SOIL SURVEY OF

Washington County, New York

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

Major fieldwork for this soil survey was done in the period 1959-71. Soil names and descriptions were approved in 1972. 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 Washington County Soil and Water Conservation District. Funds to accelerate the survey were provided by the Washington County Board of Supervisors.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

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 Washington 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 alphabetical 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 capability unit to which the soil has been assigned.

Individual colored maps that show 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 that have a moderate limitation can be colored yellow, and those that have 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 descriptions of the capability units and the woodland groups.

Foresters and others can refer to the section "Use of the Soils as 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 properies, 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 and Classification of the Soils."

Newcomers in Washington 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 "Environmental Factors Affecting Soil Use."

Cover: Cropland, woodland, and recreational areas around Lake Lauderdale. The Hoosic-Otisville association, gently sloping and sloping, surrounds the lake. The Nassau-Bernardston association, undulating through hilly, extends to the mountains in the background.

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SOIL SURVEY OF WASHINGTON COUNTY, NEW YORK

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SOILS SURVEYED BY BURTON R. LAUX, CHARLES H. MAINE, KARL S. OLSSON, JOHN A. PHILLIPS, RICHARD J. SCANU AND HARVEL E. WINKLEY, SOIL CONSERVATION SERVICE [1]

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE CORNELL UNIVERSITY AGRICULTURAL EXPERIMENT STATION

WASHINGTON COUNTY, in the northeastern part of New York (fig. 1), has a land area of 535,680 acres. It is bounded on the north by Essex County, on the east by Lake Champlain and Vermont, on the south by Rensselaer County, and on the west by the Hudson River, Warren County, and Lake George. Washington County soils formed in three physiographic regions; namely, the Adirondack Mountain area in the northwestern part, the Taconic Upland region in the eastern half, and the Hudson-Champlain Lowland, which is a broad depression that separates the two highland regions.

Washington County is a rural farming area. The 1969 Census of Agriculture shows 1,038 farms in the county, of which 766 are commercial farms. Dairying is the main type of farming. Hay and corn for silage to feed dairy cattle are the main crops. A few farmers raise potatoes, apples, and vegetables, and a few raise poultry. Maple syrup is produced in the hilly and mountainous sections. The 1969 Census of Agriculture shows that 50 percent of the land area in Washington County is in farms. In 1970, the population was 52,700.

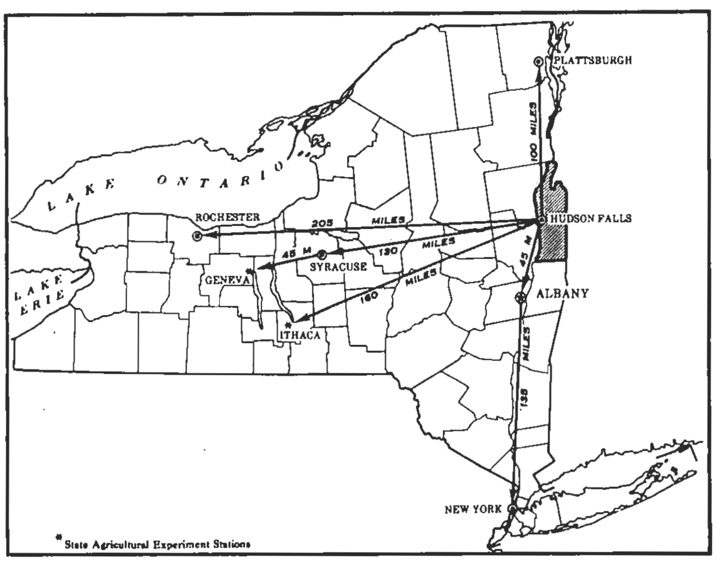

Figure 1.—**Location of Washington County in New York.**

Washington County is a scenic, picturesque area unspoiled by the pressures of urban expansion and sprawl. Small country villages interspersed among dairy farms and woodlands create an attractive landscape. Rolling hills, rushing streams, and many lakes add beauty to the landscape.

The potential is good for increased use of soils for recreational purposes. The soil survey shows 6,900 acres of Carlisle muck. This soil has high potential for specialty vegetable crops if it is cleared of trees and drained. At present it is mostly wooded and undrained.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Washington 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 (*13, 14*).[2] 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

[1] Others participating in the field survey were DONALD F. FLORA, BILLY D. SEAY, and RALPH WORK, Soil Conservation Service.

