderately permeable; subject to seepage.	Shale bedrock at a depth of 20 to 40 inches; erodible; well drained to somewhat excessively drained.

TABLE 8.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Fill material	Highway location	Embankment foundations	Foundations for low buildings
Palms: Pb	Unsuited: muck; possible use as an amendment for mineral soil.	Unsuited: none present.	Unsuited: 16 to 50 inches of muck over variable mineral soil.	Prolonged high water table at or near the surface; 16 to 50 inches of wet, compressible organic material over variable mineral soils; nearly level or depressional topography; natural drainage outlets inadequate; very poor to no trafficability.	Onsite investigation needed; 16 to 50 inches of wet, compressible organic material over variable mineral soil.	Onsite investigation needed; 16 to 50 inches of wet, compressible organic material over variable mineral soils; prolonged high water table at or near the surface.
*Palmyra: PgA, PgB, PgC, PHD, PHE, PHF. For Howard part of PHD, PHE, and PHF, see Howard series for interpretations other than slope.	Poor: too gravelly.	Good	Good	Highway grade location is not critical above the water table; cut slopes are subject to local seepage and sloughing; subgrade in cuts is generally good but subject to differential frost heave in places; trafficability is generally good except on units PHD, PHE, and PHF, which have moderately steep to very steep unfavorable slopes.	Generally adequate strength for moderately high embankments; underlain by wet, compressible soil material in places; units PHD, PHE, and PHF are moderately steep to very steep and require bonding measures in places.	Adequate strength; seasonal high water table at a depth of 3 feet in a few places; units PHD, PHE, and PHF have moderately steep to very steep unfavorable slopes; subject to caving.
Phelps: PpA, PpB	Poor: too gravelly.	Good to fair below a depth of about 28 inches; excessive fines in places; wet in places.	Good below a depth of about 28 inches; wet in places.	Seasonal high water table at a depth of 1 to 2 feet; cut slopes subject to seepage and sloughing; subgrade in cuts is subject to differential frost heave; trafficability is generally good but seasonally the water table hampers hauling in cut areas.	Generally adequate stength for moderately high embankments; underlain by wet, compressible soil material in places.	Generally adequate strength; underlain by wet, compressible soil material in places; seasonal high water table at a depth of 1 to 2 feet; subject to caving.
Rhinebeck: Rh	Poor to fair: limited volume; too clayey in places.	Unsuited: none present.	Poor: clayey material; sticky and plastic when wet; moderate shrink-swell potential.	Seasonal high water table at a depth of 1/2 to 1 foot; cut slopes subject to seepage and slumping; cuts need flat slopes for stability and generally slopes need protective plant cover; subgrade in cuts is compressible clayey material that is very sticky when wet; trafficability very poor when wet.	Generally adequate strength for low embankments; high compressibility and low shear strength.	Generally adequate strength; seasonal high water table at a depth of 1/2 to 1 foot; high compressibility; moderate shrink-swell potential.
Saprists and Fluvaquents, ponded: SA.	Unsuited: under water.	Unsuited: none present.	Unsuited: under water.	Ponded most of the time; natural drainage outlets inadequate; generally not trafficable.	Variable; onsite investigation needed.	Ponded most of the time.
Schoharie: ScB, ScC, SdD, SEE.	Fair to poor: limited volume; too clayey in places; SEE has unfavorable slopes.	Unsuited: none present.	Poor: clayey material; sticky and plastic when wet; moderate shrink-swell potential; SEE has unfavorable slopes.	Seasonal high water table at a depth of 1 1/2 to 3 feet; cut slopes subject to seepage and slumping; flat slopes needed for stability and slopes need protective plant cover; subgrade in cuts is in highly compressible clayey material; sticky when wet; very poor trafficability when wet; SEE has steep, unfavorable slopes.	Generally adequate strength for low embankments; low shear strength and compressibility; SEE is steep and is unsuitable.	Generally adequate strength; seasonal high water table at a depth of 1 1/2 to 3 feet; moderate shrink-swell potential; SEE has steep, unfavorable slopes.

interpretations—Continued

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
Prolonged high water table at or near the surface; 16 to 50 inches of moderately permeable to moderately rapidly permeable organic material over mineral soils of variable permeability.	Not suitable for embankments; 16 to 50 inches of organic material over wet variable mineral soils.	Prolonged high water table at or near the surface; 16 to 50 inches of organic material over variable mineral soils; high shrinkage when drained; subject to soil blowing; natural drainage outlets inadequate.	Drainage needed with water level controls for subirrigation.	Nearly level or depressional topography.	Nearly level or depressional topography.
Pervious gravelly material; seasonal high water table at a depth of 3 feet in a few places; all units but PgA and PgB have unfavorable slopes.	Low to medium compressibility; high to medium permeability; good to fair compaction characteristics; good for outside shell.	Well drained to excessively drained.	Moderate to high available water capacity; moderate to rapid intake rate; rooting depth is mainly in the top 30 inches; all units but PgA are erodible; units PHD, PHE, and PHF have moderately steep to very steep unfavorable slopes.	Moderately permeable to moderately rapidly permeable to a depth of about 31 inches and rapidly permeable or very rapidly permeable below; subject to excessive seepage; units PgC, PHD, PHE, and PHF have rolling to very steep unfavorable slopes.	Moderately permeable to moderately rapidly permeable to a depth of about 31 inches and rapidly permeable below; well drained to excessively drained; units PgC, PHD, PHE, and PHF have rolling to very steep unfavorable slopes.
Pervious material below a depth of 28 inches; seasonal high water table at a depth of 1 to 2 feet.	Low to medium compressibility; high to low permeability; good to fair compaction characteristics; good for outside shell; wet in places.	Moderately permeable to a depth of 28 inches and rapidly permeable below; seasonal high water table at a depth of 1 to 2 feet; ditchbanks unstable.	Moderate to high available water capacity; moderate intake rate; rooting depth is mainly in top 24 to 30 inches; unit PpB is subject to erosion.	Moderately permeable to a depth of about 28 inches and rapidly permeable below; subject to excessive seepage; unit PpA is nearly level.	Rapidly permeable below a depth of 28 inches; moderately well drained; unit PpA is nearly level.
Slowly permeable or very slowly permeable below the surface layer; seasonal high water table at a depth of 1/2 to 1 foot.	Medium to low shear strength; medium compressibility; low permeability; fair to good compaction characteristics; sticky and plastic when wet; moderate shrink-swell potential.	Slowly permeable or very slowly permeable below the surface layer; seasonal high water table at a depth of 1/2 to 1 foot; ditchbanks unstable.	Moderate available water capacity; slow intake rate; rooting depth is mainly in top 1 1/2 to 2 feet; seasonal high water table at a depth of 1/2 to 1 foot.	Slowly permeable below the surface layer; subject to prolonged waterflow; nearly level.	Erodible; unstable ditchbanks; subject to prolonged waterflow; somewhat poorly drained; nearly level.
Ponded most of the time; onsite investigation needed.	Variable material under water.	Ponded most of the time; natural drainage outlets inadequate.	Ponded most of the time.	Ponded most of the time; nearly level.	Ponded most of the time; nearly level.
Slowly permeable or very slowly permeable below a depth of about 12 inches; seasonal high water table at a depth of 1 1/2 to 3 feet; units SdD and SEE have unfavorable slopes.	Low shear strength; medium compressibility; low permeability; sticky and plastic when wet; moderate shrink-swell potential.	Seasonal high water table at a depth of 1 1/2 to 3 feet; slowly permeable or very slowly permeable below a depth of 12 inches; ditchbanks unstable; units SdD and SEE have unfavorable slopes.	Moderate to high available water capacity; slow intake rate; rooting depth is mainly in top 24 to 30 inches; all units are erodible; units SdD and SEE have unfavorable slopes.	Slowly permeable or very slowly permeable below a depth of 12 inches; unit SdD has hilly topography and unit SEE has slopes of more than 20 percent.	Erodible; clayey subsoil and substratum in most places; moderately well drained; units SdD and SEE have slopes of more than 15 percent.

TABLE 8.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Fill material	Highway location	Embankment foundations	Foundations for low buildings
Teel: Te	Good	Unsuited: none present.	Fair to poor: excessive fines; under water with increasing depth in places; silty material; highly erodible.	Subject to flooding; seasonal high water table at a depth of 1 to 2 feet; cuts not indicated; trafficability poor when wet.	Generally adequate strength for low embankments; variable compressibility.	Subject to flooding; seasonal high water table at a depth of 1 to 2 feet.
Urban land: Ub. Onsite investigation needed to determine interpretations.						
Varick: Va	Poor: wet for long periods.	Unsuited: none present.	Poor: bedrock at a depth of 20 to 40 inches; low volume; wet for long periods.	Prolonged high water table at or near the surface; nearly level topography; natural drainage outlets inadequate; shale bedrock at a depth of 20 to 40 inches; trafficability poor when wet.	Adequate strength for high embankments; shale bedrock at a depth of 20 to 40 inches.	Adequate strength; prolonged high water table at or near the surface; shale bedrock at a depth of 20 to 40 inches.
Volusia: VoB, VoC	Poor: channery fragments.	Unsuited: none present.	Good to fair: excessive fines in places; wet in places; large stones in places.	Seasonal high water table at a depth of 1/2 to 1 foot; cut slopes subject to seepage and sloughing; grade in cuts generally good but seasonally wet; trafficability poor when wet.	Generally adequate strength for high embankments.	Adequate strength; seasonal high water table at a depth of 1/2 to 1 foot.
Volusia, moderately shallow variant: VuB.	Poor: channery fragments.	Unsuited: none present.	Poor: sandstone bedrock at a depth of 20 to 40 inches; low volume.	Seasonal high water table at a depth of 1/2 to 1 foot; sandstone bedrock at a depth of 20 to 40 inches; rock in cuts; seepage above pan and bedrock and also through rock strata; trafficability poor when wet.	Adequate strength for high embankments.	Adequate strength; seasonal high water table at a depth of 1/2 to 1 foot; sandstone bedrock at a depth of 20 to 40 inches.
Wampsville: WaA, WaB, WaC.	Poor: too gravelly.	Poor: excessive fines.	Fair to good: excessive fines in places.	Highway grade location is not critical above the water table; cut slopes subject to local seepage and sloughing; subgrade in cuts subject to differential frost heave; trafficability is generally good except when wet.	Generally adequate strength for moderately high embankments; underlain by wet, compressible soil material in places.	Generally adequate strength; seasonal high water table at a depth of 3 feet in places; subject to caving.

interpretations—Continued

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
Subject to flooding; permeability is generally moderate but pervious layers are at increasing depth in places; seasonal high water table at a depth of 1 to 2 feet.	Low to medium compressibility and permeability; good to poor compaction characteristics; under water with increasing depth in places; susceptible to piping; highly erodible.	Subject to flooding; seasonal high water table at a depth of 1 to 2 feet; ditchbanks unstable; subject to channel siltation; moderately permeable.	High available water capacity; moderate to slow intake rate; rooting depth is mainly in top 24 to 30 inches; moderately permeable; seasonal high water table at a depth of 1 to 2 feet; subject to flooding.	Nearly level; subject to flooding.	Nearly level; subject to flooding.
Slowly permeable or very slowly permeable below the surface layer; prolonged high water table at or near the surface; shale bedrock at a depth of 20 to 40 inches.	Shale bedrock at a depth of 20 to 40 inches; low volume; wet for long periods.	Slowly permeable or very slowly permeable below the surface layer; shale bedrock at a depth of 20 to 40 inches; prolonged high water table at or near the surface.	Prolonged high water table at or near the surface.	Nearly level topography.	Nearly level topography.
Very slowly permeable below a depth of 15 inches; seasonal high water table at a depth of 1/2 to 1 foot; bedrock below a depth of 3 1/2 feet in places; unit VoC has unfavorable slopes.	Low to medium compressibility; low permeability; good to fair compaction characteristics; some large stones.	Very slowly permeable fragipan at a depth of about 15 inches; seasonal high water table at a depth of 1/2 to 1 foot; unit VoC is sloping.	Low to moderate available water capacity; slow intake rate; rooting depth is confined to the 10- to 16-inch zone above the fragipan; seasonal high water table at a depth of 1/2 to 1 foot; unit VoC is sloping and erodible.	Generally no unfavorable features; unit VoB includes areas that have nearly level topography.	Very slowly permeable fragipan below a depth of about 15 inches; somewhat poorly drained; subject to prolonged waterflow; unit VoB includes areas that have nearly level topography.
Sandstone bedrock at a depth of 20 to 40 inches.	Sandstone bedrock at a depth of 20 to 40 inches; low volume.	Very slowly permeable fragipan at a depth of about 14 inches; seasonal high water table at a depth of 1/2 to 1 foot; sandstone bedrock at a depth of 20 to 40 inches.	Low to moderate available water capacity; slow intake rate; rooting depth is confined to 10- to 16-inch zone above fragipan; seasonal high water table at a depth of 1/2 to 1 foot.	Sandstone bedrock at a depth of 20 to 40 inches; includes areas that have nearly level topography.	Sandstone bedrock at a depth of 20 to 40 inches; includes areas that have nearly level topography; very slowly permeable fragipan below a depth of about 14 inches; somewhat poorly drained; subject to prolonged waterflow.
Pervious layers; subject to excess seepage; seasonal high water table at a depth of 3 feet in places; unit WaC has unfavorable slopes.	Low to medium compressibility; medium to low permeability; fair to good compaction characteristics.	Well drained ------	High available water capacity; moderate intake rate; rooting depth is mainly in top 30 inches; units WaB and WaC are erodible.	Moderately permeable; subject to seepage; unit WaA is nearly level, and unit WaC has rolling topography.	Well drained; unit WaA is nearly level and unit WaC has rolling topography.

TABLE 8.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Fill material	Highway location	Embankment foundations	Foundations for low buildings
Wareham: Wb	Poor: sandy.	Good to fair for sand; excessive fines in places. Unsuitable for gravel; none present.	Fair: wet for long periods in places; subject to water erosion and soil blowing.	Seasonal high water table at or near the surface to a depth of 1 foot for long periods; nearly level or depressional topography; natural drainage outlets inadequate; fine sand hinders hauling operations.	Variable compressibility; underlain by soft, wet, compressible soil material in places.	Variable strength; underlain by soft, wet, compressible soil material in places; large settlement possible under heavy or vibratory loads; seasonal high water table at a depth of 1 foot for long periods; subject to caving.
Warners Mapped only in an undifferentiated group with Martisco soils.	Poor: wet for long periods.	Unsuited: none present.	Unsuited: wet for long periods; loamy mineral soil over marl and variable mineral soils.	Subject to flooding; prolonged high water table at the surface; nearly level topography; natural drainage outlets inadequate; cuts not indicated; very poor trafficability.	Low strength; variable compressibility; requires onsite investigation.	Subject to flooding; prolonged high water table at the surface.
*Wassaic: WcB, WcC, WDD. For Benson part of WDD, see Benson series for interpretations other than slope.	Poor to fair: low volume; too many coarse fragments in places.	Unsuited: none present.	Poor: limestone or calcareous sandstone bedrock at a depth of 20 to 40 inches; low volume.	Limestone or calcareous sandstone bedrock at a depth of 20 to 40 inches; rock in most cuts; seepage above and through rock strata in most places; trafficability generally good except on the steeper parts of unit WDD.	Adequate strength for high embankments; the steeper parts of unit WDD require bonding measures in places.	Adequate strength; limestone or calcareous sandstone bedrock at a depth of 20 to 40 inches; seepage above and through rock strata in most places; unit WDD has moderately steep unfavorable slopes.
Wayland: Wn	Poor: good material but wet for long periods.	Unsuited: none present.	Poor: wet for long periods; highly erodible; excessive fines.	Subject to frequent flooding; prolonged high water table at or near the surface; nearly level or depressional topography; natural drainage outlets inadequate; cuts not indicated; wet subgrades; very poor trafficability.	Generally adequate strength for low embankments; variable compressibility.	Subject to frequent flooding; prolonged high water table at or near the surface.
Weaver: Wv	Good	Unsuited: none present.	Fair to poor: wet in places with increasing depth; highly erodible; excessive fines.	Subject to frequent flooding; seasonal high water table at a depth of 1 to 2 feet; nearly level flood plains and gently sloping alluvial fans; cut slopes subject to seepage and sloughing; subgrade in cuts unstable; subject to differential frost heave; trafficability poor when wet.	Low strength; variable compressibility; requires onsite investigation.	Not applicable; subject to frequent flooding; seasonal high water table at a depth of 1 to 2 feet.

interpretations—Continued

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
Pervious sandy material; seasonal high water table at or near the surface to a depth of 1 foot for long periods.	Low to medium compressibility; very rapidly permeable; susceptible to piping; good to fair compaction characteristics; under water in places.	Very rapidly permeable; seasonal high water table at or near the surface to a depth of 1 foot for long periods; ditchbanks unstable; subject to channel siltation.	Low to moderate available water capacity; rapid intake rate; rooting depth is affected by water table and is mainly in top 8 to 30 inches; seasonal high water table at or near the surface to a depth of 1 foot for long periods.	Nearly level or depressional topography.	Nearly level or depressional topography.
Variable permeability; subject to flooding; prolonged high water table at or near the surface.	Variable material; generally under water; needs onsite investigation.	Variable permeability; prolonged high water table at the surface; natural drainage outlets inadequate; ditchbanks unstable; subject to flooding.	Very poorly drained	Nearly level topography.	Nearly level topography.
Limestone or calcareous sandstone bedrock at a depth of 20 to 40 inches; moderately permeable.	Limestone or calcareous sandstone bedrock at a depth of 20 to 40 inches; low volume.	Well drained	Moderate to high available water capacity; moderate intake rate; rooting depth is mainly in the 20- to 40-inch zone above the bedrock.	Limestone or calcareous sandstone at a depth of 20 to 40 inches; moderately rapidly permeable above the bedrock; subject to seepage; unit WDD has slopes of more than 20 percent.	Limestone or calcareous sandstone bedrock at a depth of 20 to 40 inches; erodible; well drained; unit WDD has slopes of more than 15 percent.
Subject to frequent flooding; prolonged high water table at or near the surface; moderately slow permeability; pervious layers in places.	Medium to low shear strength; medium to high compressibility; low to medium permeability; susceptible to piping; fair to poor compaction characteristics; wet for long periods.	Subject to frequent flooding; prolonged high water table at or near the surface; moderately slow permeability; ditchbanks unstable; natural drainage outlets inadequate.	Poorly drained and very poorly drained; subject to frequent flooding.	Nearly level or depressional topography on flood plains.	Nearly level or depressional topography on flood plains.
Subject to frequent flooding; moderately permeable; pervious layers in places; seasonal high water table at a depth of 1 to 2 feet.	Variable material; under water with increasing depth; requires onsite investigation.	Subject to frequent flooding; moderately permeable; seasonal high water table at a depth of 1 to 2 feet; ditchbanks unstable.	Subject to frequent flooding; high available water capacity; moderate to slow intake rate; rooting depth mainly in top 24 to 30 inches; seasonal high water table at a depth of 1 to 2 feet.	Nearly level flood plains and gently sloping alluvial fans; moderately permeable; subject to seepage and channel siltation; subject to frequent flooding.	Nearly level flood plains and gently sloping alluvial fans; subject to frequent flooding; moderately well drained; subject to channel siltation.

TABLE 8.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Fill material	Highway location	Embankment foundations	Foundations for low buildings
Williamson: WwA, WwB, WwC, WwC2.	Good to fair: limited volume in places.	Unsuited: none present.	Fair: excessive fines; highly erodible.	Seasonal high water table at a depth of 1 to 2 feet; cut slopes subject to sloughing and are highly erodible; subgrade in cuts is unstable when wet; subject to differential frost heave; trafficability poor when wet.	Generally adequate strength for low embankments.	Generally adequate strength; seasonal high water table at a depth of 1 to 2 feet.

[1] Engineers and others should not apply specific values to the estimates given for bearing capacity of soils.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content; that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A *high* or *moderate* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Engineering interpretations

The interpretations in table 8 are based on the engineering properties of soils shown in table 7, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Onondaga County. In table 8, ratings are used to summarize suitability of the soils as possible sources of topsoil, sand and gravel, and road fill. Also listed are soil features not to be overlooked in planning, construction, and maintenance of highways, light buildings, farm drainage systems, irrigation systems, ponds and reservoirs, terraces and diversions, and waterways.

Soil suitability as a source of topsoil, sand and gravel, and road fill is rated by the terms *good*, *fair*, *poor*, or *unsuitable*. These ratings are based on the relative suitability of the soil materials for these purposes and, in the case of topsoil and road fill, on soil features that affect the ease or difficulty of excavating them.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material, or its response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability. Also considered are thickness of suitable material and soil features that determine ease or difficulty of excavating, particularly soil slope and wetness.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 8 provide guidance about where to look for probable sources. A soil rated as a *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, and neither do they indicate quality of the deposit.

Fill material is soil used in embankments for roads or for raising depressions. The suitability ratings reflect (1) the predicted performance of soil after it has been placed in a fill that has been properly compacted and provided with adequate drainage, and (2) the relative ease of excavating the material at borrow areas.

Highway location is affected by such soil features as load-supporting capacity, shrink-swell potential, soil slope, depth to bedrock, depth to water table, stability of cut slopes, erodibility, seepage, stoniness, hazard of flooding, frost hazard, and trafficability.

Embankment foundations are affected by such soil features as load-carrying capacity, shrink-swell potential, wetness, slope, and depth to bedrock. Most soils that formed in glacial till provide good embankment foundations, but those that formed in glacial outwash, lacustrine sediments, and alluvium are variable. Peat and muck are unsuitable and should be avoided.

Foundations for low buildings are affected by such soil features as load-supporting capacity, slope, depth to bedrock, stoniness, depth to water table, shrink-swell potential, and hazard of flooding.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Embankments and dikes require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil is among unfavorable factors.

interpretations—Continued

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
Moderately permeable to a depth of about 22 inches; slowly permeable or very slowly permeable fragipan below; pervious layers below fragipan in places; seasonal high water table at a depth of 1 to 2 feet.	Medium to low shear strength; medium compressibility; medium to low permeability; susceptible to piping; highly erodible.	Moderately permeable to a depth of 22 inches; slowly permeable or very slowly permeable in fragipan below this depth; seasonal high water table at a depth of 1 to 2 feet; ditchbanks unstable; subject to channel siltation.	Moderate available water capacity; moderate to slow intake rate; rooting depth confined mainly to the 15- to 24-inch zone above the fragipan; all units but WwA are highly erodible.	Moderately permeable to a depth of about 22 inches; slowly permeable or very slowly permeable in the fragipan below this depth; subject to seepage and channel siltation; unit WwA is nearly level.	Highly erodible; moderately well drained; subject to channel siltation; unit WwA is nearly level.

Agricultural drainage is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope; stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion, or soil blowing; soil texture; content of stones; accumulations of salts and alkali; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and in fragipans or other layers that restrict movement of water; amount of water held available to plants; and need for drainage, or depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff and seepage so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

Waterway layout and construction are affected by such soil properties as texture, depth, and erodibility of the soil material; presence of stones or rock outcrops; and the steepness of slopes. Other factors affecting waterways are seepage, natural soil drainage, available water capacity, susceptibility to siltation, and the ease of establishing and maintaining vegetation.

Engineering properties of geologic deposits and bedrock

Characteristics of the geologic deposits in which the soils of Onondaga County formed serve as a basis for placing the soils into broad categories for engineering uses. The following geologic deposits or materials occur in the county: deep glacial till; thin glacial till; glacial outwash; lacustrine deposits; recent alluvium; organic deposits; and bedrock. The deposits and materials and their broad engineering significance are described in the following paragraphs.

DEEP GLACIAL TILL

Glacial till deposits formed when glaciers that had moved into Onondaga County from the north melted and left varying depths of ancient soil and ground-up rock that they had picked up. The resulting deposits are highly variable assortments of soil and rock material that range in particle size from large angular rock fragments and boulders to clay. Glacial till is generally not stratified, but in places, some local sorting has left pockets of sand, gravel, silt, or clay within the till mass.

Deep till deposits discussed in this survey are 3½ feet thick or more over bedrock. Most of these deposits have been subjected to the compactive weight of overriding ice and are very dense and compact. Deposits laid down during ablation stages or downwasting and back-wasting periods of glaciation are generally not so dense and are more permeable.

Soils formed in deep glacial till that is mainly dense and compact are those of the Appleton, Bombay, Cazenovia, Conesus, Darien, Fonda, Hilton, Honeoye, Kendaia, Lansing, Lima, Lyons, Madrid, Manheim, Mardin, Mohawk, Ontario, Ovid, and Volusia series. In a few places, the till in which the Madrid and Bombay soils formed is less dense and is friable.

Very few of the soils formed in deep till deposits are in flat areas. Slopes range mainly from gentle to very steep, and the terrain is such that cut and fill earthwork is involved in most construction. Deep cuts in these deposits often encounter bedrock, especially near the Onondaga escarpment, which crosses the central part of the county in an east-west direction.

For highway engineering purposes, earthwork involves both longitudinal and sidehill cuts and fills. In such better drained soils as Lansing, Honeoye, and Ontario soils, which formed in dense till, properly designed cuts are fairly stable, and subgrades are generally satisfactory. The constantly recurring exception on cut slopes is sloughing, which is associated with frost withdrawal or with large amounts of runoff. This dense or very slowly permeable till impedes

infiltration, and subsequent runoff causes severe sloughing unless it is intercepted. The soils on these dense till deposits furnish good embankment foundations for fills of 10 feet or more if they are not too steep. These soils also furnish good foundation support for buildings. Material excavated from till deposits, if properly compacted, can be used to form stable embankments. In many areas, till deposits in Onondaga County contain large stones and boulders that interfere with fill placement in thin lifts.

THIN GLACIAL TILL

This material is similar to deep glacial till, but the depth to bedrock is generally less than 3½ feet. In most places, the till has weathered, and the relatively less dense material of the solum extends to the bedrock. Rock fragments are common in the soil mass, and even in light grading operations bedrock is generally encountered in excavations.

Soils formed in thin glacial till are over several types of sedimentary bedrock that underlie various sections of the county. These include relatively soft shales over which soils of the Angola, Aurora, Brockport, Camillus, Lairdsville, Lockport, Palatine, and Varick series have formed. These shales are generally rippable with heavy equipment, and they weather and are unstable if exposed to the effects of frost and alternate wetting and drying. Soils that are mainly over hard limestone are those of the Benson, Farmington, and Wassaic series. Those that are over hard sandstone, siltstone, shale, or interstratified occurrences of these hard rocks are soils of the Arnot, Lordstown, and Manlius series, and moderately shallow variants of the Mardin and Volusia series.

Soils formed in thin tills generally furnish satisfactory embankment foundations for fills as deep as 10 feet or more. The soil material is so thin that little settlement can occur, and the bedrock is relatively unyielding. Some areas, however, are steep or very steep, so keying or other bonding measures are needed in places to prevent fills from sliding.

Because of low volume, soils formed in thin till deposits are poor sources of fill material if only the soil material is used. If both the soil material and the underlying bedrock are used as fill material, considerable difficulty may result when placing the fill material in layers thin enough to attain good compaction using most standard compaction equipment. This is especially true where the hard limestone and sandstone formations are encountered.

GLACIAL OUTWASH

These deposits consist mainly of sorted sand and gravel that have been deposited by glacial melt waters. They occupy such geologic landforms as outwash terraces, eskers, valley trains, kames, lake beaches and bars, deltas, and outwash fans. Many of these deposits, especially those on deltas and outwash fans, are underlain by or contain lenses of silt and clay which impede drainage.

The soils that formed in deposits of glacial outwash are those of the Alton, Fredon, Halsey, Herkimer, Howard, Otisville, Palmyra, Phelps, and Wampsville series.

Sand and gravel in the outwash deposits are suitable for many uses. Depending on gradation, soundness, and plasticity, sandy and gravelly outwash can be used for such purposes as fill material for highway embankments; fill material for parking areas and developments; fill material to decrease stress on underlying soils so construction operations can progress; subbase for pavements; wearing surfaces for driveways, parking lots, and some roads; material for highway shoulders; free draining, granular backfill for structures and pipes; outside shells of dams for impounding water; abrasives for snow and ice control on highways; slope-protection blankets to drain and help stabilize wet cut slopes; granular blankets to prevent pumping under concrete pavements; and sources of aggregates for concrete.

Some of the well-drained to excessively drained Alton, Howard, Palmyra, and Wampsville soils are on outwash deposits occupying extensive flat terraces and deltas. These areas generally furnish excellent locations for highways and other developments. In places, these deposits are underlain by wet compressible silt and clay. This possibility must be considered on all sites of proposed high fills and heavy structures. Generally, outwash deposits have adequate strength to support low buildings and moderately high embankments of 5 to 10 feet where slopes are not too steep. Cut slopes on which sandy strata of outwash are encountered are subject to erosion and sloughing. Also, cobbles are dislodged in cuts in places as a result of frost action. If silt and very fine sand strata, which retard internal drainage, are intercepted by a highway gradeline or if they are near the top of the subgrade in cuts, differential frost heaving occurs. Cuts in these outwash materials are dry in places during construction seasons, and it is difficult to foresee the potentially adverse moisture conditions that develop in wet seasons.

LACUSTRINE DEPOSITS

For a considerable length of time, glacial lakes occupied extensive areas of the northern part of the county as well as some valley areas. These glaciolacustrine deposits are relatively stone free and range in texture from sand to clay.

Soils that formed in deep lacustrine silt and clay deposits are those of the Schoharie, Odessa, Lakemont, and Rhinebeck series. Soils of the Arkport, Colonie, Croghan, Galen, Lamson, Minoa, Naumburg, and Wareham series formed in deep sandy deposits. These are also deep deposits of silt and very fine sand in which soils of the Canandaigua, Collamer, Dunkirk, Niagara, and Williamson series formed.

The soils that formed in these lacustrine deposits are nearly level or depressional to very steeply sloping. Because of their fine texture and relatively low strength, these soils, with the exception of the sandy deposits, are erodible. The sandy Arkport and Colonie soils, however, are subject to soil blowing and difficult to vegetate in cuts or in graded areas because of the low available moisture capacity and low fertility. The deep deposits of silt and very fine sand in which soils of the Canandaigua, Collamer, Dunkirk, Niagara, and Williamson series formed are the most easily eroded soils in the county. The clayey soils are more erosion resistant, but erosion is severe on all sloping lacus-

trine deposits wherever water concentrates in channels.

Landslides and slips occur on some silt and clay deposits which have relatively low shear strength. Cut slopes should be fairly flat. If they are not, a blanket of granular material can be used to provide stability. Highways and structures along the top of the slope or on any part of steeper slopes on terrace fronts are subject to damage because of the relatively low shear strength.

Except for the soils on deep sands, infiltration is restricted. Where relief is nearly level, runoff is very slow. Wetness generally increases with increasing depth, and experience has shown that some clayey and silty deposits in this area have high natural moisture content. Determination of moisture content is necessary, therefore, before using these locations for engineering works or as sources for borrow. Moisture content should also be carefully controlled when building embankments with these materials.

Because they are relatively weak, clayey and silty lacustrine sediments are more difficult to use in engineering works than most other mineral soil materials in the county. Where soils are flat and wet, as are Lakemont soils, highway gradelines need to be kept high. Sites for high embankments and heavy structures or buildings on all areas of soils formed in these finer sediments need to be investigated thoroughly for strength, settlement characteristics, and height of the water table. The fine sand and silt deposits are susceptible to frost action, and they lose strength seasonally when the moisture content is increased by thawing. The clayey sediments are very sticky and plastic when wet. Both sediments are difficult to work. A drainage course is needed beneath highway pavements and parking lots that are to be constructed on them. Consideration needs to be given to the use of transition filters under the drainage course. These filters prevent the movement, or piping, of the fine-textured lacustrine sediment into the drainage course.

During wet periods, trafficability over soils formed in silty or clayey sediments is poor. It is also poor on the noncohesive sands similar to those in which Colonie soils formed.

RECENT ALLUVIUM

These deposits consist of strata of sediments of varying textures deposited on the flood plains of present-day streams.

The land type Fluvaquents, frequently flooded, and soils of the Hamlin, Teel, Warners, Wayland, and Weaver series formed in recent alluvium.

The soils on these alluvial deposits are subject to annual overflow, and in places they are flooded more frequently. When these soils are not flooded, the water table fluctuates according to the water levels of the adjacent streams.

Even skim cuts generally encounter a water table; hence, cuts are generally not practical. Since the areas are subject to overflow, highway grade locations should be above flood elevation.

Foundation conditions for bridges and high embankments are generally poor on soils formed in these alluvial deposits. In places, they are underlain by soft, wet, compressible lacustrine sediments. Thorough investigation and, on some locations, special analysis and design, are required before construction of bridges or placement of embankments.

ORGANIC DEPOSITS

Organic deposits are for the most part accumulations of plant and animal remains. In places, they include a minimal amount of inorganic material. They occur in very poorly drained depressional areas.

Carlisle, Edwards, Martisco, and Palms muck are the soils formed in organic deposits in Onondaga County. The soils in organic deposits are entirely unsuitable for highway or other embankment sites or for building foundations because they are highly compressible and unstable. Generally, for highways, organic deposits should be removed and replaced with suitable backfill. Backfill below the water table should be made with broken rock or granular material. The highway gradeline on these areas must be above the high water elevation. Organic deposits are not good sources of topsoil, but they can be used to amend the unsatisfactory physical features of both sandy and clayey soils that are to be used as topsoil.

BEDROCK

Bedrock is a very important feature to consider in engineering construction in Onondaga County. Exposures of bare bedrock are termed Rock outcrop in mapping units and associations in this survey. In addition to exposed bedrock, it is near the surface in many areas. The subsections "Physiography" and "Geology" in this survey describe the extent and geographical occurrence of the different kinds of bedrock in Onondaga County.

Soils and engineering construction in winter

Freezing weather affects soils in ways that have a bearing on engineering construction. Some common problems are discussed in the following paragraphs.

FROST EFFECTS

All soils, rocks, and buildings in Onondaga County are subject in varying degrees to the effects of freezing and thawing of soil water. As a consequence, measures to combat frost damage are generally needed for all types of engineering construction.

Two types of frost heave occur. One type is uniform heave, and the other is differential heave.

Uniform heave occurs where such uniform soil textures and uniform water conditions exist as in the silty lacustrine deposits in which the Dunkirk, Collamer, Niagara, and Canandaigua soils formed and the clayey deposits in which the Schoharie, Odessa, Lakemont, and Rhinebeck soils formed.

Differential heave occurs where the soil textures vary in contiguous strata; or at cut and fill transitions when there is an available source of water close to the surface; or in those soils that contain varying sized rock fragments in the frost zone, especially those greater than 10 inches in size. Differential heaving also occurs where lateral drains, culverts, and approach fills to bridges and overpasses break the uniformity of subgrade conditions. Differential heave is most serious in nonuniform, stratified gravelly outwash deposits in which such soils as Alton,

Howard, Palmyra, Phelps, Otisville, Herkimer, Fredon, Halsey, and Wampsville soils have formed. Large rock fragments that are moved by boulder heaves are most commonly found in such soils formed in glacial till deposits of the uplands as Ontario, Hilton, Madrid, and Bombay soils.

Differential heave, in contrast to uniform heave, produces more pavement stressing and surface roughness.

The freezing and thawing effect on all soils in the county, regardless of texture, causes deterioration of thin pavements and unpaved roads as well as loss of density of supporting soils. On cut slopes, it causes displacement of cobbles, stones, and boulders, and soil creep. It also causes weathering and dislodgment of rock in rock cuts. During periods of thawing, there is a loss of subgrade support, and drainage is restricted by the still-frozen layer during the process.

WINTER EMBANKMENT CONSTRUCTION

During freezing weather, much greater compactive effort is required to obtain the minimum acceptable degree of compaction of soils. As the temperature falls below 25° F, which is common for long periods in Onondaga County, it becomes virtually impossible to attain a satisfactory degree of densification with standard compaction equipment. This is true even when working with such relatively clear sands and gravels as those of the Colonie, Alton, and Otisville soils.

Highway embankments constructed during freezing temperatures generally settle unevenly for a period of years, and consequently, the pavement becomes rough. Winter work on construction of embankments needs to be limited to the placement of rock fills. The surfaces of partly constructed embankments that are left exposed during winter months need to be crowned and rolled smooth to shed water and keep infiltration to a minimum.

Town and Country Planning

This section is of special interest to developers, planners, and others who are concerned with community, industry, and recreational planning and development. It is also of interest to individuals who plan to build a home and are concerned with the choice of a homesite.

In Onondaga County, population is increasing and farmland is decreasing as residential, commercial, and recreational facilities are developed. The areas adjacent to Syracuse, especially the towns of Clay, Cicero, De Witt, and Lysander, are rapidly expanding. An effect of this expansion is the increasing need for useful and reliable information about the use of soils for nonfarm purposes.

Table 9 lists the soils of the county and shows the soil features that are most limiting and the estimated degree to which these features affect use of soils for the various purposes. Other useful information can be found on the soil maps and in other parts of the survey, particularly in the sections "Descriptions of the Soils" and "Engineering Uses of the Soils."

TABLE 9.—*Limitations of soils for*

Soil	Community developments				
	Dwellings with basements	Shopping centers and small industrial buildings	Local roads and streets	Septic-tank absorption fields	Underground public utilities
Alton gravelly fine sandy loam, 0 to 3 percent slopes.	Slight	Slight	Slight	Slight[2]	Severe: very gravelly layers subject to sloughing.
Alton gravelly fine sandy loam, 3 to 8 percent slopes.	Slight	Moderate: slope	Slight	Slight[2]	Severe: very gravelly layer subject to sloughing.
Alton gravelly fine sandy loam, rolling.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope	Severe: very gravelly layers subject to sloughing; slope.
Angola-Darien silt loams, 0 to 6 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Severe: high susceptibility to frost action.	Severe: somewhat poorly drained; slow permeability; less than 40 inches depth to rippable bedrock in places.	Severe: somewhat poorly drained; rippable bedrock at a depth of 20 to 40 inches in places.
Angola-Darien silt loams, 6 to 12 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained; slope.	Severe: high susceptibility to frost action.	Severe: somewhat poorly drained; slow permeability; less than 40 inches depth to rippable bedrock in places.	Severe: somewhat poorly drained; rippable bedrock at a depth of 20 to 40 inches in places.
Appleton loam, 0 to 3 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Severe: high susceptibility to frost action.	Severe: somewhat poorly drained; moderately slow permeability.	Severe: somewhat poorly drained.
Appleton channery silt loam, 0 to 3 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Severe: high susceptibility to frost action.	Severe: somewhat poorly drained; moderately slow permeability.	Severe: somewhat poorly drained.

In most places, soil investigations for the survey did not extend to depths below 3½ to 5 feet. Also, small areas of included soils differ from the dominant soil for which the mapping unit was named. Consequently, onsite determination is necessary for most uses, especially those, such as sanitary landfills, that require deep excavations.

The main soil features considered in rating the soils for the various uses were slope; natural drainage, or the depth to seasonal or prolonged high water table; permeability, or the rate at which water moves through the soil; the presence of hard bedrock, which generally requires blasting before it can be excavated; the presence of rippable bedrock, which generally can be excavated with such light excavating equipment as backhoes; stoniness, or the presence of large stones 10 inches or more across; rockiness, or areas where bedrock is exposed or covered with a very thin soil mantle; surface texture or particle-size (sand, silt, clay, gravel, stone fragments, cobbles, and shale fragments) distribution; and the hazard of flooding or ponding.

In table 9, the limitations of the soils in the county are rated *slight*, *moderate*, or *severe*. One or more chief limitations for the use specified are listed if the limitations are rated moderate or severe. A rating of *slight* indicates that the soil has few or no limitations and is considered desirable for the specified use. A rating of *moderate* indicates that a moderate problem is recognized but can be overcome or corrected. A rating of *severe* indicates that the use of the soil is seriously limited by one or more hazards or restrictions that are difficult and costly to overcome. A rating of severe for a particular use does not imply that a soil so rated cannot be put to that use. Also, it should be recognized that large-scale cuts or fills in an area can alter the natural soil so much that ratings given in the table no longer apply.

No single property restricts all types of uses for town and country planning equally. For example, the somewhat poorly drained natural drainage class has a moderate limitation for picnic and play areas, but it has a severe limitation for septic-tank absorption fields.

Following are the explanations of the uses rated in table 9:

Dwellings with basements.—These ratings are for homes and other buildings, three stories high or less, with basements, built mainly for subdivision development. Considered in rating the soils were soil drainage class, slope, depth to either hard or rippable bedrock, surface rockiness, surface stoniness, and flood hazard. Dwellings without basements generally have better ratings for soil drainage class and depth to either hard or rippable bedrock, but all other ratings are the same. For example, somewhat poorly drained soil is rated severe for dwellings with basements and moderate for dwellings without basements.

Shopping centers and small industrial buildings.—These ratings are for shopping centers and small industrial buildings that have foundation requirements not exceeding those of ordinary three-story buildings. The soil ratings considered were soil drain-

town and country planning

Community developments—Continued		Recreational uses			
Sanitary landfill (trenches)	Lawns, landscaping, and golf fairways[1]	Picnic and play areas	Camp areas	Paths and trails	Athletic fields
Severe: rapid permeability.	Moderate: gravel --	Moderate: gravel --	Moderate: gravel --	Moderate: gravel --	Severe: gravel.
Severe: rapid permeability.	Moderate: gravel --	Moderate: gravel --	Moderate: gravel --	Moderate: gravel --	Severe: gravel.
Severe: rapid permeability.	Moderate: gravel; slope.	Moderate: gravel; slope.	Moderate: gravel; slope.	Moderate: gravel --	Severe: gravel; slope.
Severe: rippable bedrock at a depth of 20 to 40 inches in places.	Moderate: somewhat poorly drained; bedrock at a depth of 20 to 40 inches in places.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; slow permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.
Severe: rippable bedrock at a depth of 20 to 40 inches in places.	Moderate: somewhat poorly drained; bedrock at a depth of 20 to 40 inches; slope.	Moderate: somewhat poorly drained; slope.	Moderate: somewhat poorly drained; slope; slow permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; slope.
Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; slow permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.
Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; rock fragments.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; slow permeability; stone fragments.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; stone fragments.