[2] Italic numbers in parentheses refer to Literature Cited, p. 145.

where a soil of that series was first observed and mapped. Hoosic and Kingsbury, for example, are the names of two soil series. All the soils in the United States that have the same series name are essentially alike in other 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, Bernardston gravelly silt loam, 8 to 15 percent slopes, is one of several phases within the Bernardston series.

After a guide for classifying and naming the soils had been worked out, the soil scientiest 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 Washington 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. Bernardston-Nassau shaly silt loams, 8 to 15 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. Hollis-Charlton association, moderately steep and steep, 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. If two or more dominant series are represented in the group, the name of the group ordinarily consists of the names of the dominant soils joined by "and." Hudson and Vergennes soils, steep and very steep, is an example.

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, such as Fluvaquents and Rock outcrop.

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 medium 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 failure to slow permeability or a high water table. They see that streets, road pavements, and foundations for houses crack on a given kind of soil, and they relate this failure to a high shrink-swell potential. Thus, they use observation and knowledge of soil properties, together with available research data, to predict the limitations or suitability of a soil 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 study 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, in color, the soil associations in Washington County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally 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 may occur in another, but in a different pattern.

A map that shows soil associations 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 land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area or in planning engineering works, 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 characteristics that affect their management.

The soil associations in this survey have been grouped into seven general kinds of landscapes for broad interpretative purposes. Each of the broad groups and their included soil associations are described on the following pages. The terms for texture used in the title for several of the associations apply to the texture of the surface layer.

The two pages of the general soil map and a summary of limitations of the soils of Washington County are in an envelope at the back of this publication.

Deep Soils Formed in Glaciolacustrine Sediments on Lake Plains and in Valleys

The associations in this group are on lake or estuarine plains, mainly in Champlain and Hudson Valleys and to a lesser extent in Owl Kill Valley and in valleys of the Hoosic, Mettawee, and Indian Rivers. The six associations in this group make up about 15.8 percent of the county. The soils are deep. They formed mainly in deposits of glacial-lake or estuarine clay, silt, sand, and very fine sand. They are mainly nearly level through sloping, but range to steep and very steep. They range from well drained to somewhat poorly drained. Most areas have been cleared and are dairy farms.

1. Claverack-Cosad association, nearly level and gently sloping

Deep, moderately well drained and somewhat poorly drained, coarse textured and moderately coarse textured soils over silt and clay on lake plains, estuaries, or deltas

This association fringes deltas of the lake or estuarine plains, mainly in the Champlain and Hudson Valleys. Slopes range from 0 to 6 percent. Elevations are about 200 to 400 feet above sea level.

This association makes up about 0.3 percent of the county. It is about 50 percent Claverack soils, 30 percent Cosad soils, and 20 percent less extensive soils.

Claverack soils are deep, moderately well drained, coarse-textured soils that formed in 20 to 40 inches of sandy material over lacustrine or estuarine silt and clay. They are nearly level and gently sloping. Runoff is somewhat slow, and in places some runoff water accumulates. Seasonally the water table fluctuates between depths of 18 and 24 inches. It is perched on the very slowly permeable clay substratum.

The deep, somewhat poorly drained Cosad soils are similar to Claverack soils, but the sandy material is 20 to 34 inches deep over clay. Cosad soils are on broad flats above Claverack soils where runoff is slow or in depressions below Claverack soils where runoff water accumulates. The seasonal water table fluctuates between depths of 6 and 18 inches and is high for longer periods than in Claverack soils.

Less extensive in this association are the somewhat poorly drained to excessively drained Vergennes, Kingsbury, and Oakville soils. Vergennes and Kingsbury soils formed in the same kind of clayey sediments as Claverack and Cosad soils. In most places they are on lower parts of the landscape. The deep sandy Oakville soils are in higher positions, above Claverack and Cosad soils.

Most of this association is cleared and used for dairy farming. Seasonal wetness and the slow or very slow permeability of the clayey substratum adversely affect both farm and nonfarm uses of the major soils of this association.

2. Hartland-Belgrade association, nearly level through sloping

Deep, well drained and moderately well drained, medium-textured soils formed in silt and very fine sand on lake plains and terraces

This association occupies high, level lake plains and old galcial stream terraces, mainly in valleys of the Hudson, Hoosic, Mettawee, and Indian Rivers and also in Owl Kill Valley. Slopes mainly range from 0 to 12 percent, but some dissections and terrace breaks are steeper. Elevations are about 300 to 400 feet above sea level.