TABLE 9.—*Limitations of soils for*

Soil	Community developments				
	Dwellings with basements	Shopping centers and small industrial buildings	Local roads and streets	Septic-tank absorption fields	Underground public utilities
Appleton channery silt loam, 3 to 8 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Severe: high susceptibility to frost action.	Severe: somewhat poorly drained; moderately slow permeability.	Severe: somewhat poorly drained.
Arkport very fine sandy loam, 2 to 6 percent slopes.	Slight	Moderate: slope	Slight	Slight[2]	Moderate: loamy very fine sand layers subject to sloughing.
Arkport very fine sandy loam, rolling.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope[2]	Moderate: loamy very fine sand layers subject to sloughing.
Arkport very fine sandy loam, hilly.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope
Arnot channery silt loam, gently sloping.	Severe: hard bedrock at a depth of 10 to 20 inches.	Severe: hard bedrock at a depth of 10 to 20 inches.	Severe: hard bedrock at a depth of 10 to 20 inches.	Severe: bedrock at a depth of 10 to 20 inches.	Severe: hard bedrock at a depth of 10 to 20 inches.
Arnot-Lordstown association, very steep.	Severe: slope; hard bedrock at a depth of 10 to 40 inches.	Severe: slope; hard bedrock at a depth of 10 to 40 inches.	Severe: slope; hard bedrock at a depth of 10 to 40 inches.	Severe: slope; hard bedrock at a depth of 10 to 40 inches.	Severe: slope; hard bedrock at a depth of 10 to 40 inches.
Aurora silt loam, 0 to 6 percent slopes.	Moderate: moderately well drained; rippable bedrock at a depth of 20 to 40 inches.	Moderate: moderately well drained; rippable bedrock at a depth of 20 to 40 inches; slope.	Moderate: rippable bedrock at a depth of 20 to 40 inches; susceptibility to frost action.	Severe: rippable bedrock at a depth of 20 to 40 inches; slow permeability.	Moderate: rippable bedrock at a depth of 20 to 40 inches.
Aurora silt loam, 6 to 12 percent slopes.	Moderate: moderately well drained; rippable bedrock at a depth of 20 to 40 inches; slope.	Severe: slope	Severe: slope	Severe: rippable bedrock at a depth of 20 to 40 inches; slow permeability.	Moderate: rippable bedrock at a depth of 20 to 40 inches; slope.
Aurora silt loam, 12 to 18 percent slopes.	Severe: slope	Severe: slope	Severe: slope	Severe: rippable bedrock at a depth of 20 to 40 inches; slow permeability; slope.	Severe: slope
Aurora silt loam, 12 to 18 percent slopes, eroded.	Severe: slope	Severe: slope	Severe: slope	Severe: rippable bedrock at a depth of 20 to 40 inches; slow permeability; slope.	Severe: slope
Aurora-Farmington-Rock outcrop association, steep.	Severe: slope; bedrock within a depth of 40 inches; many bedrock ledges.	Severe: slope	Severe: slope	Severe: slope; mixed hard and rippable bedrock within a depth of 40 inches; many bedrock ledges; slow permeability.	Severe: slope; mixed hard and rippable bedrock within a depth of 40 inches; many bedrock ledges; slow permeability.
Benson silt loam, undulating.	Severe: hard bedrock at a depth of 10 to 20 inches.	Severe: hard bedrock at a depth of 10 to 20 inches.	Severe: hard bedrock at a depth of 10 to 20 inches.	Severe: hard bedrock at a depth of 10 to 20 inches.	Severe: hard bedrock at a depth of 10 to 20 inches.
Benson silt loam, rolling.	Severe: hard bedrock at a depth of 10 to 20 inches.	Severe: hard bedrock at a depth of 10 to 20 inches; slope.	Severe: hard bedrock at a depth of 10 to 20 inches.	Severe: hard bedrock at a depth of 10 to 20 inches.[3]	Severe: hard bedrock at a depth of 10 to 20 inches.
Benson-Wassaic-Rock outcrop association, sloping.	Severe: hard bedrock within a depth of 40 inches; many rock outcrops.	Severe: hard bedrock within a depth of 40 inches; many rock outcrops.	Severe: hard bedrock within a depth of 40 inches; many rock outcrops.	Severe: hard bedrock within a depth of 40 inches; many rock outcrops.[3]	Severe: hard bedrock within a depth of 40 inches; many rock outcrops.
Benson-Wassaic-Rock outcrop association, very steep.	Severe: slope; hard bedrock within a depth of 40 inches; many bedrock ledges.	Severe: slope; hard bedrock within a depth of 40 inches; many bedrock ledges.	Severe: slope; hard bedrock within a depth of 40 inches; many bedrock ledges.	Severe: slope; hard bedrock within a depth of 40 inches; many bedrock ledges.[3]	Severe: slope; hard bedrock within a depth of 40 inches; many bedrock ledges.
Bombay gravelly loam, 2 to 8 percent slopes.	Moderate: moderately well drained.	Moderate: moderately well drained; slope.	Moderate: frost action.	Moderate: moderately well drained.	Moderate: moderately well drained.

town and country planning—Continued.

Community developments—Continued		Recreational uses			
Sanitary landfill (trenches)	Lawns, landscaping, and golf fairways[1]	Picnic and play areas	Camp areas	Paths and trails	Athletic fields
Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; rock fragments.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; slow permeability; stone fragments.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; stone fragments.
Severe: rapid permeability.	Slight	Slight	Slight	Slight	Moderate: slope.
Severe: rapid permeability.	Moderate: slope	Moderate: slope	Moderate: slope	Slight	Severe: slope.
Severe: rapid permeability.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Severe: slope.
Severe: hard bedrock at a depth of 10 to 20 inches.	Severe: bedrock at a depth of 10 to 20 inches.	Moderate: stone fragments.	Moderate: stone fragments.	Moderate: angular stone fragments.	Severe: hard bedrock at a depth of 10 to 20 inches; slope in places.
Severe: slope; hard bedrock at a depth of 10 to 40 inches.	Severe: slope; hard bedrock at a depth of 10 to 40 inches.	Severe: slope	Severe: slope	Severe: slope	Severe: slope; hard bedrock at a depth of 10 to 20 inches in places.
Moderate: rippable bedrock at a depth of 20 to 40 inches; moderately well drained.	Moderate: bedrock at a depth of 20 to 40 inches.	Slight	Moderate: slow permeability.	Slight	Moderate: slope; slow permeability; rippable bedrock at a depth of 20 to 40 inches.
Moderate: rippable bedrock at a depth of 20 to 40 inches; moderately well drained.	Moderate: bedrock at a depth of 20 to 40 inches; slope.	Moderate: slope	Moderate: slope; slow permeability.	Slight	Severe: slope.
Moderate: rippable bedrock at a depth of 20 to 40 inches; slope.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Severe: slope.
Moderate: rippable bedrock at a depth of 20 to 40 inches; slope.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Severe: slope.
Severe: slope; mixed hard and rippable bedrock within a depth of 40 inches; many bedrock ledges; slow permeability.	Severe: slope; mixed hard and rippable bedrock within a depth of 40 inches; many bedrock ledges; slow permeability.	Severe: slope	Severe: slope	Severe: slope	Severe: slope; bedrock within a depth of 40 inches; many bedrock ledges.
Severe: hard bedrock at a depth of 10 to 20 inches.	Severe: hard bedrock at a depth of 10 to 20 inches.	Slight	Slight	Slight	Severe: bedrock at a depth of 10 to 20 inches.
Severe: hard bedrock at a depth of 10 to 20 inches.	Severe: bedrock at a depth of 10 to 20 inches.	Moderate: slope	Moderate: slope	Slight	Severe: bedrock at a depth of 10 to 20 inches; slope.
Severe: hard bedrock within a depth of 40 inches; many rock outcrops.	Severe: hard bedrock within a depth of 40 inches; many rock outcrops.	Moderate: slope; very rocky.	Moderate: slope; very rocky.	Moderate: very rocky.	Severe: hard bedrock within a depth of 40 inches; many rock outcrops; slope.
Severe: slope; hard bedrock within a depth of 40 inches; many bedrock ledges.	Severe: slope; hard bedrock within a depth of 40 inches; many bedrock ledges.	Severe: slope	Severe: slope	Severe: slope	Severe: slope; hard bedrock within a depth of 40 inches; many bedrock ledges.
Slight	Moderate: gravel	Slight	Moderate: gravel	Slight	Moderate: slope; moderately well drained; gravel.

TABLE 9.—*Limitations of soils for*

Soil	Community developments				
	Dwellings with basements	Shopping centers and small industrial buildings	Local roads and streets	Septic-tank absorption fields	Underground public utilities
Camillus silt loam, 2 to 6 percent slopes.	Slight	Moderate: slope	Slight	Slight[3]	Slight
Camillus silt loam, 6 to 12 percent slopes.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope[3]	Moderate: slope
Camillus silt loam, 6 to 12 percent slopes, eroded.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope[3]	Moderate: slope
Camillus silt loam, 12 to 18 percent slopes, eroded.	Severe: slope	Severe: slope	Severe: slope	Severe: slope of more than 15 percent.[3]	Severe: slope
Camillus and Lairdsville shaly soils, steep.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope
Canandaigua mucky silt loam.	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained; high susceptibility to frost action.	Severe: poorly drained and very poorly drained; slow permeability.	Severe: poorly drained and very poorly drained.
Carlisle muck	Severe: very poorly drained; organic deposit.	Severe: very poorly drained; organic deposit.	Severe: very poorly drained; organic deposit.	Severe: very poorly drained.	Severe: very poorly drained; organic deposit.
Cazenovia silt loam, 2 to 8 percent slopes.	Moderate: moderately well drained.	Moderate: slope; moderately well drained.	Moderate: susceptibility to frost action.	Severe: slow permeability.	Moderate: moderately well drained.
Cazenovia silt loam, 8 to 15 percent slopes.	Moderate: moderately well drained; slope.	Severe: slope	Moderate: slope; susceptibility to frost action.	Severe: slow permeability.	Moderate: slope; moderately well drained.
Cazenovia silt loam, 8 to 15 percent slopes, eroded.	Moderate: moderately well drained; slope.	Severe: slope	Moderate: slope; susceptibility to frost action.	Severe: slow permeability.	Moderate: slope; moderately well drained.
Cazenovia soils, 15 to 25 percent slopes.	Severe: slope	Severe: slope	Severe: slope	Severe: slow permeability; slope.	Severe: slope
Collamer silt loam, 0 to 2 percent slopes.	Moderate: moderately well drained.	Moderate: moderately well drained.	Moderate: susceptibility to frost action.	Severe: slow permeability.	Moderate: moderately well drained.
Collamer silt loam, 2 to 6 percent slopes.	Moderate: moderately well drained.	Moderate: moderately well drained; slope.	Moderate: susceptibility to frost action.	Severe: slow permeability.	Moderate: moderately well drained.
Colonie loamy fine sand, 0 to 6 percent slopes.	Slight	Moderate: slope	Slight	Slight[2]	Severe: loamy fine sand and fine sand subject to sloughing.
Colonie loamy fine sand, rolling.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope[2]	Severe: loamy fine sand and fine sand subject to sloughing.
Conesus gravelly silt loam, 0 to 3 percent slopes.	Moderate: moderately well drained.	Moderate: moderately well drained.	Moderate: susceptibility to frost action.	Severe: slow permeability.	Moderate: moderately well drained.
Conesus gravelly silt loam, 3 to 8 percent slopes.	Moderate: moderately well drained.	Moderate: moderately well drained; slope.	Moderate: susceptibility to frost action.	Severe: slow permeability.	Moderate: moderately well drained.

town and country planning—Continued

Community developments—Continued		Recreational uses			
Sanitary landfill (trenches)	Lawns, landscaping, and golf fairways[1]	Picnic and play areas	Camp areas	Paths and trails	Athletic fields
Severe: rippable bedrock at a depth of 20 to 40 inches; rapid permeability.	Slight	Slight	Slight	Slight	Moderate: slope.
Severe: rippable bedrock at a depth of 20 to 40 inches; rapid permeability.	Moderate: slope	Moderate: slope	Moderate: slope	Slight	Severe: slope.
Severe: rippable bedrock at a depth of 20 to 40 inches; rapid permeability.	Moderate: slope	Moderate: slope	Moderate: slope	Slight	Severe: slope.
Severe: rippable bedrock at a depth of 20 to 40 inches; rapid permeability.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Severe: slope.
Severe: slope; rapid permeability; bedrock at a depth of 20 to 40 inches.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.	Severely: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.
Severe: very poorly drained; organic deposit.	Severe: very poorly drained; muck texture.	Severe: very poorly drained; organic soils.	Severe: very poorly drained; organic soils.	Severe: very poorly drained; organic soils.	Severe: very poorly drained; organic soils.
Moderate: silty clay loam; firm till is very stony in places.	Slight	Slight	Moderate: moderately well drained; slow permeability.	Slight	Moderate: slope; moderately well drained; slow permeability.
Moderate: silty clay loam; firm till is very stony in places.	Moderate: slope	Moderate: slope	Moderate: slope; slow permeability.	Slight	Severe: slope.
Moderate: silty clay loam; firm till; very stony in places.	Moderate: slope	Moderate: slope	Moderate: slope; slow permeability.	Slight	Severe: slope.
Moderate: slope; silty clay loam; firm till; very stony in places.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Severe: slope.
Slight	Slight	Slight	Moderate: moderately well drained; slow permeability.	Slight	Moderate: moderately well drained; slow permeability.
Slight	Slight	Slight	Moderate: moderately well drained; slow permeability.	Slight	Moderate: slope; moderately well drained; slow permeability.
Severe: rapid permeability; sand.	Severe: loamy fine sand without textural B horizon.	Moderate: loamy fine sand.	Moderate: loamy fine sand.	Moderate: loamy fine sand.	Severe: loamy fine sand subject to blowing.
Severe: rapid permeability; sand.	Severe: loamy fine sand without textural B horizon.	Moderate: loamy fine sand; slope.	Moderate: slope; loamy fine sand.	Moderate: loamy fine sand.	Severe: slope; loamy fine sand subject to blowing.
Moderate: firm or very firm till; very stony in places.	Moderate: gravel	Slight	Moderate: moderately well drained; slow permeability; gravel.	Slight	Moderate: moderately well drained; slow permeability; gravel.
Moderate: firm or very firm till; very stony in places.	Moderate: gravel	Slight	Moderate: moderately well drained; slow permeability; gravel.	Slight	Moderate: slope; moderately well drained; slow permeability; gravel.

TABLE 9.—*Limitations of soils for*

Soil	Community developments				
	Dwellings with basements	Shopping centers and small industrial buildings	Local roads and streets	Septic-tank absorption fields	Underground public utilities
Croghan loamy fine sand, 0 to 6 percent slopes.	Moderate: moderately well drained.	Moderate: moderately well drained; slope in places.	Slight	Moderate: moderately well drained.[2]	Severe: loamy fine sand and sand subject to sloughing.
Darien silt loam	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Moderate: somewhat poorly drained; susceptibility to frost action.	Severe: somewhat poorly drained; very slow permeability.	Severe: somewhat poorly drained.
Dunkirk silt loam, rolling.	Moderate: slope	Severe: slope	Moderate: susceptibility to frost action.	Severe: moderately slow or slow permeability.	Moderate: slope; silt layers below a depth of 40 inches subject to sloughing.
Edwards muck	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained; organic deposits.	Severe: very poorly drained.	Severe: very poorly drained; organic deposits.
Farmington-Aurora association, sloping.	Severe: hard bedrock at a depth of 10 to 40 inches in places.	Severe: slope; hard bedrock at a depth of 10 to 40 inches in places.	Severe: slope; hard bedrock at a depth of 10 to 40 inches in places.	Severe: bedrock at a depth of 10 to 40 inches in places.	Severe: hard bedrock at a depth of 10 to 20 inches in places.
Fluvaquents, frequently flooded.	Severe: flooding; poorly drained and very poorly drained in places.	Severe: flooding; poorly drained and very poorly drained in places.	Severe: flooding; poorly drained and very poorly drained in places.	Severe: flooding; poorly drained and very poorly drained in places.	Severe: flooding; poorly drained and very poorly drained in places.
Fonda mucky silty clay loam.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained; silty clay and clay.
Fredon loam	Severe: somewhat poorly drained and poorly drained.	Severe: somewhat poorly drained and poorly drained.	Severe: somewhat poorly drained and poorly drained.	Severe: somewhat poorly drained and poorly drained.	Severe: somewhat poorly drained and poorly drained; very gravelly strata; subject to sloughing.
Galen very fine sandy loam, 0 to 2 percent slopes.	Moderate: moderately well drained.	Moderate: moderately well drained; slope.	Moderate: susceptibility to frost action.	Moderate: moderately well drained.[2]	Moderate: moderately well drained; loamy fine sand and fine sand strata subject to sloughing.
Galen very fine sandy loam, 2 to 6 percent slopes.	Moderate: moderately well drained.	Moderate: moderately well drained.	Moderate: susceptibility to frost action.	Moderate: moderately well drained.[2]	Moderate: moderately well drained; loamy fine sand and fine sand layers subject to sloughing.
Halsey mucky loam	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained; very gravelly layers subject to sloughing.
Hamlin silt loam	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding
Hamlin silt loam, high bottom.	Severe: flooding	Severe: flooding	Moderate: flooding	Severe: flooding	Moderate: infrequent flooding.
Herkimer silt loam	Severe: flooding	Severe: flooding	Severe: flooding, moderate in some areas.	Severe: flooding	Severe: very shaly strata subject to sloughing; flooding.
Hilton loam, 0 to 3 percent slopes.	Moderate: moderately well drained.	Moderate: moderately well drained.	Moderate: susceptibility to frost action.	Severe: slow permeability.	Moderate: moderately well drained.
Hilton loam, 3 to 8 percent slopes.	Moderate: moderately well drained.	Moderate: moderately well drained; slope.	Moderate: susceptibility to frost action.	Severe: slow permeability.	Moderate: moderately well drained.
Honeoye silt loam, 2 to 8 percent slopes.	Slight	Moderate: slope	Slight	Severe: slow permeability.	Slight

town and country planning—Continued.

Community developments—Continued		Recreational uses			
Sanitary landfill (trenches)	Lawns, landscaping, and golf fairways[1]	Picnic and play areas	Camp areas	Paths and trails	Athletic fields
Severe: rapid permeability; sand.	Severe: loamy fine sand without textural B horizon.	Moderate: loamy fine sand.	Moderate: loamy fine sand.	Moderate: loamy fine sand.	Severe: loamy fine sand subject to blowing.
Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; slow permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.
Slight	Moderate: slope	Moderate: slope	Moderate: slope; moderately slow and slow permeability.	Slight	Severe: slope.
Severe: very poorly drained; organic deposits.	Severe: very poorly drained; muck texture.	Severe: very poorly drained; organic soil.	Severe: very poorly drained; organic soil.	Severe: very poorly drained; organic soil.	Severe: very poorly drained; organic soil.
Severe: hard bedrock at a depth of 10 to 20 inches in most places.	Severe: bedrock at a depth of 10 to 20 inches in places.	Moderate: slope	Moderate: slope; slow permeability.	Slight	Severe: slope; bedrock at a depth of 10 to 20 inches in places.
Severe: flooding; poorly drained and very poorly drained in places.	Severe: flooding; poorly drained and very poorly drained in places.	Severe: frequent flooding.	Severe: frequent flooding.	Moderate: may flood 2 to 3 times during season of use.	Severe: frequent flooding.
Severe: very poorly drained; silty clay and clay.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained; very slow permeability.	Severe: very poorly drained.	Severe: very poorly drained; very slow permeability.
Severe: rapid permeability; poorly drained in places.	Moderate: somewhat poorly drained and poorly drained.	Severe: somewhat poorly drained and poorly drained.	Severe: somewhat poorly drained and poorly drained.	Moderate: somewhat poorly drained and poorly drained.	Severe: somewhat poorly drained and poorly drained.
Moderate: fine or very fine sandy layers; rapid permeability in places.	Slight	Slight	Slight	Slight	Moderate: moderately well drained.
Moderate: fine or very fine sand; rapid permeability in places.	Slight	Slight	Slight	Slight	Moderate: slope; moderately well drained.
Severe: very poorly drained; rapid permeability.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.
Severe: flooding	Severe: flooding	Moderate: flooding	Moderate: infrequent flooding during season of use.	Slight	Moderate: may flood once in two years during season of use.
Severe: flooding	Slight	Slight	Moderate: very infrequent flooding during season of use.	Slight	Moderate: may flood once in 5 to 10 years during season of use.
Severe: rapid permeability; flooding.	Slight	Slight	Moderate: very infrequent flooding during season of use.	Slight	Moderate: slope; may flood once in two years during season of use.
Moderate: firm or very firm till.	Slight	Slight	Moderate: moderately well drained; slow permeability.	Slight	Moderate: moderately well drained; gravel; slow permeability.
Moderate: firm or very firm till.	Slight	Slight	Moderate: moderately well drained, slow permeability.	Slight	Moderate: slope; moderately well drained; gravel; slow permeability.
Moderate: firm or very firm till; very stony in places.	Slight	Slight	Slight	Slight	Moderate: slope; gravel.

TABLE 9.—*Limitations of soils for*

Soil	Community developments				
	Dwellings with basements	Shopping centers and small industrial buildings	Local roads and streets	Septic-tank absorption fields	Underground public utilities
Honeoye silt loam, 8 to 15 percent slopes.	Moderate: slope	Severe: slope	Moderate: slope	Severe: slow permeability.	Moderate: slope
Honeoye silt loam, rolling.	Moderate: slope	Severe: slope	Moderate: slope	Severe: slow permeability.	Moderate: slope
Honeoye and Lansing gravelly silt loams, 15 to 25 percent slopes.	Severe: slope	Severe: slope	Severe: slope	Severe: slope; slow permeability.	Severe: slope
Honeoye very stony soils, sloping.	Moderate: slope, very stony.	Severe: slope	Severe: slope	Severe: very stony; slow permeability.	Moderate: very stony; slope.
Honeoye, Lansing and Ontario soils, steep.	Severe: slope	Severe: slope	Severe: slope	Severe: slope; slow permeability.	Severe: slope
Honeoye, Lansing and Ontario soils, very steep.	Severe: slope	Severe: slope	Severe: slope	Severe: slope; slow permeability.	Severe: slope
Howard gravelly fine sandy loam, 0 to 3 percent slopes.	Slight	Slight	Slight	Slight[2]	Severe: very gravelly layer; subject to sloughing.
Howard gravelly fine sandy loam, 3 to 8 percent slopes.	Slight	Moderate: slope	Slight	Slight[2]	Severe: very gravelly layers subject to sloughing.
Howard gravelly fine sandy loam, rolling.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope[2]	Severe: very gravelly layers subject to sloughing.
Howard gravelly loam, 0 to 3 percent slopes.	Slight	Slight	Slight	Slight[2]	Severe: very gravelly layers subject to sloughing.
Howard gravelly loam, 3 to 8 percent slopes.	Slight	Moderate: slope	Slight	Slight[2]	Severe: very gravelly layers subject to sloughing.
Howard gravelly loam, rolling.	Moderate: slope	Severe: slope	Moderate: slope	Moderate[2]	Severe: very gravelly layers subject to sloughing.
Howard gravelly silt loam, 0 to 3 percent slopes.	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding[2]	Severe: very gravelly layers subject to sloughing; flooding.
Howard gravelly silt loam, 3 to 8 percent slopes.	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding[2]	Severe: very gravelly layers subject to sloughing; flooding.
Kendaia silt loam, 0 to 3 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Severe: susceptibility to frost action.	Severe: somewhat poorly drained; slow permeability.	Severe: somewhat poorly drained.
Kendaia silt loam, 3 to 8 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Severe: susceptibility to frost action.	Severe: somewhat poorly drained; slow permeability.	Severe: somewhat poorly drained.
Lairdsville silt loam, 2 to 6 percent slopes.	Moderate: rippable bedrock at a depth of 20 to 40 inches.	Moderate: rippable bedrock at a depth of 20 to 40 inches; slope.	Moderate: susceptibility to frost action.	Severe: very slow permeability.	Moderate: moderately well drained; rippable bedrock at a depth of 20 to 40 inches.
Lairdsville silty clay loam, 6 to 12 percent slopes, eroded.	Moderate: slope; moderately well drained; rippable bedrock at a depth of 20 to 40 inches.	Severe: slope	Moderate: slope; susceptibility to frost action.	Severe: very slow permeability.	Moderate: slope; moderately well drained; rippable bedrock at a depth of 20 to 40 inches.
Lakemont silty clay loam.	Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained; very slow permeability.	Severe: poorly drained; silty clay and clay.

town and country planning—Continued.

Community developments—Continued		Recreational uses			
Sanitary landfill (trenches)	Lawns, landscaping, and golf fairways[1]	Picnic and play areas	Camp areas	Paths and trails	Athletic fields
Moderate: firm or very firm till; very stony in places.	Moderate: slope --	Moderate: slope --	Moderate: slope --	Slight ----------	Severe: slope.
Moderate: firm or very firm till; stony in places.	Moderate: slope --	Moderate: slope --	Moderate: slope --	Slight ----------	Severe: slope.
Moderate: slope; firm or very firm till; stony in places.	Severe: slope ------	Severe: slope ------	Severe: slope ------	Moderate: slope-----	Severe: slope; gravel.
Moderate: very stony; firm or very firm till.	Severe: stony ----	Moderate: slope --	Moderate: slope; very stony.	Moderate: very stony.	Severe: slope.
Severe: slope ------	Severe: slope ------	Severe: slope ------	Severe: slope ------	Severe: slope ------	Severe: slope.
Severe: slope ------	Severe: slope ------	Severe: slope ------	Severe: slope ------	Severe: slope ------	Severe: slope.
Severe: rapid permeability.	Moderate: gravel --	Slight ----------	Moderate: gravel --	Slight ----------	Severe: gravel.
Severe: rapid permeability.	Moderate: gravel --	Slight ----------	Moderate: gravel --	Slight ----------	Severe: gravel.
Severe: rapid permeability.	Moderate: gravel; slope.	Moderate: slope --	Moderate: slope; gravel.	Slight ----------	Severe: slope; gravel.
Severe: rapid permeability.	Moderate: gravel --	Moderate: gravel --	Moderate: gravel --	Moderate: gravel --	Severe: gravel.
Severe: rapid permeability.	Moderate: gravel --	Moderate: gravel --	Moderate: gravel --	Moderate: gravel --	Severe: gravel.
Severe: rapid permeability.	Moderate: gravel; slope.	Moderate: gravel; slope.	Moderate: gravel; slope.	Moderate: gravel --	Severe: gravel; slope.
Severe: rapid permeability; flooding.	Moderate: gravel --	Slight ----------	Moderate: gravel; flooding very infrequent during season of use.	Slight ----------	Severe: gravel.
Severe: rapid permeability; flooding.	Moderate: gravel --	Slight ----------	Moderate: gravel; flooding very infrequent during season of use.	Slight ----------	Severe: gravel.
Moderate: somewhat poorly drained; firm or very firm till; very stony in places.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; slow permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.
Moderate: somewhat poorly drained; firm or very firm till; very stony in places.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; slow permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.
Severe: silty clay and clay textures.	Moderate: bedrock at a depth of 20 to 40 inches.	Slight ----------	Severe: very slow permeability.	Slight ----------	Severe: slow permeability.
Severe: silty clay and clay.	Moderate: silty clay loam; slope; bedrock at a depth of 20 to 40 inches.	Moderate: slope; silty clay loam.	Severe: very slow permeability.	Moderate: silty clay loam.	Severe: slope; very slow permeability.
Severe: poorly drained; silty clay and clay.	Severe: poorly drained.	Severe: poorly drained	Severe: poorly drained; very slow permeability.	Severe: poorly drained.	Severe: poorly drained; very slow permeability.

TABLE 9.—*Limitations of soils for*

Soil	Community developments				
	Dwellings with basements	Shopping centers and small industrial buildings	Local roads and streets	Septic-tank absorption fields	Underground public utilities
Lamson very fine sandy loam.	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained loamy sand and sand subject to sloughing.
Lansing gravelly silt loam, 2 to 8 percent slopes.	Slight	Moderate: slope	Slight	Severe: slow permeability.	Slight
Lansing gravelly silt loam, 8 to 15 percent slopes.	Moderate: slope	Severe: slope	Moderate: slope	Severe: slow permeability.	Moderate: slope
Lansing gravelly silt loam, rolling.	Moderate: slope	Severe: slope	Moderate: slope	Severe: slow permeability.	Moderate: slope
Lima silt loam, 0 to 3 percent slopes.	Moderate: moderately well drained.	Moderate: moderately well drained.	Moderate: susceptibility to frost action.	Severe: slow permeability; moderately well drained.	Moderate: moderately well drained.
Lima silt loam, 3 to 8 percent slopes.	Moderate: moderately well drained.	Moderate: moderately well drained; slope.	Moderate: susceptibility to frost action.	Severe: slow permeability; moderately well drained.	Moderate: moderately well drained.
Lockport and Brockport silty clay loams, 0 to 6 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Moderate: somewhat poorly drained; susceptibility to frost action.	Severe: somewhat poorly drained; very slow permeability.	Severe: somewhat poorly drained.
Lordstown channery silt loam, sloping.	Severe: hard bedrock at a depth of 20 to 40 inches.	Severe: hard bedrock at a depth of 20 to 40 inches; slope.	Moderate: hard bedrock at a depth of 20 to 40 inches; slope.	Severe: hard bedrock at a depth of 20 to 40 inches.	Severe: hard bedrock at a depth of 20 to 40 inches.
Lordstown-Arnot channery silt loams, moderately steep.	Severe: slope; hard bedrock at a depth of 10 to 40 inches.	Severe: slope; hard bedrock at a depth of 10 to 40 inches.	Severe: slope; hard bedrock at a depth of 10 to 40 inches.	Severe: slope; hard bedrock at a depth of 10 to 40 inches.	Severe: slope; hard bedrock at a depth of 10 to 40 inches.
Lyons silt loam	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.	Sever: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained; slow and very slow permeability.	Severe: poorly drained and very poorly drained.
Made land, chemical waste. Too variable to rate.					
Madrid fine sandy loam, 2 to 8 percent slopes.	Slight	Moderate: slope	Slight	Moderate: moderate permeability.	Slight
Madrid fine sandy loam, 8 to 15 percent slopes.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: moderate permeability; slope.	Moderate: slope
Madrid fine sandy loam, 8 to 15 percent slopes, eroded.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: moderate permeability; slope.	Moderate: slope
Madrid fine sandy loam, rolling.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: moderate permeability; slope.	Moderate: slope
Madrid gravelly loam, 2 to 8 percent slopes.	Slight	Moderate: slope	Slight	Moderate: moderate permeability; slope.	Slight
Madrid gravelly loam, 8 to 15 percent slopes.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: moderate permeability; slope.	Moderate: slope
Manheim silt loam, 0 to 3 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Severe: high susceptibility to frost action.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.

town and country planning—Continued.

Community developments—Continued		Recreational uses			
Sanitary landfill (trenches)	Lawns, landscaping, and golf fairways[1]	Picnic and play areas	Camp areas	Paths and trails	Athletic fields
Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.
Moderate: firm or very firm till; very stony in places.	Moderate: gravel	Slight	Moderate: gravel	Slight	Severe: gravel.
Moderate: firm or very firm till; very stony in places.	Moderate: gravel; slope.	Moderate: slope	Moderate: slope; gravel.	Slight	Severe: slope; gravel.
Moderate: firm or very firm till; very stony in places.	Moderate: gravel; slope.	Moderate: slope	Moderate: slope; gravel.	Slight	Severe: slope; gravel.
Moderate: firm or very firm till; very stony in places.	Slight	Slight	Moderate: moderately well drained; slow permeability.	Slight	Moderate: moderately well draind; gravel.
Moderate: firm or very firm till; very stony in places.	Slight	Slight	Moderate: moderately well drained; slow permeability.	Slight	Moderate: slope; moderately well drained; gravel.
Severe: silty clay and clay.	Moderate: somewhat poorly drained; silty clay loam; bedrock at a depth of 20 to 40 inches.	Moderate: somewhat poorly drained; silty clay loam.	Severe: somewhat poorly drained; very slow permeability.	Moderate: somewhat poorly drained; silty clay loam.	Severe: somewhat poorly drained; very slow permeability.
Severe: hard bedrock at a depth of 20 to 40 inches.	Moderate: slope; gravel; bedrock at a depth of 20 to 40 inches.	Moderate: stone fragments; slope.	Moderate: slope; stone fragments.	Moderate: stone fragments.	Severe: slope; stone fragments.
Severe: hard bedrock at a depth of 10 to 40 inches.	Severe: slope; bedrock at a depth of 10 to 20 inches in places.	Severe: slope	Severe: slope	Moderate: slope; stone fragments.	Severe: slope; stone fragments; bedrock at a depth of 10 to 20 inches in places.
Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.
Slight	Slight	Slight	Slight	Slight	Moderate: slope; gravel.
Moderate: slope	Slight	Moderate: slope	Moderate: slope	Slight	Severe: slope.
Moderate: slope	Slight	Moderate: slope	Moderate: slope	Slight	Severe: slope.
Moderate: slope	Slight	Moderate: slope	Moderate: slope	Slight	Severe: slope.
Slight	Moderate: gravel	Slight	Slight	Slight	Severe: gravel.
Slight	Moderate: slope	Moderate: slope	Moderate: slope	Slight	Severe: slope; gravel.
Moderate: somewhat poorly drained; firm till; very stony in places.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; slow to moderate permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.

TABLE 9.—*Limitations of soils for*

Soil	Community developments				
	Dwellings with basements	Shopping centers and small industrial buildings	Local roads and streets	Septic-tank absorption fields	Underground public utilities
Manheim silt loam, 3 to 8 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Severe: high susceptibility to frost action.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.
Manlius shaly silt loam, 2 to 6 percent slopes.	Moderate: shale bedrock at a depth of 20 to 40 inches.	Moderate: shale bedrock at a depth of 20 to 40 inches; slope.	Slight	Severe: shale bedrock at a depth of 20 to 40 inches.	Moderate: rippable bedrock at a depth of 20 to 40 inches.
Manlius shaly silt loam, 6 to 12 percent slopes.	Moderate: shale bedrock at a depth of 20 to 40 inches; slope.	Severe: slope	Moderate: slope	Severe: shale bedrock at a depth of 20 to 40 inches; slope.	Moderate: rippable bedrock at a depth of 20 to 40 inches; slope.
Manlius shaly silt loam, 12 to 18 percent slopes.	Severe: slope	Severe: slope	Severe: slope	Severe: shale bedrock at a depth of 20 to 40 inches; slope.	Severe: slope
Mardin channery silt loam, 2 to 8 percent slopes.	Moderate: moderately well drained.	Moderate: slope; moderately well drained.	Moderate: susceptibility to frost action.	Severe: very slow permeability.	Moderate: fragipan; moderately well drained.
Mardin channery silt loam, 8 to 15 percent slopes.	Moderate: moderately well drained; slope.	Severe: slope	Moderate: slope; susceptibility to frost action.	Severe: very slow permeability.	Moderate: slope; fragipan; moderately well drained.
Mardin channery silt loam, 15 to 25 percent slopes.	Severe: slope	Severe: slope	Severe: slope	Severe: very slow permeability; slope.	Severe: slope
Mardin soils, steep	Severe: slope	Severe: slope	Severe: slope	Severe: slope; very slow permeability.	Severe: slope
Mardin channery silt loam, moderately shallow variant, 2 to 6 percent slopes.	Severe: hard bedrock at a depth of 20 to 40 inches.	Severe: hard bedrock at a depth of 20 to 40 inches.	Moderate: hard bedrock at a depth of 20 to 40 inches; susceptibility to frost action.	Severe: very slow permeability; bedrock at a depth of 20 to 40 inches.	Severe: hard bedrock at a depth of 20 to 40 inches.
Mardin channery silt loam, moderately shallow variant, 6 to 18 percent slopes.	Severe: hard bedrock at a depth of 20 to 40 inches.	Severe: hard bedrock at a depth of 20 to 40 inches; slope.	Moderate: hard bedrock at a depth of 20 to 40 inches; slope; susceptibility to frost action.	Severe: very slow permeability; bedrock at a depth of 20 to 40 inches.	Severe: hard bedrock at a depth of 20 to 40 inches; slope in places.
Martisco and Warners soils.	Severe: very poorly drained; organic deposits in places.	Severe: very poorly drained; organic deposits in places.	Severe: high susceptibility to frost action; very poorly drained; organic deposits in places.	Severe: very poorly drained.	Severe: very poorly drained; flooding in places.
Minoa fine sandy loam, 0 to 2 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Severe: high susceptibility to frost action.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained; fine sandy layers subject to sloughing.
Minoa fine sandy loam, 2 to 6 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Severe: high susceptibility to frost action.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained; fine sandy layers subject to sloughing.
Mohawk silt loam, 2 to 8 percent slopes.	Slight	Moderate: slope	Moderate: susceptibility to frost action.	Severe: slow permeability.	Slight
Mohawk silt loam, 8 to 15 percent slopes.	Moderate: slope	Severe: slope	Moderate: slope; susceptibility to frost action.	Severe: slow permeability.	Moderate: slope

town and country planning—Continued

Community developments—Continued		Recreational uses			
Sanitary landfill (trenches)	Lawns, landscaping, and golf fairways[1]	Picnic and play areas	Camp areas	Paths and trails	Athletic fields
Moderate: somewhat poorly drained; firm till; very stony in places.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; slow to moderate permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.
Moderate: rippable bedrock at a depth of 20 to 40 inches.	Moderate: bedrock at a depth of 20 to 40 inches; shale fragments.	Slight	Slight	Slight	Moderate: slope; rippable bedrock at a depth of 20 to 40 inches; shale fragments.
Moderate: rippable bedrock at a depth of 20 to 40 inches.	Moderate: bedrock at a depth of 20 to 40 inches; slope; shale fragments.	Moderate: slope	Moderate: slope	Slight	Severe: slope.
Moderate: rippable bedrock at a depth of 20 to 40 inches.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Severe: slope.
Moderate: firm or very firm fragipan and till; very stony in places.	Moderate: stone fragments.	Moderate: stone fragments.	Moderate: stone fragments; slow or very slow permeability.	Moderate: stone fragments.	Severe: stone fragments; very slow permeability.
Moderate: firm or very firm fragipan and till; very stony in places.	Moderate: slope; stone fragments.	Moderate: slope; stone fragments.	Moderate: slope; stone fragments; slow or very slow permeability.	Moderate: stone fragments.	Severe: slope; stone fragments; very slow permeability.
Moderate: slope; firm or very firm fragipan and till; very stony in places.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope; stone fragments.	Severe: slope; stone fragments; very slow permeability.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope; stone fragments; very slow permeability.
Severe: hard bedrock at a depth of 20 to 40 inches.	Moderate: bedrock at a depth of 20 to 40 inches; stone fragments.	Moderate: stone fragments.	Moderate: stone fragments; slow or very slow permeability.	Moderate: stone fragments.	Severe: stone fragments; very slow permeability.
Severe: hard bedrock at a depth of 20 to 40 inches.	Moderate: bedrock at a depth of 20 to 40 inches; slope; stone fragments.	Moderate: slope; stone fragments.	Moderate: slope; stone fragments; slow or very slow permeability.	Moderate: stone fragments.	Severe: slope; stone fragments; very slow permeability.
Severe: very poorly drained; organic deposits; flooding.	Severe: very poorly drained; muck texture in places.	Severe: very poorly drained; organic soils.	Severe: very poorly drained; organic soils.	Severe: very poorly drained; organic soils.	Severe: very poorly drained; organic soils.
Moderate: somewhat poorly drained; fine sandy layers.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.
Moderate: somewhat poorly drained; fine sandy layers.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.
Moderate: firm or very firm till; very stony below a depth of 40 inches in places.	Slight	Slight	Slight	Slight	Moderate: slope; general.
Moderate: firm or very firm till; very stony below a depth of 40 inches in places.	Moderate: slope	Moderate: slope	Moderate: slope	Slight	Severe: slope.

TABLE 9.—*Limitations of soils for*

Soil	Community developments				
	Dwellings with basements	Shopping centers and small industrial buildings	Local roads and streets	Septic-tank absorption fields	Underground public utilities
Mohawk silt loam, 15 to 25 percent slopes.	Severe: slope	Severe: slope	Severe: slope	Severe: slow permeability; slope.	Severe: slope
Naumburg loamy fine sand.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Severe: high susceptibility to frost action.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained; loamy sand and sand layers subject to sloughing.
Niagara silt loam, 0 to 4 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Severe: high susceptibility to frost action.	Severe: somewhat poorly drained; moderately slow or slow permeability.	Severe: somewhat poorly drained.
Odessa silty clay loam, 0 to 2 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Moderate: somewhat poorly drained; susceptibility to frost action.	Severe: very slow permeability; somewhat poorly drained.	Severe: somewhat poorly drained; silty clay.
Odessa silty clay loam, 2 to 6 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Moderate: somewhat poorly drained; susceptibility to frost action.	Severe: very slow permeability; somewhat poorly drained.	Severe: somewhat poorly drained; silty clay.
Ontario loam, 2 to 8 percent slopes.	Slight	Moderate: slope	Slight	Severe: slow or very slow permeability.	Slight
Ontario gravelly loam, 8 to 15 percent slopes.	Moderate: slope	Severe: slope	Moderate: slope	Severe: slow or very slow permeability.	Moderate: slope
Ontario gravelly loam, 8 to 15 percent slopes, eroded.	Moderate: slope	Severe: slope	Moderate: slope	Severe: slow or very slow permeability.	Moderate: slope
Ontario gravelly loam, rolling.	Moderate: slope	Severe: slope	Moderate: slope	Severe: slow or very slow permeability.	Moderate: slope
Ontario and Madrid soils, 15 to 25 percent slopes.	Severe: slope	Severe: slope	Severe: slope	Severe: slow or very slow permeability; slope.	Severe: slope
Otisville gravelly loamy fine sand, 0 to 8 percent slopes.	Slight	Moderate: slope	Slight	Slight[2]	Severe: very gravelly layers subject to sloughing.
Otisville gravelly loamy fine sand, rolling.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope[2]	Severe: very gravelly layers subject to sloughing.
Ovid silt loam, 0 to 3 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Severe: high susceptibility to frost action.	Severe: very slow permeability.	Severe: somewhat poorly drained.
Ovid silt loam, 3 to 8 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Severe: high susceptibility to frost action.	Severe: very slow permeability.	Severe: somewhat poorly drained.
Palatine shaly silt loam, 2 to 6 percent slopes.	Moderate: rippable bedrock at a depth of 20 to 40 inches.	Moderate: rippable bedrock at a depth of 20 to 40 inches; slope.	Slight	Slight[3]	Moderate: rippable bedrock at a depth of 20 to 40 inches.
Palatine shaly silt loam, 6 to 12 percent slopes.	Moderate: rippable bedrock at a depth of 20 to 40 inches; slope.	Severe: slope	Moderate: slope	Moderate: slope[3]	Moderate: rippable bedrock at a depth of 20 to 40 inches; slope.
Palms muck	Severe: very poorly drained; organic deposits.	Severe: very poorly drained; organic deposits.	Severe: very poorly drained; organic deposits.	Severe: very poorly drained.	Severe: very poorly drained; organic deposits.
Palmyra gravelly loam, 0 to 3 percent slopes.	Slight	Slight	Slight	Slight[2]	Severe: very gravelly layers subject to sloughing.
Palmyra gravelly loam, 3 to 8 percent slopes.	Slight	Moderate: slope	Slight	Slight[2]	Severe: very gravelly layers subject to sloughing.

town and country planning—Continued

Community developments—Continued		Recreational uses			
Sanitary landfill (trenches)	Lawns, landscaping, and golf fairways[1]	Picnic and play areas	Camp areas	Paths and trails	Athletic fields
Moderate: slope; firm or very firm till; very stony in places below a depth of 40 inches.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Severe: slope.
Severe: sand; rapid permeability.	Severe: loamy fine sand without textural B horizon.	Moderate: somewhat poorly drained; loamy fine sand.	Moderate: somewhat poorly drained; loamy fine sand.	Moderate: somewhat poorly drained; loamy fine sand.	Severe: somewhat poorly drained; loamy fine sand subject to blowing.
Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; moderately slow or slow permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.
Severe: silty clay	Moderate: somewhat poorly drained; silty clay loam.	Moderate: somewhat poorly drained; silty clay loam.	Severe: somewhat poorly drained; very slow permeability.	Moderate: somewhat poorly drained; silty clay.	Severe: somewhat poorly drained; very slow permeability.
Severe: silty clay	Moderate: somewhat poorly drained; silty clay loam.	Moderate: somewhat poorly drained; silty clay loam.	Severe: somewhat poorly drained; very slow permeability.	Moderate: somewhat poorly drained; silty clay.	Severe: somewhat poorly drained; very slow permeability.
Moderate: firm or very firm till.	Slight	Slight	Slight	Slight	Moderate: slope; gravel.
Moderate: firm or very firm till.	Moderate: slope; gravel.	Moderate: slope; gravel.	Moderate: slope; gravel.	Slight	Severe: slope; gravel.
Moderate: firm or very firm till.	Moderate: slope; gravel.	Moderate: slope; gravel.	Moderate: slope; gravel.	Slight	Severe: slope; gravel.
Moderate: firm or very firm till.	Moderate: slope; gravel.	Moderate: slope; gravel.	Moderate: slope; gravel.	Slight	Severe: slope; gravel.
Moderate: slope; firm or very firm till in places.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Severe: slope; gravel.
Severe: very rapid permeability.	Severe: gravelly loamy fine sand texture without textural B.	Moderate: gravel; loamy fine sand texture.	Moderate: gravel; loamy fine sand texture.	Moderate: gravel; loamy fine sand texture.	Severe: gravel; loamy fine sand subject to soil blowing.
Severe: very rapid permeability.	Severe: gravelly loamy fine sand texture without textural B.	Moderate: slope; gravel; loamy fine sand texture.	Moderate: slope; gravel; loamy fine sand texture.	Moderate: gravel; loamy fine sand texture.	Severe: slope; gravel; loamy fine sand subject to soil blowing.
Moderate: somewhat poorly drained; firm silty clay loam.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; very slow to slow permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; very slow permeability.
Moderate: somewhat poorly drained; firm silty clay loam.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; very slow to slow permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; very slow permeability.
Severe: rapid permeability; rippable bedrock at a depth of 20 to 40 inches.	Moderate: bedrock at a depth of 20 to 40 inches; shale fragments.	Slight	Slight	Slight	Moderate: slope; rippable bedrock at a depth of 20 to 40 inches; shale fragments.
Severe: rapid permeability; rippable bedrock at a depth of 20 to 40 inches.	Moderate: slope; bedrock at a depth of 20 to 40 inches; shale fragments.	Moderate: slope	Moderate: slope	Slight	Severe: slope.
Severe: very poorly drained; organic deposits.	Severe: very poorly drained; muck texture.	Severe: very poorly drained; organic soil.	Severe: very poorly drained; organic soil.	Severe: very poorly drained; organic soil.	Severe: very poorly drained; organic soil.
Severe: rapid permeability.	Moderate: gravel	Moderate: gravel	Moderate: gravel	Moderate: gravel	Severe: gravel.
Severe: rapid permeability.	Moderate: gravel	Moderate: gravel	Moderate: gravel	Moderate: gravel	Severe: gravel.