This association makes up about 0.3 percent of the county. It is about 45 percent Hartland soils, 40 percent Belgrade soils, and 15 percent less extensive soils.

Hartland soils are deep, well-drained, medium-textured soils that formed in lacustrine and old glacial stream terrace deposits that are rich in silt and very fine sand. They are mainly nearly level, but range from nearly level through sloping. They are adjacent to, but typically above, Belgrade soils.

The deep, moderately well drained, medium-textured Belgrade soils are similar soils that formed in the same kind of material as Hartland soils, but have a seasonal high water table that fluctuates between depths of 18 and 24 inches. They are mainly gently sloping and occupy landscapes where some runoff accumulates.

Less extensive in this association are the Wallington and Hamlin soils. Wallington soils are somewhat poorly drained and are associated with both Hartland and Belgrade soils. They generally are in depressions. The well-drained Hamlin soils are on flood plains along streams.

Some of the better soils for farming in the county are in this association. Most of the acreage is farmed. The hazard of erosion is the major limitation. The major soils of this association are highly erodible even where they are gently sloping.

3. Hudson-Rhinebeck association, nearly level through sloping

Deep, dominantly moderately well drained and somewhat poorly drained, medium-textured soils formed in calcareous silt and clay on lake plains

This association occupies nearly level, undulating and rolling lake plains, mainly in the Hudson Valley south of the Batten Kill. Slopes range from 0 to 12 percent. Elevations are generally less than 300 feet above sea level.

This association makes up about 1 percent of the county. It is about 45 percent Hudson soils, 40 percent Rhinebeck soils, and 15 percent less extensive soils.

Hudson soils are deep, dominantly moderately well drained, medium-textured soils that formed in deposits of lake-laid silt and clay. They are mainly gently sloping and sloping. They have a seasonal high water table that is perched on the slowly or very slowly permeable clayey subsoil and substratum and fluctuates between depths of 18 and 24 inches. These soils are on convex landscapes, typically above Rhinebeck soils, where runoff is somewhat slow and some runoff water accumulates.

The somewhat poorly drained Rhinebeck soils formed in material similar to that of Hudson soils. They differ from those soils mainly in that the seasonal high water table fluctuates between depths of 6 and 18 inches. These soils are dominantly nearly level, but in places are gently sloping. They are above Hudson soils where runoff is slow or in depressions and on foot slopes below Hudson soils where runoff accumulates.

Less extensive in this association are the Madalin, Bernardston, and Nassau soils. Madalin soils are poorly drained and very poorly drained and occupy wet depressions. The deep, well drained and moderately well drained Bernardston soils are on till islands on the lake plain. The shallow, somewhat excessively drained Nassau soils occur where folds of slaty bedrock protrude above the lake plain.

Most of this association is cleared and used for dairy farming. Seasonal wetness and slow or very slow permeability are the main limitations that affect both farm and nonfarm uses of the major soils of this association. Consequently, most farm buildings in the association are on the better drained, less extensive soils that formed on the islands of till that project above the lake plain (fig. 2). The sloping soils of this association are highly erodible.

4. *Hudson and Vergennes soils, steep and very steep*

Deep, dominantly moderately well drained, medium textured and moderately fine textured soils formed in calcareous silt and clay on lake or estuarine plains

This association is on the steeper walls of deep dissections and terrace fronts of the lake or estuarine plains in Hudson and Champlain Valleys. Slopes range from 20 to 40 percent. Steplike scars of mass slippage are a common feature of the landscape. Elevations are generally less than 300 feet above sea level.

This association makes up about 3 percent of the

Figure 2.—**Hudson-Rhinebeck association, nearly level through sloping. Farm buildings occupy an area of better drained soils on an island of till above the surrounding lake plain.**

county. It is about 90 percent Hudson and Vergennes soils and 10 percent less extensive soils.

Hudson soils are deep, dominantly moderately well drained soils. They have a medium-textured surface layer that is underlain by a finer textured subsoil. They formed in deposits of lake-laid silt and clay in Hudson Valley, mainly south of the Batten Kill. They are steep and very steep. They have a seasonal high water table that is perched on the slowly or very slowly permeable subsoil and substratum and fluctuates between depths of 18 and 24 inches.

Vergennes soils are deep, moderately well drained, moderately fine textured soils that formed in calcareous lake and estuarine clays. They are steep and very steep. They have a seasonal high water table that is perched on the very slowly permeable clayey subsoil and substratum and fluctuates between depths of 18 and 24 inches. These soils are mainly in Champlain Valley, but are also on the same steep landscapes on the lake or estuarine plain as Hudson soils.