TABLE 9.—*Limitations of soils for*

Soil	Community developments				
	Dwellings with basements	Shopping centers and small industrial buildings	Local roads and streets	Septic-tank absorption fields	Underground public utilities
Palmyra gravelly loam, rolling.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope[2]	Severe: gravelly layers subject to sloughing.
Palmyra and Howard soils, hilly.	Severe: slope	Severe: slope	Severe: slope	Severe: slope[2]	Severe: slope; very gravelly layers subject to sloughing.
Palmyra and Howard soils, steep.	Severe: slope	Severe: slope	Severe: slope	Severe: slope[2]	Severe: slope; very gravelly layers subject to sloughing.
Palmyra and Howard soils, very steep.	Severe: slope	Severe: slope	Severe: slope	Severe: slope[2]	Severe: slope; very gravelly layers subject to sloughing.
Phelps gravelly loam, 0 to 3 percent slopes.	Moderate: moderately well drained.	Moderate: moderately well drained.	Moderate: susceptibility to frost action.	Severe: moderately well drained.[2]	Severe: very gravelly layers subject to sloughing.
Phelps gravelly loam, 3 to 8 percent slopes.	Moderate: moderately well drained.	Moderate: moderately well drained; slope.	Moderate: susceptibility to frost action.	Severe: moderately well drained.	Severe: very gravelly layers subject to sloughing.
Rhinebeck silt loam	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Moderate: somewhat poorly drained; susceptibility to frost action.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained; silty clay.
Saprists and Fluvaquents, ponded.	Severe: very poorly drained; prolonged ponding.	Severe: very poorly drained; prolonged ponding.	Severe: very poorly drained; prolonged ponding.	Severe: very poorly drained; prolonged ponding.	Severe: very poorly drained; prolonged ponding.
Schoharie silt loam, 2 to 6 percent slopes.	Moderate: moderately well drained; moderate shrink-swell potential.	Moderate: moderately well drained; slope; moderate shrink-swell potential.	Moderate: susceptibility to frost action.	Severe: very slow permeability.	Severe: silty clay
Schoharie silt loam, rolling.	Moderate: moderately well drained; slope; moderate shrink-swell potential; moderate slippage.	Severe: slope	Moderate: susceptibility to frost action.	Severe: very slow permeability.	Severe: silty clay texture.
Schoharie silty clay loam, hilly.	Severe: slope; subject to mass slippage.	Severe: slope; subject to mass slippage.	Severe: slope; subject to mass slippage.	Severe: very slow permeability; slope.	Severe: slope; silty clay.
Schoharie soils, steep	Severe: slope; subject to mass slippage.	Severe: slope; subject to mass slippage.	Severe: slope; subject to mass slippage.	Severe: very slow permeability; slope.	Severe: slope; silty clay.
Teel silt loam	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding
Urban land. Ratings not given.					
Varick silt loam	Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained; high susceptibility to frost action.	Severe: poorly drained.	Severe: poorly drained.
Volusia channery silt loam, 0 to 8 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Moderate: susceptibility to frost action; somewhat poorly drained.	Severe: very slow permeability; somewhat poorly drained.	Severe: somewhat poorly drained.
Volusia channery silt loam, 8 to 15 percent slopes.	Severe: somewhat poorly drained.	Severe: slope; somewhat poorly drained.	Moderate: susceptibility to frost action; somewhat poorly drained; slope.	Severe: very slow permeability; somewhat poorly drained.	Severe: somewhat poorly drained.

town and country planning—Continued

Community developments—Continued		Recreational uses			
Sanitary landfill (trenches)	Lawns, landscaping, and golf fairways[1]	Picnic and play areas	Camp areas	Paths and trails	Athletic fields
Severe: rapid permeability.	Moderate: gravel; slope.	Moderate: gravel; slope.	Moderate: gravel; slope.	Moderate: gravel --	Severe: gravel; slope.
Severe: rapid permeability.	Severe: slope ------	Severe: slope ------	Severe: slope ------	Moderate: slope; gravel.	Severe: slope; gravel.
Severe: slope; rapid permeability.	Severe: slope ------	Severe: slope ------	Severe: slope ------	Severe: slope ------	Severe: slope; gravel.
Severe: slope; rapid permeability.	Severe: slope ------	Severe: slope ------	Severe: slope ------	Severe: slope ------	Severe: slope; gravel.
Severe: rapid permeability.	Moderate: gravel --	Moderate: gravel --	Moderate: gravel --	Moderate: gravel --	Severe: gravel.
Severe: rapid permeability.	Moderate: gravel --	Moderate: gravel --	Moderate: gravel --	Moderate: gravel --	Severe: gravel.
Severe: silty clay --	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; slow permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.
Severe: very poorly drained; prolonged ponding.	Severe: very poorly drained; prolonged ponding.	Severe: very poorly drained; prolonged ponding.	Severe: very poorly drained; prolonged ponding.	Severe: very poorly drained; prolonged ponding.	Severe: very poorly drained; prolonged ponding.
Severe: silty clay --	Slight ----------	Slight ----------	Moderate: very slow permeability.	Slight ----------	Severe: very slow permeability.
Severe: silty clay texture.	Moderate: slope --	Moderate: slope --	Moderate: slope; very slow permeability.	Slight ----------	Severe: slope; very slow permeability.
Severe: silty clay --	Severe: slope ------	Severe: slope ------	Severe: slope ------	Moderate: slope --	Severe: slope; very slow permeability.
Severe: slope; silty clay.	Severe: slope ------	Severe: slope ------	Severe: slope ------	Severe: slope ------	Severe: slope; very slow permeability.
Severe: flooding --	Moderate: flooding	Moderate: flooding	Moderate: infrequent flooding during season of use.	Slight ----------	Moderate: may flood once in 2 years during season of use; moderately well drained.
Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained; slow or very slow permeability.	Severe: poorly drained.	Severe: poorly drained; very slow permeability.
Moderate: somewhat poorly drained; firm or very firm fragipan and till; very stony in places.	Moderate: somewhat poorly drained; stone fragments.	Moderate: somewhat poorly drained; stone fragments.	Severe: somewhat poorly drained; very slow permeability.	Moderate: somewhat poorly drained; stone fragments.	Severe: somewhat poorly drained; very slow permeability; stone fragments.
Moderate: somewhat poorly drained; firm or very firm fragipan and till; very stony in places.	Moderate: slope; somewhat poorly drained; stone fragments.	Moderate: slope; somewhat poorly drained; stone fragments.	Severe: somewhat poorly drained; very slow permeability.	Moderate: somewhat poorly drained; stone fragments.	Severe: slope; somewhat poorly drained; very slow permeability; stone fragments.

TABLE 9.—*Limitations of soils for*

Soil	Community developments				
	Dwellings with basements	Shopping centers and small industrial buildings	Local roads and streets	Septic-tank absorption fields	Underground public utilities
Volusia channery silt loam, moderately shallow variant, 0 to 6 percent slopes.	Severe: somewhat poorly drained; bedrock at a depth of 20 to 40 inches.	Severe: somewhat poorly drained; bedrock at a depth of 20 to 40 inches.	Moderate: somewhat poorly drained; bedrock at a depth of 20 to 40 inches; susceptibility to frost action.	Severe: very slow permeability; bedrock at a depth of 20 to 40 inches; somewhat poorly drained.	Severe: hard bedrock at a depth of 20 to 40 inches; somewhat poorly drained.
Wampsville gravelly silt loam, 0 to 3 percent slopes.	Slight	Slight	Slight	Slight[2]	Moderate: gravel high in content of clay shale; subject to sloughing.
Wampsville gravelly silt loam, 3 to 8 percent slopes.	Slight	Moderate: slope	Slight	Slight[2]	Moderate: gravel high in content of clay shale; subject to sloughing.
Wampsville gravelly silt loam, rolling.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope[2]	Moderate: gravel high in content of clay shale; subject to sloughing; slope.
Wareham loamy fine sand.	Severe: somewhat poorly drained and poorly drained.	Severe: somewhat poorly drained and poorly drained.	Severe: high susceptibility to frost action; poorly drained in places.	Severe: somewhat poorly drained and poorly drained.	Severe: somewhat poorly drained and poorly drained; loose sand subject to sloughing.
Wassaic silt loam, 0 to 8 percent slopes.	Severe: hard bedrock at a depth of 20 to 40 inches.	Severe: hard bedrock at a depth of 20 to 40 inches.	Moderate: hard bedrock at a depth of 20 to 40 inches.	Severe: hard bedrock at a depth of 20 to 40 inches.	Severe: hard bedrock at a depth of 20 to 40 inches.
Wassaic silt loam, 8 to 15 percent slopes.	Severe: hard bedrock at a depth of 20 to 40 inches.	Severe: hard bedrock at a depth of 20 to 40 inches; slope.	Moderate: hard bedrock at a depth of 20 to 40 inches; slope.	Severe: hard bedrock at a depth of 20 to 40 inches.	Severe: hard bedrock at a depth of 20 to 40 inches.
Wassaic-Benson silt loams, moderately steep.	Severe: hard bedrock at a depth of 10 to 40 inches; slope.	Severe: hard bedrock at a depth of 10 to 40 inches; slope.	Severe: slope	Severe: hard bedrock at a depth of 10 to 40 inches; slope.	Severe: hard bedrock at a depth of 10 to 40 inches; slope.
Wayland silt loam	Severe: poorly drained and very poorly drained; flooding.	Severe: poorly drained and very poorly drained; flooding.	Severe: poorly drained and very poorly drained; high susceptibility to frost action; flooding.	Severe: poorly drained and very poorly drained; flooding.	Severe: poorly drained and very poorly drained; frequent flooding.
Weaver silt loam	Severe: flooding	Severe: flooding	Severe: flooding; high susceptibility to frost action.	Severe: flooding	Severe: flooding
Williamson silt loam, 0 to 2 percent slopes.	Moderate: moderately well drained.	Moderate: moderately well drained.	Moderate: susceptibility to frost action.	Severe: slow or very slow permeability.	Moderate: moderately well drained.
Williamson silt loam, 2 to 6 percent slopes.	Moderate: moderately well drained.	Moderate: moderately well drained; slope.	Moderate: susceptibility to frost action.	Severe: slow or very slow permeability.	Moderate: moderately well drained.
Williamson silt loam, rolling.	Moderate: slope; moderately well drained.	Severe: slope	Moderate: slope; susceptibility to frost action.	Severe: slow or very slow permeability.	Moderate: slope; moderately well drained.
Williamson silt loam, rolling, eroded.	Moderate: slope; moderately well drained.	Severe: slope	Moderate: slope; susceptibility to frost action.	Severe: slow or very slow permeability.	Moderate: slope; moderately well drained.

[1] Golf fairways are also considered to be a recreational use.
[2] Soil has rapid permeability; contamination hazard may exist for nearby streams, ponds, and lakes.

age class, slope, depth to either hard or rippable bedrock, surface rockiness, surface stoniness, and flood hazard.

Local roads and streets.—This refers to the use of the soil for the location of hard-surfaced streets and roads in subdivisions and recreational developments. Specific layout requires onsite investigation. Soil requirements and limitations for streets and roads are similar to those for highways. The main properties used in rating the soils were soil drainage class, slope, depth to bedrock, surface rockiness, surface stoniness, and flooding hazard. (See tables 7 and 8 for

town and country planning—Continued

Community developments—Continued		Recreational uses			
Sanitary landfill (trenches)	Lawns, landscaping, and golf fairways[1]	Picnic and play areas	Camp areas	Paths and trails	Athletic fields
Severe: hard bedrock at a depth of 20 to 40 inches.	Moderate: somewhat poorly drained; stone fragments; bedrock at a depth of 20 to 40 inches.	Moderate: somewhat poorly drained; stone fragments.	Severe: somewhat poorly drained; very slow permeability.	Moderate: somewhat poorly drained; stone fragments.	Severe: somewhat poorly drained; very slow permeability; stone fragments.
Severe: rapid permeability.	Moderate: gravel	Moderate: gravel	Moderate: gravel	Moderate: gravel	Severe: gravel.
Severe: rapid permeability.	Moderate: gravel	Moderate: gravel	Moderate: gravel	Moderate: gravel	Severe: gravel.
Severe: rapid permeability.	Moderate: slope; gravel.	Moderate: slope; gravel.	Moderate: slope; gravel.	Moderate: gravel	Severe: slope; gravel.
Severe: sand texture; poorly drained in places.	Severe: loamy fine sand without textural B horizon; poorly drained in places.	Severe: somewhat poorly drained and poorly drained.	Severe: somewhat poorly drained and poorly drained.	Moderate: somewhat poorly drained and poorly drained; loamy fine sand texture.	Severe: somewhat poorly drained and poorly drained.
Severe: hard bedrock at a depth of 20 to 40 inches.[2]	Moderate: bedrock at a depth of 20 to 40 inches.	Slight	Slight	Slight	Moderate: slope; stone fragments.
Severe: hard bedrock at a depth of 20 to 40 inches.	Moderate: bedrock at a depth of 20 to 40 inches; slope.	Moderate: slope	Moderate: slope	Slight	Severe: slope.
Severe: hard bedrock at a depth of 10 to 40 inches.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Severe: slope; bedrock at a depth of 10 to 40 inches in places.
Severe: poorly drained and very poorly drained; flooding.	Severe: poorly drained and very poorly drained; flooding.	Severe: poorly drained and very poorly drained; frequent flooding.	Severe: poorly drained and very poorly drained; frequent flooding.	Severe: poorly drained and very poorly drained; frequent flooding.	Severe: poorly drained and very poorly drained; frequent flooding.
Severe: flooding	Moderate: flooding	Moderate: flooding	Severe: flooding during season of use.	Slight	Severe: floods more than once in 2 years during season of use.
Slight	Slight	Slight	Moderate: moderately well drained; moderately slow or slow permeability.	Slight	Moderate: moderately well drained; moderately slow or slow permeability.
Slight	Slight	Slight	Moderate: moderately well drained; moderately slow or slow permeability.	Slight	Moderate: slope; moderately well drained; moderately slow or slow permeability.
Slight	Moderate: slope	Moderate: slope	Moderate: slope; moderately slow or slow permeability.	Slight	Severe: slope.
Slight	Moderate: slope	Moderate: slope	Moderate: slope; moderately slow or slow permeability.	Slight	Severe: slope.

[3] Twenty to 40 inches to soft, weathered bedrock that is easily rippable for septic tank fields but does present a possible pollution hazard.

more detailed information on streets and roads. Table 7 gives the range in permeability and other properties for the major horizons of the soils in each series in the county. In table 8, each soil is rated as a source of fill material, and soil features that affect highway location are also rated.

Septic-tank absorption fields.—This rating indicates the kind and degree of limitation that can be expected when using a soil for a septic-tank absorption or filter field. It is assumed that the septic-tank system will be adequately designed and installed (*4*, *13*). Considered in the ratings were the permeability

of the soil layers at and below the tile line, soil drainage class, depth to bedrock, surface rockiness, slope, surface stoniness, and flood hazard. The source of water supply, whether from individual or community systems, was not considered in making the ratings, but the hazard of pollution of wells, springs, streams, and lakes was noted in the table for some of the soils. Specific location of absorption fields requires onsite investigation.

Underground public utilities.—The selection of a soil suitable for the installation of such underground service facilities as storm drains, sewers, gas or water mains, or underground electric or telephone cables is determined mainly by depth to bedrock. Locally, the Vernon, Camillus, Marcellus, and in many places, the Skaneateles Shales are rippable and can be excavated with such light power equipment as backhoes. Most of the other rock foundations require blasting or use of powerful rock-excavating machinery. Other important features are slope, texture, stoniness, rockiness, and soil drainage class. The hazard of flooding and the soil drainage class are severe seasonal limitations. Corrosion potential was not considered in making these ratings.

Sanitary landfill (trenches).—It is assumed that the landfill operations for the disposal of trash and garbage will be performed by the trench method. Importation of fill or cover material was not considered in the ratings. The main features that affect the use of the soils for sanitary landfill are soil drainage class, permeability, slope, texture, depth to bedrock, and hazard of flooding. In general, soils that are deep, well drained or moderately well drained, level to sloping, not stony, not too permeable, not too plastic or sticky, and not subject to flooding are suitable for sanitary landfill. Rapidly permeable, gravelly and sandy soils that handle easily have a severe rating because of a severe pollution hazard to nearby wells, springs, lakes, and streams. Specific locations of landfill sites require onsite investigation.

Lawns, landscaping, and golf fairways.—The interpretations refer to the use of the soil in place for lawns, landscaping, and golf fairways. The importation of topsoil or fill was not considered in the ratings, and traps, greens, and roughs were not considered as part of the fairway. The main soil features considered in the ratings were soil drainage class, slope, depth to bedrock, surface rockiness, surface stoniness, surface-soil texture, and flood hazard. (Refer to the sections "General Management for Farming," "Capability Grouping," and "Descriptions of the Soils" for additional information to aid in establishing and maintaining lawns, fairways, flower gardens, and shrubbery.)

Picnic and play areas.—The natural beauty of the landscape is important in considering areas for picnics, informal games, and unorganized play. These areas are left essentially in their natural state. Problems of water supply and sewage disposal were not considered in the ratings. The main soil characteristics considered were soil drainage class, slope, surface texture, coarse fragments on the surface, stoniness, rockiness, and frequency of flooding during the season of use.

Camp areas.—These are areas used intensively as sites for tents and such camping vehicles as camping trailers, pickup campers, and self-contained campers. They are also used for the accompanying activities of outdoor living. It is assumed that these areas will be frequently used during the camping season and will involve heavy foot traffic and limited vehicular traffic. Problems of sewage disposal, water supply, and access roads were not considered in the ratings. The main soil characteristics considered were soil drainage class and the degree of wetness during the season of use; flooding hazard during the season of use; permeability, or how rapidly water moves through the soil following rains; slope; surface texture and its effect in creating either muddy or dusty conditions; coarse fragments on the surface; stoniness; and rockiness. Level to gently sloping, well drained and moderately well drained, medium-textured soils that are free of coarse fragments and stones are those best suited to camp areas.

Paths and trails.—Paths and trails are used for local and cross-country travel by foot, horseback, two-wheeled vehicles, and snowmobiles. Design and layout should require little or no cutting and filling. Soil features that affect trafficability, dust, design, and maintenance of trafficways are given special emphasis. The main soil characteristics considered were soil drainage class, degree of wetness during season of use, frequency of flooding during season of use, slope, surface texture, coarse fragments on the surface, and rockiness or stoniness. Snowmobiles are operated during winter when the soils are frozen and snow covered, so the most significant soil characteristics are slope, stoniness, and rockiness.

Athletic fields.—This refers to the use of the soils for the development of intensively used athletic fields or playgrounds for baseball, football, badminton, and for other similar organized games. It is assumed that the finished areas will be nearly level and subject to heavy foot traffic. Importation of topsoil or fill material was not considered in the ratings. Soil properties considered in the ratings were soil drainage class, frequency of flooding during season of use, permeability, slope, surface texture, depth to bedrock, coarse fragments on the surface, stoniness, and rockiness. Soil suitability for growing and maintaining vegetation was not part of the rating, but it is an important item to consider in the final evaluation of a site.

Formation, Morphology, and Classification of the Soils

This section discusses the major factors that affect the formation and morphology of the soils of Onondaga County and classifies the soils by higher categories.

Factors of Soil Formation

Soils are formed through the interaction of five major factors. They are climate, plant and animal life, parent material, relief, and time. The relative influence of each factor generally varies from place to

place. Local variations in soils are a result of differences in kind of parent material and in topography and drainage. In places, one factor dominates the formation of a soil and determines most of its properties.

Climate

The climate of Onondaga County is characteristic of a humid continental type that is marked by extreme seasonal temperature changes. Average annual precipitation is about 35 inches, and average annual air temperature is about 47° F. Rainfall is rather uniform during the growing season, May through September, when it averages 14 to 16 inches. The cool temperature has promoted the accumulation of organic matter in the surface layer. For more detailed information about climate, see the "Climate" subsection in the section "General Nature of the County."

Plant and animal life

All living organisms are important in soil formation. These include vegetation, animals, bacteria, and fungi. Vegetation is generally responsible for the amount of organic matter, color of the surface layer, and the amount of nutrients available to plants. Such animals as earthworms, cicadas, and burrowing animals help keep the soil open and porous. Bacteria and fungi decompose the vegetation, thus releasing nutrients for plant food. In Onondaga County, the native forests have had more influence on soil formation than any other living organism. Man, however, has greatly influenced the surface layer where he has cleared the forests and plowed the land. He has added fertilizer, has mixed some of the soil horizons, and has even moved soil materials from place to place.

Parent material

Parent material is the unconsolidated mass from which the soils formed. It determines the mineral and chemical composition of the soil, and to a large extent determines the rate that soil-forming processes take place.

In Onondaga County, soils formed from glacial till, a mixture of glacial till and residuum, glacial outwash, lacustrine materials, recent stream alluvium, and organic materials. Most of the soil materials were left after the glaciers melted 10,000 to 15,000 years ago. Alluvial and organic materials are of recent origin and are being deposited at the present time.

Soils formed from glacial till are the most extensive and have a wide range of characteristics. They commonly have a firm substratum. Appleton, Cazenovia, Honeoye, and Lansing soils are a few examples. Examples of soils formed in a mixture of glacial till and residuum are Aurora, Benson, Camillus, and Farmington soils. Soils formed from glacial outwash deposits are generally loamy and are commonly underlain by stratified sand and gravel. Examples of these are Alton, Howard, and Palmyra soils. Soils on stream bottoms formed from water-laid materials called recent alluvium. They are medium textured and have little or no soil development. Examples of these are Hamlin, Teel, and Wayland soils. Soils that formed from organic materials are called muck soils. Examples are Carlisle muck, Edwards muck, and Palms muck.

Relief

The northern half of Onondaga County is mostly within the Ontario-Erie Plain. The southern half, from the Onondaga Limestone escarpment southward, is mainly within the Allegheny Plateau of New York.

The plateau area has broad, glaciated uplands dissected by major glacial valleys. Elevations differ by as much as 1,000 feet between the tops of the glaciated uplands and the valley floors.

Elevations throughout the county range from 360 feet along the Oswego River to 2,060 feet at the highest point in the southeastern corner of the county. Average elevations over much of the county are between 400 and 1,500 feet above sea level.

The upland slopes of the southern half of the county are gently rolling to sloping, and the valley sides are sloping to very steep. The northern half of the county is made up of low-lying hills and drumlins surrounded by a nearly level and gently sloping lake plain. The most extensive lake plain that has drumlins is in the northeastern quarter of the county. The general features of all parts of the county show the smoothing effects of glaciation.

The shape of the land surface, commonly called the lay of the land; the slope; and the position of the soil in relation to the water table have had great influence on the formation of soils in the county. Soils that formed in sloping areas where runoff is moderate to rapid generally are well drained, have a bright-colored, unmottled subsoil, and in most places are leached to greater depths than wetter soils in the same general area. In more gently sloping areas where runoff is slower, the soils generally exhibit some evidence of wetness for short periods of time, such as mottling in the subsoil. In level areas or slight depressions where the water table is at or near the surface for long periods, the soils show evidence of wetness to a marked degree. They have a dark-colored, thick, organic surface layer and a strongly mottled or grayish subsoil. Some soils, however, are wet because of a high water table or because of their position. Also, the permeability of the soil material, as well as the length, steepness, and configuration of the slopes, influences the kind of soil that is formed from place to place. Local differences in soils are largely the result of differences in parent material and topography.

Time

The formation of soils requires time for changes to take place in the parent material, generally a long time. The soils of Onondaga County formed in the period since glaciation, within the past 10,000 to 15,000 years. Evidence of this relatively limited time can be seen in the soils.

Soils formed on low bottoms, subject to varying degrees of overflow, receive new sediments in places with each flooding. These soils have only weak soil structure and weak color differences between horizons. An example is the Hamlin soils. Soils that have well-developed soil horizons, such as Ontario soils,

have been developing for a longer time than Hamlin soils.

Morphology of the Soils

In this subsection, horizons and their nomenclature are briefly described. The processes involved in horizon formation are also described and explained.

Major soil horizons

The results of the soil-forming factors can be distinguished by the different layers, or soil horizons, seen in a soil profile. The soil profile extends from the surface of the land downward to materials that are little altered by the soil-forming processes.

Most soils contain three major horizons called A, B, and C (*9*). These major horizons may be further subdivided by the use of numbers and letters to indicate changes within one horizon. An example is the B2t horizon, which represents a B horizon that contains an accumulation of clay.

The A horizon is the surface layer. The A1 horizon is that part of the surface layer that contains the largest accumulation of organic matter. The A horizon is also the layer of maximum leaching or eluviation of clay and iron. If considerable leaching has taken place and organic matter has not darkened the material, the horizon is called an A2 horizon. In some soils in Onondaga County, the A2 horizon is brownish in color because of the oxidation of iron.

The B horizon underlies the A horizon and is commonly called the subsoil. It is the horizon of maximum accumulation, or illuviation, of clay, iron, aluminum, or other compounds, leached from the surface layer. In some soils, the B horizon is formed by alteration in place rather than by illuviation. The alteration is caused by oxidation and reduction of iron in places or by the weathering of clay minerals. The B horizon commonly has blocky or prismatic structure, and it generally is firmer and lighter colored than the A1 horizon, but it is darker colored than the C horizon.

The C horizon is below the A or B horizon. It consists of materials that are little altered by the soil-forming processes, but that are modified by weathering in places.

Processes of horizon differentiation

In Onondaga County, several processes are involved in the formation of soil horizons. Among these are the accumulation of organic matter, the leaching of soluble salts, the reduction and transfer of iron, the formation of soil structure, and the formation and translocation of clay minerals. These processes are continually taking place, generally at the same time throughout the profile, and have been going on for thousands of years.

The accumulation and incorporation of organic matter take place as plant residue recomposes. These additions darken the surface layer and help to form the A1 horizon. Once organic matter is lost, a long time is generally required to replace it. In Onondaga County, the organic-matter content of the surface layer averages about 4 percent.

In order for soils to have distinct subsoil horizons, it is believed that some of the lime and other soluble salts are leached before the translocation of clay minerals. Among the factors that affect this leaching are the kinds of salts originally present, the depth to which the soil solution percolates, and the texture of the soil profile.

Well drained and moderately well drained soils in Onondaga County have yellowish-brown or reddish-brown subsoil horizons. These colors are caused mainly by thin coatings of iron oxides on sand and silt grains, but in some soils, such as the Cazenovia soils, the colors are inherited from the reddish glacial materials in which they formed. Weak to moderate development of subangular blocky structure has taken place, but the subsoil contains little or no more clay than do the overlying surface horizons.

The fragipan has developed in the subsoil of some moderately well drained and somewhat poorly drained soils, such as Mardin, Volusia, and Williamson soils. These horizons are very firm and brittle when moist, and they are very hard when dry. Soil particles are tightly packed so that bulk density is high and pore space is low. Genesis of these horizons is not fully understood, but studies show that swelling and shrinking takes place in alternating wet and dry periods. This may account for the packing of soil particles and also for a gross polygonal pattern of cracks in the fragipan. Clay, silica, and oxides of aluminum are the most likely cementing agents causing brittleness and hardness.

The reduction and transfer of iron is associated mainly with the wetter, more poorly drained soils. This process is called gleying. Moderately well drained to somewhat poorly drained soils have mottles of yellowish brown and reddish brown which indicate the segregation of iron. In such poorly drained to very poorly drained soils as the Lyons, Lamson, and Canandaigua soils, the subsoil and underlying materials are grayish colored, which indicates reduction and transfer of iron by removal in solution.

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in such large areas as countries and continents.

The system of soil classification currently used (*10*) was adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study, readers interested in development of the current

system should search the latest literature available (7).[8]

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system, the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. In table 10, the soil series of Onondaga County are placed in four categories of the current system. Classes of the current system are briefly defined in the following paragraphs.

Order. Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. Each order is named with a word of three or four syllables ending *sol* (Alf-i-sol). Six of these orders are represented in Onondaga County. They are Entisols, Inceptisols, Alfisols, Spodosols, Mollisols, and Histosols. Entisols are recent soils that do not have genetic horizons or have only the beginnings of such horizons. Inceptisols are weakly developed mineral soils that have cambic B horizons and may have a fragipan. Alfisols have argillic B horizons where clay has accumulated. This clay accumulation is generally identified by the presence of clay films on ped surfaces. Spodosols have a spodic horizon in the subsoil. In Onondaga County, these horizons have redder colors than the rest of the horizons in the profile because of the presence of illuviated iron. Mollisols have thick, dark surface horizons called mollic epipedons. Histosols are organic soils and are more than 30 percent organic matter if the mineral fraction is 50 percent or more clay and 20 percent or more organic matter if the mineral fraction is not clay.

Suborder. Each order is subdivided into suborders that are based primarily on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is *Udalf* (*Ud*, meaning of humid climate, and *alf*, from Alfisol). The suborder is not shown in the table.

Great Group. Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is *Hapludalfs* (*Hapl*, meaning simple horizons, *ud* of humid climates, and *alf* from Alfisols). The great group is not shown in the table because the great group is the last word in the name of the subgroup.

Subgroup. Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others called intergrades that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is *Typic Hapludalfs* (a typical Hapludalf).

[8] Also see the unpublished working document "Selected Chapters from the Unedited Text of the Soil Taxonomy of the National Cooperative Soil Survey." It is ordinarily available in the SCS State Office, and is a good source of information on current soil classification.

TABLE 10.—*Soil series classified according to the current system*

Series	Family	Subgroup	Order
Alton	Loamy-skeletal, mixed, mesic	Dystric Eutrochrepts	Inceptisols.
Angola	Fine-loamy, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Appleton	Fine-loamy, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Arkport	Coarse-loamy, mixed, mesic	Psammentic Hapludalfs	Alfisols.
Arnot	Loamy-skeletal, mixed, mesic	Lithic Dystrochrepts	Inceptisols.
Aurora	Fine-loamy, mixed, mesic	Glossaquic Hapludalfs	Alfisols.
Benson	Loamy-skeletal, mixed, mesic	Lithic Eutrochrepts	Inceptisols.
Bombay[1]	Coarse-loamy, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Brockport	Fine, illitic, mesic	Aeric Ochraqualfs	Alfisols.
Camillus	Fine-loamy, mixed, mesic	Dystric Eutrochrepts	Inceptisols.
Canandaigua	Fine-silty, mixed, nonacid, mesic	Mollic Haplaquepts	Inceptisols.
Carlisle	Euic, mesic	TypicMedisaprists	Histosols.
Cazenovia	Fine-loamy, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Collamer[1]	Fine-silty, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Colonie	Mixed, mesic	Alfic Udipsamments	Entisols.
Conesus	Fine-loamy, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Croghan[1]	Sandy, mixed, frigid	Aquic Haplorthods	Spodosols.
Darien	Fine-loamy, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Dunkirk	Fine-silty, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Edwards	Marly, euic, mesic	Limnic Medisaprists	Histosols.
Farmington	Loamy, mixed, mesic	Lithic Eutrochrepts	Inceptisols.

TABLE 10.—*Soil series classified according to the current system—Continued*

Series	Family	Subgroup	Order
Fonda	Fine, illitic, nonacid, mesic	Mollic Haplaquepts	Inceptisols.
Fredon[1]	Coarse-loamy over sandy or sandy-skeletal, mixed, nonacid, mesic.	Aeric Haplaquepts	Inceptisols.
Galen	Coarse-loamy, mixed, mesic	Psammentic Hapludalfs	Alfisols.
Halsey[1]	Coarse-loamy over sandy or sandy-skeletal, mixed, nonacid, mesic.	Mollic Haplaquepts	Inceptisols.
Hamlin	Coarse-silty, mixed, mesic	Dystric Fluventic Eutrochrepts	Inceptisols.
Herkimer[1]	Coarse-loamy, mixed, mesic	Dystric Eutrochrepts	Inceptisols.
Hilton	Fine-loamy, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Honeoye	Fine-loamy, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Howard	Loamy-skeletal, mixed mesic	Glossoboric Hapludalfs	Alfisols.
Kendaia	Fine-loamy, mixed, nonacid, mesic	Aeric Haplaquepts	Inceptisols.
Lairdsville	Fine, illitic, mesic	Typic Hapludalfs	Alfisols.
Lakemont	Fine, illitic, mesic	Udollic Ochraqualfs	Alfisols.
Lamson	Coarse-loamy, mixed, nonacid, mesic	Aeric Haplaquepts	Inceptisols.
Lansing	Fine-loamy, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Lima	Fine-loamy, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Lockport	Fine, illitic, mesic	Aeric Ochraqualfs	Alfisols.
Lordstown	Coarse-loamy, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Lyons	Fine-loamy, mixed, nonacid, mesic	Mollic Haplaquepts	Inceptisols.
Madrid	Coarse-loamy, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Manheim	Fine-loamy, mixed, mesic	Udollic Ochraqualfs	Alfisols.
Manlius	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Mardin	Coarse-loamy, mixed, mesic	Typic Fragiochrepts	Inceptisols.
Mardin, moderately shallow variant.	Coarse-loamy, mixed, mesic	Typic Fragiochrepts	Inceptisols.
Martisco	Fine-silty, carbonatic, mesic	Histic Humaquepts	Inceptisols.
Minoa	Coarse-loamy, mixed, mesic	Aquic Dystric Eutrochrepts	Inceptisols.
Mohawk	Fine-loamy, mixed, mesic	Mollic Hapludalfs	Alfisols.
Naumburg[1]	Sandy, mixed, frigid	Aeric Haplaquods	Spodosols.
Niagara	Fine-silty, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Odessa	Fine, illitic, mesic	Aeric Ochraqualfs	Alfisols.
Ontario	Fine-loamy, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Otisville	Sandy-skeletal, mixed, mesic	Typic Udorthents	Entisols.
Ovid	Fine-loamy, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Palatine	Loamy-skeletal, mixed, mesic	Typic Hapludolls	Mollisols.
Palms	Loamy, mixed, euic, mesic	Terric Medisaprists	Histosols.
Palmyra	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Glossoboric Hapludalfs	Alfisols.
Phelps	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Glossaquic Hapludalfs	Alfisols.
Rhinebeck	Fine, illitic, mesic	Aeric Ochraqualfs	Alfisols.
Schoharie	Fine, illitic, mesic	Typic Hapludalfs	Alfisols.
Teel	Coarse-silty, mixed, mesic	Fluvaquentic Eutrochrepts	Inceptisols.
Varick	Fine-loamy, mixed, mesic	Mollic Ochraqualfs	Alfisols.
Volusia	Fine-loamy, mixed, mesic	Aeric Fragiaquepts	Inceptisols.
Volusia, moderately shallow variant.	Fine-loamy, mixed, mesic	Aeric Fragiaquepts	Inceptisols.
Wampsville	Fine-loamy, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Wareham	Mixed, mesic	Mollic Psammaquents	Entisols.
Warners	Fine-silty, carbonatic, mesic	Fluvaquentic Haplaquolls	Mollisols.
Wassaic	Fine-loamy, mixed, mesic	Glossoboric Hapludalfs	Alfisols.
Wayland	Fine-silty, mixed, nonacid, mesic	Mollic Fluvaquents	Entisols.
Weaver	Fine-loamy, mixed, mesic	Fluvaquentic Eutrochrepts	Inceptisols.
Williamson	Coarse-silty, mixed, mesic	Typic Fragiochrepts	Inceptisols.

[1] These soils are taxadjuncts to the series. They are outside the defined range for the series in the following respects:
Bombay soils have low-chroma mottles in the upper part of the argillic horizon.
Collamer soils have low-chroma mottles in the upper part of the argillic horizon.
Croghan soils are more than a few degrees warmer.
Fredon soils have carbonates at shallower depths and lack contrasting textures in the textural control section.
Halsey soils are too shallow to carbonates.
Herkimer soils have a thicker solum.
Naumburg soils are more than a few degrees warmer.

Family. Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used as family differentiae (see table 10). An example is the fine-loamy, mixed, mesic family of Typic Hapludalfs.

Series. This is a collection of soil individuals essentially uniform in differentiating characteristics and in arrangement of horizons. It is defined on the basis of morphological characteristics below plow depth. Soils of the same series that have contrasting surface textures are designated as phases of that series. Some of the differentiating characteristics that separate soil series are arrangement of horizons, color, structure, texture,

reaction, consistence, coarse fragments, mottling, and mineral and chemical composition.

As soil scientists increase their knowledge about soil genesis and morphology, it becomes necessary to revise established soil series and to create new series where necessary. A proposed new series has tentative status until it has been reviewed at the state, regional, and national levels of responsibility for soil classification. All of the soil series described in this publication are established series.

General Nature of the County

This section provides information about the environment of Onondaga County affecting or related to soil use. It discusses climate; geology; physiology; drainage; vegetation; settlement and population; land use; industry, transportation, and markets; and water supply.

Climate[9]

Onondaga County has a climate classified as humid-continental. The land areas of North America are the primary source of the air masses and weather systems that affect the region. The influence of the Atlantic Ocean is secondary, although it contributes some maritime characteristics to the climate. The humid attribute arises from the currents of the upper atmosphere which frequently bring moisture to the region from the Gulf of Mexico and the Atlantic Ocean.

The county is affected by most weather systems in their normal movement toward the northeastern United States. Vigorous storms moving up the Atlantic Coast usually affect the area, so the weather is variable. Temperature, humidity, wind, and other atmospheric conditions normally undergo noticeable change within a few days. The weather in a given week often differs from that of the preceding or subsequent week. Seasonal weather is commonly variable from year to year.

Lake Ontario has an important influence on the climate. It moderates the temperature, reducing the occurrence of both hot weather in summer and extreme cold weather in winter. The lake serves as a heat sink in spring. This cooling effect on temperatures causes a delay in plant development, and tender crops pass more safely through high-risk periods of freeze damage. Cooling at night is modified, an important effect of which is to extend the frost-free growing season, especially in autumn. The lake contributes to a great amount of cloudiness in winter, which lessens the occurrence of severe, below-zero temperatures in comparison with those localities further inland and at similar latitudes in New York State.

Temperature and precipitation data are summarized in table 11. Table 12 gives probabilities of the last freezing temperatures in spring and the first in fall.

Topography and elevation are factors in producing some variation of climate within Onondaga County. The hilly terrain and higher elevations in the southern half of the county can cause important differences in temperature and other aspects of climate within relatively short distances.

The summer is pleasantly warm. Maximum daytime temperatures generally range from the upper seventies to the middle eighties. Temperatures of 90° F or higher occur on an average of 3 to 7 days per year. The winters are long and cold with occasional periods of severe weather. The occurrence of below-zero temperatures varies from about 6 days in the northwestern part of Onondaga County to about 12 days in the southeastern part. In most winters, the coldest temperature is between −5° and −20° F.

The frost-free growing season averages between 160 and 165 days in the vicinity of Syracuse. It generally is about 175 days in the extreme northwestern part of the county and about 150 days in the southeastern highlands.

Average annual precipitation ranges from 36 inches in the lake plain to 39 to 40 inches in the southern and southeastern border areas of the county. About 45 percent of the annual precipitation is received during the growing season, from May through September. Precipitation is rather evenly distributed throughout the year, averaging about 3 inches per month. It is generally adequate for farming needs and water supplies. Serious droughts are uncommon, but their occurrence should not be disregarded in long-range planning.

Snowfall is heavy throughout the county. Average annual snowfall in northern and eastern sections ranges from 100 to 120 inches, but it averages about 90 inches in southwestern Onondaga County. Total snowfall of 50 inches or more is not uncommon in two successive months.

Lake Ontario has significant effect on winter precipitation. Cold air often flows across the unfrozen, relatively warm lake waters, acquires moisture and other properties, and produces precipitation in the form of snow showers, flurries, or squalls. At times, snowfall is substantial. These lake-effect storms are most prevalent from late in December to the middle or late part of March. Maximum snow cover generally occurs in February.

Geology[10]

Nearly all of the parent materials of the soils of Onondaga County were deposited either directly or indirectly through glaciation. Only the recent alluvium of the flood plains is postglacial.

During glacial periods temperatures dropped, snow and ice accumulated, and an ice sheet at least one-half mile thick advanced over what is now the Syracuse area. Within the last million years the ice sheet advanced and receded several times. Clear evidence of two major advances has been found in the Syracuse area. Millions of tons of glacial ice-scoured bedrock moved the soils and ground these materials to

[9] By A. BOYD PACK, climatologist for New York, National Weather Service, U.S. Department of Commerce.

[10] HARLAN F. MOONEN, geologist, Soil Conservation Service, assisted in preparing this section.

TABLE 11.—*Temperature and precipitation*

[Data from Syracuse]

Month	Temperature				Precipitation				
			Seven years in 10 will have—			Three years in 10 will have—		Snowfall	
	Average daily maximum	Average daily minimum	Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—	Average total	More than—	Less than—	Average total	Seven years in 10 will have more than—
	°F	°F	°F	°F	In	In	In	In	In
January	31	15	46	−2	2.7	3.0	2.2	25	18
February	33	16	49	−2	2.8	3.2	2.1	25	19
March	42	25	61	12	3.0	3.6	2.4	16	11
April	57	36	75	25	3.1	3.6	2.5	2	[1]6
May	68	46	85	33	3.0	3.6	2.4	[2]	[1]1
June	78	56	90	44	3.1	3.7	2.4		
July	82	60	91	51	3.1	3.7	2.1		
August	80	59	90	48	3.5	3.8	2.5		
September	73	52	88	39	2.7	3.3	2.0		
October	62	42	79	29	3.1	3.5	1.9	1	[1]2
November	48	33	67	20	3.3	4.0	2.3	9	4
December	35	21	53	2	3.1	3.5	2.4	22	14
Year	57	38	93	−7	36.5	39.8	33.1	100	82

[1] One year in 10. [2] Trace.

TABLE 12.—*Probabilities of last freezing temperature in spring and first in fall*

[Data from Syracuse]

Probability	Dates for given probability and temperature				
	16°F or lower	20°F or lower	24°F or lower	28°F or lower	32°F or lower
Spring:					
1 year in 10 later than	April 5	April 8	April 16	May 4	May 17
2 years in 10 later than	March 30	April 3	April 11	April 28	May 12
5 years in 10 later than	March 19	March 24	April 2	April 17	May 2
Fall:					
1 year in 10 earlier than	November 21	November 9	November 3	October 8	September 24
2 years in 10 earlier than	November 24	November 14	November 8	October 14	September 30
5 years in 10 earlier than	December 1	November 24	November 17	October 25	October 11

fine pieces as the ice moved southward. The hills were mostly smoothed, and existing valleys were deepened by the first glacial advance; the second ice advance filled in the troughs made by the first glacier. Masses of till were deposited beneath the ice sheet. Mixed gravelly materials were dumped in masses at the front and sides of the ice sheet. Outwash deposits were left in riverbeds when rivers finally receded. Lacustrine deposits were left at the bottoms of glacial lakes when the ice dams melted and the lakes drained. When the ice melted, lakes and rivers were formed, further modifying the landscape. Other deposits were left where local tongues of ice advanced and receded, where tunnels existed under the ice, where the ice cracked, and where dust blew from riverbeds and flood plains. The last glacier left what is now the Syracuse area only about 10,000 years ago; consequently, soils in the area are young and closely related to the materials in which they formed (*3*).

Bedrock from which the soil material in Onondaga County derived is mostly limestone, siltstone, and shale that formed from materials deposited at the bottom of the sea during Silurian and Devonian geologic periods. These sedimentary strata are about 8,000 feet thick over crystalline rocks (*14*). The Erie-Ontario Plain in Onondaga County has a high percentage of softer, less resistant shale and limestone of Silurian age. The Allegheny Plateau, except for thick beds of Onondaga Limestone at its northern margin, is mostly interbedded shale and thin limestone of Devonian age. Bedrock strata under the Erie-Ontario Plain and the Allegheny Plateau occur in east-west bands having a regional dip southward about 1 degree, or a drop in elevation of 20 to 30 feet to the mile.

The east-west escarpment of Onondaga Limestone generally divides the county into two different regions of both soil and topography—the Erie-Ontario Plain and the Allegheny Plateau.

Bedrock in the most northerly part of the county is of the Clinton Group, which consists of red sandstone, shales, and thinly bedded limestone of middle Silu-

rian age. These are the oldest rocks in Onondaga County, and they contribute to the reddish colors and medium texture of the Appleton, Bombay, and Madrid till soils. The shales and sandstones are generally low in content of lime and potash. These rocks are well buried in this area, cropping out only in the riverbed near the Three Rivers area. The lake deposits and the glacial outwash in this area also, but to a lesser degree, reflect inherited characteristics from these formations.

South of the Clinton Group, north of Baldwinsville and east along State Route 31 to Chittenango Creek lies a relatively narrow band of Lockport dolomite that is 1 to 2 miles wide. This rather hard, dark-gray bedrock is buried below till, lake sediment, and outwash deposits. In the vicinity of Cicero Center, the Lockport Dolomite has been quarried. At these places, it is at a depth of a few inches to several feet. This dolomite contributed only small amounts of material to the Appleton, Bombay, Hilton, Madrid, and Ontario soils north of Baldwinsville. The till in the area south of State Route 31 and north of Cicero Swamp contains relatively large amounts of this rock. This formation also contributed most of the limestone in the Ontario and Palmyra soils, and in associated soils north of the Onondaga Escarpment.

South of the two narrow bands of Clinton and Lockport rocks, to a wavy east-west line that lies at the south end of Onondaga Lake, is an area underlain by the Salina Group. These are mostly calcareous shales. The heavier and often redder soils south of Baldwinsville formed in the red and green, clayey Vernon Shale. These soils are the Lairdsville, Lockport, and Brockport soils, and in places some Cazenovia soils as well. These shales also account for much of the clay in the medium-textured Ontario, Hilton, Palmyra, Wampsville, and associated soils. The Syracuse Formation, and particularly the Camillus Formation, is prominent along the southern edge of the Vernon Shale area. The soft Camillus Shales that contain both salt and gypsum are the main contributing rock of the very silty Camillus soils. These soils are mostly just north of the escarpment area. Camillus Shale outcrops are in several places across the county along State Route 5, particularly in the vicinity south and east of the village of Camillus.

Southward, on top of the Helderberg-Onondaga Escarpment, the rather massive Onondaga Limestone crops out almost all the way across the county. It forms a narrow but prominent band of moderately pure limestone of light bluish-gray color. It is commonly thinly bedded in the lower part, but in general, it is massive. Lenses of chert in parallel layers are also common in the lower part. This rock forms the solid southern rim of the lower lying lake plain. Because it was at right angles to the movement of glacial ice, it was heavily scoured, and it contributed a large amount of limestone to the till for several miles south of the outcrop. These limestone contributions range from finely ground rock flour to massive boulders. Limestone fines and fragments, derived mainly from the Onondaga Limestone, strongly influence the characteristics of the Benson, Cazenovia, Honeoye, Kendaia, Lima, Lyons, Manheim, Mohawk, Ovid, and Wassaic till soils, as well as the Fredon, Palmyra, and Phelps soils that formed from glacial outwash. Other upland and lowland soils are influenced, but less directly, by this source of limestone.

On top of the Onondaga Limestone is a thin layer of black, bituminous, very fissile shale. This is the Union Springs member of the Marcellus Formation. This dark shale crops out in a narrow band south of, and next to, the limestone outcrop area. In the shale outcrop area are the moderately deep Palatine soils. In a somewhat wider band south of the Palatine soils are the low hills of Mohawk soils and lower areas of Manheim soils. The influence of the black shale generally dissipates within a two-mile area south of the source.

In areas where the influence of other shale formations of the Hamilton Group increases, particularly the Skaneateles Shale formation, the till becomes grayer, and the limestone fragments lose their sharp edges and take on typical rounded glacial-gravel and stone configurations. This high-lime till, where deep over shale, gives rise to the soils of the Honeoye, Kendaia, and Lima drainage sequence. The softer beds close to the surface on valley sides and uplands support the soils of the Angola, Aurora, and Varick drainage sequence and the deeper Darien soil. On some of the firmer shales that have a shallower till mantle are a few areas of Farmington soils. One such area is along the western lip of Limestone Creek Valley at U.S. Highway 20. Shaly alluvial fans built up by streams cutting through the Marcellus and Skaneateles Formations form the black and dark-gray Herkimer soils. One of the most extensive areas of grayer Herkimer soils is in Pumpkin Hollow, east of Marcellus.

This broad band of high-lime soils forms the single largest soil area in the county. The southern limit is a line that begins south of Borodino, extends north of Otisco, dips south through the Tully farm areas, and curves northeastward around Pompey and southeastward to an area south of Delphi.

Some of the upper, sandier Skaneateles Shales and those of the Ludlowville Formation contain less carbonates than lower members of the Skaneateles Shales. This change in the bedrock, as well as increasing distance from the Onondaga Limestone Formation, is reflected in the medium-lime soils of the Appleton, Conesus, and Lansing drainage sequence of these upland-till areas. These are the areas south of the broad band of high-lime Honeoye and similar soils. This Lansing soil is separated by the valley soils of alluvial, lacustrine, or outwash origin; otherwise, they would form a band several miles wide across the southern part of the county and extend south to more rugged acid uplands along the Cortland County line. Along with the Lansing soil are also the Angola, Aurora, and Varick soils where the softer shales are near the surface. The harder shales that have a shallow till mantle produce the Farmington soils. Some layers are hard and acid and give rise to the moderately deep Lordstown soils and the shallow Arnot soils. Softer acid shales near the surface produce Manlius soils, and the deeper acid soils that have fragipans are the Mardin and Volusia soils. Hard, acid, sandy shale outcrops are at Dutch Hill. Small outcrops, as much as 25 feet thick, of Tully

Limestone cap the thicker Moscow Formations. This limestone layer is too thin and too buried to be of much influence on soil formation except in the immediate vicinity of the outcrops.

Along the southern edge of the county and at the highest elevations are soils common to the northern edge of the Allegheny Plateau. These are the Arnot and Lordstown soils where arenaceous, coarse, blocky shale and bedded, flaggy, olive to dark olive-gray sandstone of the Ithaca Formation are close to the surface. Manlius soils formed where the more fissile shale of the Genesee Formation is close to the surface. Deeper soils in this area, Mardin and Volusia soils, have a fragipan.

Physiography

Onondaga County is situated in the center of upstate New York. Because of its location, it borders on several physiographic regions. The county is divided in half by two major physiographic provinces—the Erie-Ontario Plain to the north and the Allegheny Plateau to the south. The demarcation line separating these two provinces is an east-west escarpment formed by the Onondaga Limestone.

The northern half of Onondaga County is typified by the Erie-Ontario Plain. West of a line from Syracuse through Baldwinsville and Little Utica are low-lying till plains, drumlins, several outwash plains, and numerous small areas of lacustrine origin. Relief in this area ranges from 380 feet to 425 feet above sea level in the lacustrine deposits and from 425 feet to 600 feet on the till plains to the highest drumlins and hills. All of the hills, and particularly the well-formed drumlins, show molding both in form and direction by the force of the glacier that overran the county.

To the east is the largest part of the Erie-Ontario Plain within the county. It has typical lake-plain topography. Elevations range from 370 feet near Onondaga Lake and Oneida Lake to more than 450 feet on the low hills or ridges of glacial till scattered throughout the plain. Some of these hills barely extended above the surface of glacial Lake Iroquois when it occupied this part of the county. In this area are several shallow basins and low spots in the glacial lake bottom that developed muck accumulations. The largest is Cicero Swamp, which is about 5 square miles in area. Except for the low-lying, islandlike hills, the muck areas, and some small sand and gravel deposits, most of the soil materials in this part of the county are lacustrine silts and clays.

The southern half of the county, beginning at the limestone escarpment, is typical of the northernmost extension of the Allegheny Plateau. Elevations rise abruptly several hundred feet at the escarpment south of Syracuse. Elevation increases to the south, ranging from 600 feet at the northern edge to 1,600 feet, except near the Cortland County line where hilltops range from 1,600 feet to more than 2,000 feet. The highest point, 2½ miles south of Fabius, is 2,060 feet above sea level. The southern half of the county has rolling till uplands between deep, U-shaped, steep-sided valleys that extend through the plateau to the south.

In a broad band of lower elevations south of the Escarpment, the soils are similar to those in the Finger Lakes Section in Cayuga and Seneca Counties. In Onondaga County, slopes are steeper and more rolling with fewer nearly level or more gently sloping areas than they are to the west in Cayuga and Seneca Counties.

The hilly area, 3 to 5 miles wide north of the Cortland County line, is more typical of the Allegheny Plateau. Valleys in this area broaden or merge with the valleys from the north. They have steep and very steep valley sides that are often rocky. Valley floors are at elevations of 1,300 feet and are higher than the northern part of the plateau south of the escarpment.

Drainage

All of the drainage from Onondaga County eventually flows into Lake Ontario, except for five small watersheds near the southern edge of the county that drain south to the Susquehanna River. These are Cold Brook near the southwestern edge of the county; the west branch of Tioughnioga River near Tully; Labrador Creek south of Apulia; Fabius Creek south of Fabius; and the west branch of Tioughnioga Creek.

Much of the southwestern part of the county drains into Skeaneateles or Otisco Lakes. Skaneateles Creek flows north from Skaneateles Lake to the Seneca River, and Nine Mile Creek flows from Otisco Lake into Onondaga Lake, which outlets into the Seneca River. The central part of the county drains into Onondaga Creek which also flows north into Onondaga Lake. East of the Onondaga drainage area to the Madison County line, drainage is into Butternut and Limestone Creeks. They flow to the north. Butternut Creek joins Limestone Creek about 1½ miles north of Minoa. Limestone Creek joins Chittenango Creek immediately north of North Manlius. Chittenango Creek, which is the northeastern boundary of Onondaga County, drains a narrow area along the creek, including the east end of Cicero Swamp, and then flows into Oneida Lake. The Oneida River is the outlet for Oneida Lake. It flows westerly and forms part of the northern boundary of the county.

A few minor streams in the northern part of the county drain directly into Oneida Lake or the Seneca, Oneida, and Oswego Rivers. The Oswego River begins at the junction of the Oneida and the Seneca Rivers at Three Rivers and flows north into Lake Ontario. Mud Creek, which drains Peat Swamp and the western half of Cicero Swamp, is a slow, sluggish stream which flows into the Oneida River at Oak Orchard. Ox Creek drains the northwestern part of the county around Beaver Lake and flows north through Oswego County into the Oswego River. Carpenters Brook, White Bottom Creek, and Dead Creek are the major streams that flow directly into the Seneca River. These streams come from springs in the Onondaga Limestone and the Camillus Shale, and have white marl streambeds.

Vegetation

Prior to settlement, Onondaga County, with the exception of a few fresh water marshes, was heavily forested with mixed hardwoods and conifers. Beech,

sugar maple, red oak, white oak, and chestnut grew on the better drained soils, and elm, soft maples, black ash, and willow grew on the more poorly drained soils. The fertile soils in the large central part of the county supported superior stands of sugar maple, white ash, beech, yellow birch, basswood, oak, hemlock, and white pine. The southern edge of the county supported stands of similar species, but trees showed somewhat poorer form and growth. On the lake plain, hickories, chestnut, and yellow-poplar were mixed with the three species of the central part of the county.

The early settlers cleared much of the land of trees, generally by burning. After transportation systems were established, a large lumber industry developed. By 1880, according to census figures, the area in farms was at an alltime high of 98.4 percent of the county. Remnants of the original forests are mostly in stands in scattered woodlots and are composed mainly of third- and second-growth trees of the original species. Many areas of the county that were once cleared have reverted to brushy areas of dogwood, thornapple, ash thickets, and young stands of hardwoods. Several thousand acres, mainly state and county properties, have been reforested to evergreens.

Settlement and Population

The first settlement in Onondaga County was made by the French who, in 1655, established a fort and trading post at Salina on Onondaga Lake (*2*). This was soon abandoned because of poor relations with the Onondaga Indians, and not until 1786 did the first permanent settler open a trading post along Onondaga Creek, south of Syracuse. Rapid settlement did not begin until after the 1788 Indian Treaty for the land known as the Military Grant. Most settlers come from eastern New York and New England. The first families to move to the county were those of Major Comfort Tyler and Asa Danforth. Tyler erected the first sawmill in 1792 in the town of De Witt near Jamesville (*2*). Onondaga County was formed from Herkimer County in 1794 and was reduced to its present limits in 1816.

The population of the county in 1800 consisted of a few thousand settlers and Indians. By 1817, when the first canal was completed from Utica to Syracuse, there were more than 30,000 residents. In 1848, when the New York Central Railroad was built, the population of Onondaga County numbered almost 75,000. After the Civil War, growth was even more rapid, and by 1900, the population exceeded 200,000. In 1930, it was 291,606, and in 1970, 466,334. In 1960, Syracuse, the only city, had a population of 216,038. According to the 1970 Census, the population of Syracuse was 192,529, a decrease of 11 percent. The largest villages are Manlius, DeWitt, Baldwinsville, East Syracuse, Fayetteville, Liverpool, North Syracuse, and Skaneateles. There are numerous smaller villages and developed areas that have several hundred or more residents. The trend for the past decade has been rather extensive migration from Syracuse to the suburbs.

Land Use

The 1969 Census of Agriculture shows that about 40 percent, or 204,966 acres, of Onondaga County was in farms. Of this amount, 93,489 acres was harvested cropland. This land was in 1,159 farms averaging about 177 acres each. There were 713 farms that had sales of $2,500 and more, and these farms averaged about 229 acres in size.

Total crops harvested in 1969 were from 13,452 acres in corn; 10,931 acres in cut silage, green or dry fodder, or pasture; 5,074 acres in wheat for grain; nearly 5,000 acres in vegetables, berries, and apples; and 2,000 to 3,000 acres in other crops.

Industry, Transportation, and Markets

Syracuse, the largest city and county seat, is near the geographical center of the county. It is also at the center of the fastest growing urban system in New York State (*3*). It is an industrial, service, and distribution center, and a medical and educational center. The main industries are electronics, machine parts, chemicals, refrigeration, and air-conditioning equipment. Limestone and shale quarries and salt wells produce materials used mainly in the manufacture of chemicals and plaster or for road building and maintenance.

The county is a transportation center for the central part of the State. An excellent system of all-weather roads serves the county. Interstate Routes 90 and 81 cross near the northern side of Syracuse. Two major railroads also serve Syracuse. The New York State (Erie) Barge Canal passes along the northern boundary and through the northwestern part of the county with a terminal within the city of Syracuse on Onondaga Lake. Three major airlines have terminals at Hancock Field.

Agricultural products from farms consist mainly of fluid milk. Other products of importance are dairy cattle and calves, poultry and poultry products, fruits, berries, vegetables, and grains. Much of the fluid milk and most of the other products are consumed within the county.

Water Supply

Surface water supplies are plentiful throughout Onondaga County. Rainfall is adequate to recharge the six lakes adjacent to or entirely within the county. Many streams and creeks flow into the lakes or into the Oneida, Oswego, or Seneca Rivers, which flow through the county or along the county boundaries. Several reservoirs and large ponds, and many smaller ponds, are throughout the county.

Numerous towns and villages obtain water from wells or springs. Other areas, including the city of Syracuse, receive their water supply from Otisco Lake or Skaneateles Lake. A large amount of water is available from the six-foot pipeline from Lake Ontario. This water is sold as needed to communities and industry as a supplemental source.

Most rural residents depend on deep or shallow wells for their water supply. Many rural landowners have developed ponds as a supplemental source of

water for livestock, fire protection, and recreational use. In a few places, ponds that have a fast recharge rate are used for irrigation.

In the northern half of the county, soils that formed in low-lying lacustrine silt and clay support many dugout ponds. Most ponds that are underlain by the firm till of the Appleton, Bombay, Hilton, or Lyons soils hold water very well.

In the southern half of the county, both dugout and diked ponds are common. Ground water generally fills dugout ponds in Appleton, Kendaia, Lyons, Ovid, or Volusia soils. Diked ponds are supplied mainly by intercepting runoff water. They are built in many of the glacial-till soils and the lacustrine-valley soils. Mardin and Volusia soils are particularly good soils for diked ponds.

Some dugout ponds in sandy or gravelly soils recharge rapidly. The water level in ponds is dependent on the depth to ground water. Most of these ponds are used to irrigate nearby truck crops.

Ground-water resources are available throughout Onondaga County in the soils and in the underlying bedrock, but water quantity and quality vary considerably within each.

The northern half of the county, which lies within the Erie-Ontario Plan Physiographic Province, contains soils derived from glacial till, lake-laid silt, clay, sand and gravel, and glacial-outwash materials. Ground-water yields of more than 350 gallons per minute (gpm) are available in glacial sand and gravel deposits, but these are confined mainly to such existing stream valleys as Nine Mile Creek, Onondaga Creek, Seneca River, Mud Creek, and Limestone Creek. Although yields of these aquifers are large, many are unusable because of the presence of salt from the underlying rock formations. Areas in which salt water is likely to be encountered are those near Onondaga Creek, Nine Mile Creek, and the Seneca River.

Ground-water yields in the lacustrine silt, sand, and clay throughout the northern part of the county range from 0.1 to 100 gallons per minute. The sand yields from 5 to 100 gallons per minute. Yields from silt and clay are quite low, in the general range of 0.1 to 0.5 gallon per minute.

Soils derived from glacial till make up a large part of the Erie-Ontario Plain in Onondaga County. Ground-water yields in this material are generally low, in the range of 0.1 to 2 gallons per minute.

The southern half of Onondaga County lies entirely within the Allegheny Plateau Physiographic Province. The soils that dominate this area are mainly derived from glacial till. Ground-water yields are exactly the same as in till soils in the northern half of the county; namely, 0.1 to 2 gallons per minute.

Glacial deposits of sand and gravel as well as deposits of mixed glacial materials are in stream-channel valleys. The sand and gravel aquifers yield ground water in the range of 50 to more than 350 gallons per minute. Ground-water yields from mixed deposits range from 1 to 350 gallons per minute. Areas of high yield in sand and gravel are in the valleys of Nine Mile Creek, Onondaga Creek, Butternut Creek, and Limestone Creek. Salty gound water can be found in the Onondaga Creek Valley and at the headwaters of Nine Mile and Limestone Creeks.

In areas where ground-water yields from soils are inadequate or of poor quality or in areas of shallow soils, it may be necessary to attempt to obtain ground-water supplies from bedrock. As in soils, yields from bedrock are extremely variable, and they are entirely dependent on such factors as rock type, cementation, solubility, and presence of fractures.

Sandstone and shale of the Clinton Group, in the extreme northern part of the county, yield from 1 to 28 gallons per minute, with an average flow of 3 gallons per minute. A narrow band of Lockport Dolomite, north of Syracuse, yields from 1 to 30 gallons per minute with an average flow of 4 gallons per minute. A wide band of Vernon and Camillus Shales extending throughout the remaining Erie-Ontario Plain yields from 1 to 245 gallons per minute, with an average flow of 20 gallons per minute. Limestones forming the Onondaga Escarpment are the best bedrock aquifers. They yield from 3 to 700 gallons per minute with an average flow of 25 gallons per minute.

Covering the southern half of Onondaga County are the Genesee Formation, Tully Limestone, and Hamilton Group where yields are 1 to 100 gallons per minute, with an average flow of 6 gallons per minute.

Bedrock aquifers in the Erie-Ontario Plain, in Onondaga Creek Valley, and at the headwaters of Nine Mile and Limestone Creeks are likely to produce salty ground water.

Almost all ground water from bedrock in Onondaga County is hard, and water from Camillus and Vernon Shale contains excessive sulfate.

In summary, ground-water supplies for domestic and farm use in Onondaga County are generally adequate from both soils and bedrock. Large supplies of ground water for municipal and industrial use, however, are located only in a few selected areas in the county, mainly in the sand and gravel aquifers in major stream valleys. Even though these large supplies are available, the possibility of contamination by salt water renders them useless for most considered possibilities.

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Glossary

Aeolian. Refers to soil material from wind-blown deposits. It is generally deposited as a surface layer of silt-sized particles.
Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere; but that in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.
Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.
Argillic horizon. A soil horizon in which clay has accumulated by illuviation.
Association, soil. A group of soils geographically associated in a characteristic repeating pattern.
Available water capacity (also termed 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 capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.
Base saturation. The degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity.
Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.
Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.
Channery soil. A soil that contains thin, flat fragments of sandstone, limestone, or schist, as much as 6 inches in length along the longer axis. A single piece is called a fragment.
Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.
Coarse fragments. Rock or mineral particles more than 2 millimeters in diameter. The particles are larger than very coarse sand. The rounded or partly rounded coarse fragments in soils are: gravel (up to 3 inches in diameter); cobbles (3 to 10 inches in diameter); and stones (more than 10 inches in diameter). The flat, thin fragments up to 6 inches are channers, and from 6 to 15 inches, flags.
Coarse-textured soil. Sand and loamy sand.
Complex, soil. A mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.
Congelifractate. Mass of material produced by frost splitting.
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 and brittle; little affected by moistening.
Contour farming. Plowing, cultivating, planting, and harvesting in rows that are at right angles to the natural direction of the slope or that are parallel to terrace grade.
Cover crop. A close-growing crop grown primarily to improve and to protect the soil between periods of regular crop production; or a crop grown between trees and vines in orchards and vineyards.
Deep soil. Soil material more than 40 inches deep over bedrock.
Delta. The alluvial or glacial outwash deposit at the mouth of existing or glacial streams.
Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.
Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, 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 different classes of natural soil drainage are recognized.
Excessively drained soils are commonly very porous and rapidly permeable and have a low available water capacity.
Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.
Well-drained soils are nearly free from mottling and are commonly of intermediate texture.
Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and mottling in the lower B and the C horizons.
Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.
Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.
Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.
Drainage sequence. A group of soils, within a specific soil zone that formed from similar parent material but that have dissimilar soil characteristics because of differences in drainage.
Drumlin. An elongated, oval hill or ridge that is composed of glacial drift, normally compact and unstratified, generally with its longer axis conforming to the direction of the movement of the ice responsible for its deposition.
Eluviation. The movement of material from one place to another within the soil, in either true solution or collodial suspension. Soil horizons that have lost material through eluviation are said to be eluvial; those that have received material are illuvial.
Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.
Esker (geology). A narrow, winding ridge or mound of stratified gravelly and sandy drift that was deposited by a subglacial stream.
Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.
Fibric soil. Organic soil material that is least decomposed. Such material contains large amounts of fiber that is well preserved and readily identifiable in botanical origin.
Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.
Fragipan. A loamy, brittle, subsurface horizon that is very low in organic-matter content and clay but is rich in silt or very fine sand. The layer is seemingly cemented. When dry, it is hard or

very hard and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.

Geologic erosion. The natural process by which land surfaces are worn down by water, ice, or frost, and wind.

Glacial drift (geology). Rock material transported by glacial ice and then deposited; also includes the assorted and unassorted materials deposited by streams flowing from glaciers.

Glacial outwash. Gravelly and sandy glaciofluvial deposits.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice; the deposits are stratified and occur in the form of kames, eskers, deltas, and outwash plains.

Graded stripcropping. Growing of crops in strips that are graded toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, and covered by grass for protection against erosion; used to conduct surface water away from cropland.

Green manure (agronomy). A crop grown for the purpose of being turned under in an early stage of maturity or soon after maturity for soil improvement.

Hemic soil. Organic soil material decomposed enough that its botanic origin cannot readily be determined.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

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 some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Illuviation. The accumulation of material in a soil horizon through the deposition of suspended material and organic matter removed from horizons above. Since part of the fine clay in the B horizon (or subsoil) of many soils has moved into the B horizon from the A horizon above, the B horizon is called an illuvial horizon.

Internal soil drainage. The downward movement of water through the soil profile. The rate of movement is determined by the texture, structure, and other characteristics of the soil profile and underlying layers, and by height of the water table, either permanent or perched. Relative terms for expressing internal drainage are *none, very slow, slow, medium, rapid,* and *very rapid.*

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed by lowering of the water level or elevation of the land.

Lamellae. Thin colored or textural bands that are in sands and loamy sands. The bands or lamellae are spaced at intervals varying from a few inches up to a foot or more.

Leached layer. A layer from which the soluble materials have been dissolved and washed away by percolating water.

Leached soil. A soil from which most of the soluble materials have been removed from the entire profile or have been removed from one part of the profile and have accumulated in another part.

Mapping unit. Areas of soil of the same kind outlined on the soil map and identified by a symbol.

Marl. An earthy, unconsolidated deposit formed in fresh-water lakes that consists chiefly of calcium carbonate mixed with various amounts of clay or other impurities.

Mechanical analysis (soils). The percentage of the various sizes of individual mineral particles, or separates, in the soil. Also, a laboratory method of determining soil texture.

Medium-textured soil. Soil of very fine sandy loam, loam, silt loam, or silt texture.

Miscellaneous land type. A mapping unit for areas of land that have little or no natural soil; or that are too nearly inaccessible for orderly examination; or that occur where, for other reasons, it is not feasible to classify the soil.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and their thickness and arrangement in the soil profile.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of 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 these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Organic matter. The products of the decomposition of plant and animal materials in soil. Included are humus, muck, peat, and similar products that are important in soil formation and usage.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Phase, soil. A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil series, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Profile, soil. A vertical section of the soil through all its horizons and extending 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 precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	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

Residual material. Unconsolidated, partly weathered mineral material that accumulates over disintegrating solid rock. Residual material is not soil but is frequently the material in which a soil has formed.

Runoff. The removal of water by flow over the surface of the soil.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or

more sand and not more than 10 percent clay.

Sapric soil. Organic soil material that is most highly decomposed. This material has the least observable content of plant fiber.

Secondary lime. Deposits of lime that result from the decomposition of a primary source of lime and subsequent reprecipitation.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Skeletans. Light-colored, grainy, loosely aggregated material appearing as coats on the surface of soil structures as a result of the stripping away of other materials by eluviation.

Slurry. The semifluid mixture of pulverized limestone or other minerals and water deposited as waste material.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that 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.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes 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 characteristic of the soil are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands to serve as vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. 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 together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tillage of a soil below normal depth ordinarily to shatter a hardpan or claypan.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Tufa. A cellular rocklike deposit of calcium carbonate found at springs or along streams.

Upland (geology). Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

Variant, soil. A soil having properties sufficiently different from those of other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

Varves. Distinctly marked annual deposits of sediment, regardless of origin.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks at or near the earth's surface by atmospheric agents. These changes result in more or less complete disintegration and decomposition of the rock.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to a capability unit or a woodland group, read the introduction to the section it is in for general information about its management. Absence of entry indicates that the soil was not placed in that particular grouping. Other information is given in tables as follows:

Acreage and extent, table 1, page 29.
Estimated yields, tables 2 and 3, pages 128 through 135.
Woodland, table 4, page 138.
Wildlife, table 5, page 144.
Engineering, tables 6, 7, and 8, pages 154 through 199.
Town and country planning, table 9, page 202.

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group
			Symbol	Page	Symbol
AlA	Alton gravelly fine sandy loam, 0 to 3 percent slopes	31	IIs-1	117	3o1
AlB	Alton gravelly fine sandy loam, 3 to 8 percent slopes	31	IIs-1	117	3o1
AlC	Alton gravelly fine sandy loam, rolling	31	IVe-10	124	3o1
AnB	Angola-Darien silt loams, 0 to 6 percent slopes	32	IIIw-2	120	3w1
AnC	Angola-Darien silt loams, 6 to 12 percent slopes	32	IIIe-7	119	3w1
AoA	Appleton loam, 0 to 3 percent slopes	33	IIIw-3	120	3w1
ApA	Appleton channery silt loam, 0 to 3 percent slopes	33	IIIw-3	120	3w1
ApB	Appleton channery silt loam, 3 to 8 percent slopes	33	IIIw-3	120	3w1
ArB	Arkport very fine sandy loam, 2 to 6 percent slopes	34	IIe-3	114	2o1
ArC	Arkport very fine sandy loam, rolling	35	IIIe-4	118	2o1
ArD	Arkport very fine sandy loam, hilly	35	IVe-10	124	2o1
ATB	Arnot channery silt loam, gently sloping	36	IVe-5	123	4d1
AVF	Arnot-Lordstown association, very steep	36	VIIs-1	127	---
	Arnot part	--	-------	---	4x1
	Lordstown part	--	-------	---	3r4
AwB	Aurora silt loam, 0 to 6 percent slopes	37	IIe-7	115	2o1
AwC	Aurora silt loam, 6 to 12 percent slopes	37	IIIe-6	119	2o1
AwD	Aurora silt loam, 12 to 18 percent slopes	37	IVe-2	122	2r2
AwD2	Aurora silt loam, 12 to 18 percent slopes, eroded	37	IVe-2	122	2r2
AXE	Aurora-Farmington-Rock outcrop association, steep	38	-------	---	---
	Aurora part	--	VIIs-1	127	2r5
	Farmington part	--	VIIs-1	127	5x1
	Rock outcrop	--	-------	---	---
BeB	Benson silt loam, undulating	38	IIIs-3	122	5d1
BeC	Benson silt loam, rolling	39	IVe-4	123	5d1
BNC	Benson-Wassaic-Rock outcrop association, sloping	39	-------	---	---
	Benson part	--	VIs-1	126	5d1
	Wassaic part	--	VIs-1	126	2r2
	Rock outcrop	--	-------	---	---
BNF	Benson-Wassaic-Rock outcrop association, very steep	39	-------	---	---
	Benson part	--	VIIs-1	127	5x1
	Wassaic part	--	VIIs-1	127	2r5
	Rock outcrop	--	-------	---	---
BoB	Bombay gravelly loam, 2 to 8 percent slopes	40	IIe-6	115	2o1
CaB	Camillus silt loam, 2 to 6 percent slopes	42	IIe-1	113	2o1
CaC	Camillus silt loam, 6 to 12 percent slopes	42	IIIe-1	118	2r1
CaC2	Camillus silt loam, 6 to 12 percent slopes, eroded	42	IVe-1	122	2r1
CaD2	Camillus silt loam, 12 to 18 percent slopes, eroded	42	IVe-1	122	2r3
CBE	Camillus and Lairdsville shaly soils, steep	42	VIe-1	126	3r3
Cd	Canandaigua mucky silt loam	43	IVw-3	125	4w1
Ce	Carlisle muck	44	IIIw-1	120	5w1
CfB	Cazenovia silt loam, 2 to 8 percent slopes	45	IIe-7	115	2o1
CfC	Cazenovia silt loam, 8 to 15 percent slopes	45	IIIe-6	119	2o1
CfC2	Cazenovia silt loam, 8 to 15 percent slopes, eroded	45	IVe-1	122	2o1
CgD	Cazenovia soils, 15 to 25 percent slopes	45	IVe-1	122	2r2
ChA	Collamer silt loam, 0 to 2 percent slopes	46	IIw-1	116	2o1
ChB	Collamer silt loam, 2 to 6 percent slopes	46	IIe-5	115	2o1

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group
			Symbol	Page	Symbol
ClB	Colonie loamy fine sand, 0 to 6 percent slopes	47	IIIs-1	121	4s1
ClC	Colonie loamy fine sand, rolling	48	IVs-1	126	4s1
CoA	Conesus gravelly silt loam, 0 to 3 percent slopes	48	IIw-3	117	2o1
CoB	Conesus gravelly silt loam, 3 to 8 percent slopes	49	IIe-6	115	2o1
CrB	Croghan loamy fine sand, 0 to 6 percent slopes	49	IIIs-2	121	4s1
Da	Darien silt loam	50	IIIw-2	120	3w1
DuC	Dunkirk silt loam, rolling	51	IVe-9	124	2r1
Ed	Edwards muck	52	IVw-5	125	5w1
FAC	Farmington-Aurora association, sloping	52	-------	---	---
	Farmington part	--	IVe-4	123	5d1
	Aurora part	--	IIIe-6	119	2o1
FL	Fluvaquents, frequently flooded	53	Vw-2	126	---
Fo	Fonda mucky silty clay loam	54	IVw-2	125	5w1
Fr	Fredon loam	55	IIIw-3	120	3w1
GaA	Galen very fine sandy loam, 0 to 2 percent slopes	55	IIw-1	116	2o1
GaB	Galen very fine sandy loam, 2 to 6 percent slopes	56	IIe-5	115	2o1
Ha	Halsey mucky loam	56	IVw-3	125	5w1
Hb	Hamlin silt loam	57	IIw-2	116	2o2
Hc	Hamlin silt loam, high bottom	57	I-1	113	2o2
He	Herkimer silt loam	58	IIe-2	114	2o1
HlA	Hilton loam, 0 to 3 percent slopes	59	IIw-3	117	2o1
HlB	Hilton loam, 3 to 8 percent slopes	59	IIe-6	115	2o1
HnB	Honeoye silt loam, 2 to 8 percent slopes	60	IIe-1	113	2o1
HnC	Honeoye silt loam, 8 to 15 percent slopes	60	IIIe-2	118	2o1
HnCK	Honeoye silt loam, rolling	60	IVe-1	122	2o1
HoD	Honeoye and Lansing gravelly silt loams, 15 to 25 percent slopes	61	IVe-1	122	2r2
HSC	Honeoye very stony soils, sloping	61	VIs-1	126	2o1
HTE	Honeoye, Lansing and Ontario soils, steep	61	VIe-1	126	2r5
HTF	Honeoye, Lansing and Ontario soils, very steep	61	VIIe-1	127	2r5
HwA	Howard gravelly fine sandy loam, 0 to 3 percent slopes	62	IIs-1	117	2o1
HwB	Howard gravelly fine sandy loam, 3 to 8 percent slopes	62	IIs-1	117	2o1
HwC	Howard gravelly fine sandy loam, rolling	63	IVe-10	124	2o1
HxA	Howard gravelly loam, 0 to 3 percent slopes	63	IIs-1	117	2o1
HxB	Howard gravelly loam, 3 to 8 percent slopes	63	IIs-1	117	2o1
HxC	Howard gravelly loam, rolling	63	IVe-10	124	2o1
HyA	Howard gravelly silt loam, 0 to 3 percent slopes	63	IIs-1	117	2o1
HyB	Howard gravelly silt loam, 3 to 8 percent slopes	63	IIs-1	117	2o1
KeA	Kendaia silt loam, 0 to 3 percent slopes	64	IIIw-3	120	3w1
KeB	Kendaia silt loam, 3 to 8 percent slopes	65	IIIw-3	120	3w1
LaB	Lairdsville silt loam, 2 to 6 percent slopes	66	IIe-8	116	2o1
LbC2	Lairdsville silty clay loam, 6 to 12 percent slopes, eroded	66	IVe-8	124	2r1
Lk	Lakemont silty clay loam	67	IVw-2	125	5w1
Lm	Lamson very fine sandy loam	68	IVw-3	125	4w1
LsB	Lansing gravelly silt loam, 2 to 8 percent slopes	69	IIe-1	113	2o1
LsC	Lansing gravelly silt loam, 8 to 15 percent slopes	69	IIIe-2	118	2o1
LsCK	Lansing gravelly silt loam, rolling	69	IVe-1	122	2o1
LtA	Lima silt loam, 0 to 3 percent slopes	70	IIw-3	117	2o1
LtB	Lima silt loam, 3 to 8 percent slopes	70	IIe-6	115	2o1
LvB	Lockport and Brockport silty clay loams, 0 to 6 percent slopes	71	IIIw-4	121	3w1
LWC	Lordstown channery silt loam, sloping	72	IIIe-3	118	3o1
LXD	Lordstown-Arnot channery silt loams, moderately steep	72	IVe-3	122	---
	Lordstown part	--	-------	---	3r2
	Arnot part	--	-------	---	4d1
Ly	Lyons silt loam	73	IVw-3	125	4w1
Ma	Made land, chemical waste	73	-------	---	---
MdB	Madrid fine sandy loam, 2 to 8 percent slopes	74	IIe-1	113	2o1
MdC	Madrid fine sandy loam, 8 to 15 percent slopes	75	IIIe-2	118	2o1
MdC2	Madrid fine sandy loam, 8 to 15 percent slopes, eroded	75	IVe-1	122	2o1
MdCK	Madrid fine sandy loam, rolling	75	IVe-1	122	2o1

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group
			Symbol	Page	Symbol
MgB	Madrid gravelly loam, 2 to 8 percent slopes	75	IIe-1	113	2o1
MgC	Madrid gravelly loam, 8 to 15 percent slopes	75	IIIe-2	118	2o1
MhA	Manheim silt loam, 0 to 3 percent slopes	76	IIIw-2	120	3w1
MhB	Manheim silt loam, 3 to 8 percent slopes	76	IIIw-2	120	3w1
MnB	Manlius shaly silt loam, 2 to 6 percent slopes	77	IIIe-3	118	3o1
MnC	Manlius shaly silt loam, 6 to 12 percent slopes	78	IIIe-3	118	3o1
MnD	Manlius shaly silt loam, 12 to 18 percent slopes	78	IVe-3	122	3r2
MoB	Mardin channery silt loam, 2 to 8 percent slopes	79	IIe-4	115	3o1
MoC	Mardin channery silt loam, 8 to 15 percent slopes	79	IIIe-5	119	3o1
MoD	Mardin channery silt loam, 15 to 25 percent slopes	79	IVe-6	123	3r2
MPE	Mardin soils, steep	79	VIe-1	126	3r4
MrB	Mardin channery silt loam, moderately shallow variant, 2 to 6 percent slopes	80	IIe-4	115	3o1
MrC	Mardin channery silt loam, moderately shallow variant, 6 to 18 percent slopes	80	IIIe-5	119	3o1
Ms	Martisco and Warners soils	81	Vw-1	126	5w1
MtA	Minoa fine sandy loam, 0 to 2 percent slopes	82	IIIw-3	120	3w1
MtB	Minoa fine sandy loam, 2 to 6 percent slopes	82	IIIw-3	120	3w1
MwB	Mohawk silt loam, 2 to 8 percent slopes	84	IIe-1	113	2o1
MwC	Mohawk silt loam, 8 to 15 percent slopes	84	IIIe-2	118	2o1
MwD	Mohawk silt loam, 15 to 25 percent slopes	84	IVe-1	122	2r2
Na	Naumburg loamy fine sand	85	IVw-1	124	4w1
NgA	Niagara silt loam, 0 to 4 percent slopes	86	IIIw-3	120	3w1
OdA	Odessa silty clay loam, 0 to 2 percent slopes	87	IIIw-4	121	3w1
OdB	Odessa silty clay loam, 2 to 6 percent slopes	87	IIIw-4	121	3w1
OgB	Ontario loam, 2 to 8 percent slopes	88	IIe-1	113	2o1
OnC	Ontario gravelly loam, 8 to 15 percent slopes	88	IIIe-2	118	2o1
OnC2	Ontario gravelly loam, 8 to 15 percent slopes, eroded	89	IVe-1	122	2o1
OnCK	Ontario gravelly loam, rolling	89	IVe-1	122	2o1
OpD	Ontario and Madrid soils, 15 to 25 percent slopes	89	IVe-1	122	2r2
OtB	Otisville gravelly loamy fine sand, 0 to 8 percent slopes	90	IIIs-1	121	4s1
OtC	Otisville gravelly loamy fine sand, rolling	90	IVs-1	126	4s1
OvA	Ovid silt loam, 0 to 3 percent slopes	91	IIIw-2	120	3w1
OvB	Ovid silt loam, 3 to 8 percent slopes	91	IIIw-2	120	3w1
PaB	Palatine shaly silt loam, 2 to 6 percent slopes	92	IIe-1	113	2o1
PaC	Palatine shaly silt loam, 6 to 12 percent slopes	92	IIIe-1	118	2o1
Pb	Palms muck	93	IVw-5	125	5w1
PgA	Palmyra gravelly loam, 0 to 3 percent slopes	94	I-1	113	2o1
PgB	Palmyra gravelly loam, 3 to 8 percent slopes	94	IIe-2	114	2o1
PgC	Palmyra gravelly loam, rolling	95	IVe-10	124	2o1
PHD	Palmyra and Howard soils, hilly	95	IVe-10	124	2r4
PHE	Palmyra and Howard soils, steep	95	VIe-1	126	2r5
PHF	Palmyra and Howard soils, very steep	95	VIIe-1	127	2r5
PpA	Phelps gravelly loam, 0 to 3 percent slopes	96	IIw-3	117	2o1
PpB	Phelps gravelly loam, 3 to 8 percent slopes	97	IIe-6	115	2o1
Rh	Rhinebeck silt loam	98	IIIw-4	121	3w1
SA	Saprists and Fluvaquents, ponded	98	VIIIw-1	127	---
ScB	Schoharie silt loam, 2 to 6 percent slopes	99	IIe-8	116	2o1
ScC	Schoharie silt loam, rolling	99	IVe-8	124	2r1
SdD	Schoharie silty clay loam, hilly	99	IVe-8	124	2r1
SEE	Schoharie soils, steep	99	VIe-1	126	2r3
Te	Teel silt loam	100	IIw-2	116	2o2
Ub	Urban land	100	-------	---	---
Va	Varick silt loam	101	IVw-4	125	4w1
VoB	Volusia channery silt loam, 0 to 8 percent slopes	102	IIIw-5	121	3w2
VoC	Volusia channery silt loam, 8 to 15 percent slopes	102	IIIe-8	120	3w2
VuB	Volusia channery silt loam, moderately shallow variant, 0 to 6 percent slopes	103	IIIw-5	121	3w2
WaA	Wampsville gravelly silt loam, 0 to 3 percent slopes	104	I-1	113	2o1

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group
			Symbol	Page	Symbol
WaB	Wampsville gravelly silt loam, 3 to 8 percent slopes	104	IIe-2	114	2o1
WaC	Wampsville gravelly silt loam, rolling	104	IVe-10	124	2o1
Wb	Wareham loamy fine sand	105	IVw-1	124	4w1
WcB	Wassaic silt loam, 0 to 8 percent slopes	107	IIe-1	113	2o1
WcC	Wassaic silt loam, 8 to 15 percent slopes	107	IIIe-1	118	2o1
WDD	Wassaic-Benson silt loams, moderately steep	108	IVe-4	123	---
	Wassaic part	---	-------	---	2r2
	Benson part	---	-------	---	5d1
Wn	Wayland silt loam	108	Vw-1	126	4w1
Wv	Weaver silt loam	109	IIw-2	116	2o2
WwA	Williamson silt loam, 0 to 2 percent slopes	110	IIw-1	116	3o1
WwB	Williamson silt loam, 2 to 6 percent slopes	110	IIe-5	115	3o1
WwC	Williamson silt loam, rolling	111	IVe-7	123	3r1
WwC2	Williamson silt loam, rolling, eroded	111	IVe-7	123	3r1

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