Less extensive in this association are the well-drained to excessively drained Oakville and Hartland soils and small areas of the land type Fluvaquents, which is dominantly poorly drained and is mainly along the drainageways of the dissections.

Areas that have been cleared are used to some extent for native pasture, and others are idle. Many areas are in forest. The steep slopes and the hazard of erosion are the main limitations. Mass slippage is a hazard, especially where slopes are more than 24 percent, and roads that traverse or are adjacent to these areas are difficult to maintain.

5. *Vergennes-Kingsbury association, nearly level through sloping*

Deep, moderately well drained and somewhat poorly drained, moderately fine textured and fine textured soils formed in calcareous lake or estuarine deposits high in content of clay

This association occupies broad, mainly nearly level through sloping lake or estuarine plains in the Champlain Valley in the central and northern parts of the county. Slopes range from 0 through 12 percent. Elevations are generally less than 300 feet above sea level.

This association makes up about 11 percent of the county. It is about 45 percent Vergennes soils, 30 percent Kingsbury soils, and 25 percent less extensive soils.

Vergennes soils are deep, moderately well drained, moderately fine textured soils that have a coarse-textured subsoil. They formed in calcareous lake or estuarine clay. They are mainly gently sloping and sloping. They have a seasonal high water table that is perched on the very slowly permeable subsoil and substratum and fluctuates between depths of 18 and 24 inches. These soils are on convex slopes where runoff is somewhat slow and some runoff water accumulates.

Closely associated with Vergennes soils are the deep, somewhat poorly drained, fine-textured Kingsbury soils that formed in the same kind of calcareous estuarine or lake-laid clay as those soils. They are nearly level and gently sloping. They have a seasonal high water table that is perched on the very slowly permeable subsoil and substratum and fluctuates between depths of 6 and 18 inches. These soils commonly are in depressions or on foot slopes below Vergennes soils where runoff water accumulates or are in broad areas above Vergennes soils where runoff is slow.

Less extensive in this association are Covington, Farmington, Pittsfield, Hollis, and Charlton soils. Covington soils are poorly drained and are associated with both Vergennes and Kingsbury soils. They are in depressions in the lake or estuarine plain. The shallow Farmington and Hollis soils and the deep Pittsfield and Charlton soils formed in till and are on slight rises or islands above the lake plain. These soils are well drained to somewhat excessively drained.

Most of this association is cleared and used for dairy farming (fig. 3). The hazard of erosion, seasonal wetness, the moderately fine textured or fine textured surface layer, and very slow permeability are limitations that affect farm and many nonfarm uses of the major soils of this association.

6. *Wallington-Belgrade association, nearly level and gently sloping*

Deep, somewhat poorly drained and moderately well drained, medium-textured soils formed in lake plain or terrace deposits high in silt and very fine sand

This association occupies nearly level and gently sloping, high lake plains and stream terraces, mainly in valleys in the southern part of the county. Slopes range from 0 to 6 percent. Elevations are about 300 to 400 feet above sea level.

This association makes up about 0.2 percent of the county. It is about 45 percent Wallington soils, 45 percent Belgrade soils, and 10 percent less extensive soils.

Wallington soils are deep, somewhat poorly drained, medium-textured soils that formed in lacustrine or stream terrace deposits that are high in content of silt and very fine sand. They have a fragipan that impedes drainage and restricts roots at a depth of 13 to 24 inches. Below a depth of about 66 inches, the substratum is stratified sand and gravel. These soils are nearly level and are commonly below Belgrade soils where runoff water accumulates or above Belgrade soils were runoff is slow. They have a seasonal high water table that is perched on the slowly permeable fragipan and fluctuates between depths of 6 and 18 inches.

The deep, moderately well drained, medium-textured Belgrade soils formed in lacustrine and stream terrace material similar to that of Wallington soils on landscapes where runoff is somewhat slow and some runoff water accumulates. Belgrade soils have a seasonal high water table at a depth of 18 to 24 inches.

Less extensive in this association are the well-drained to somewhat poorly drained Hartland, Hudson, and Rhinebeck soils. Hartland soils formed in material similar to that of Wallington and Belgrade soils and are commonly on higher, steeper landscapes. Hudson and Rhinebeck soils formed in clayey sediments and are commonly on lower landscapes.

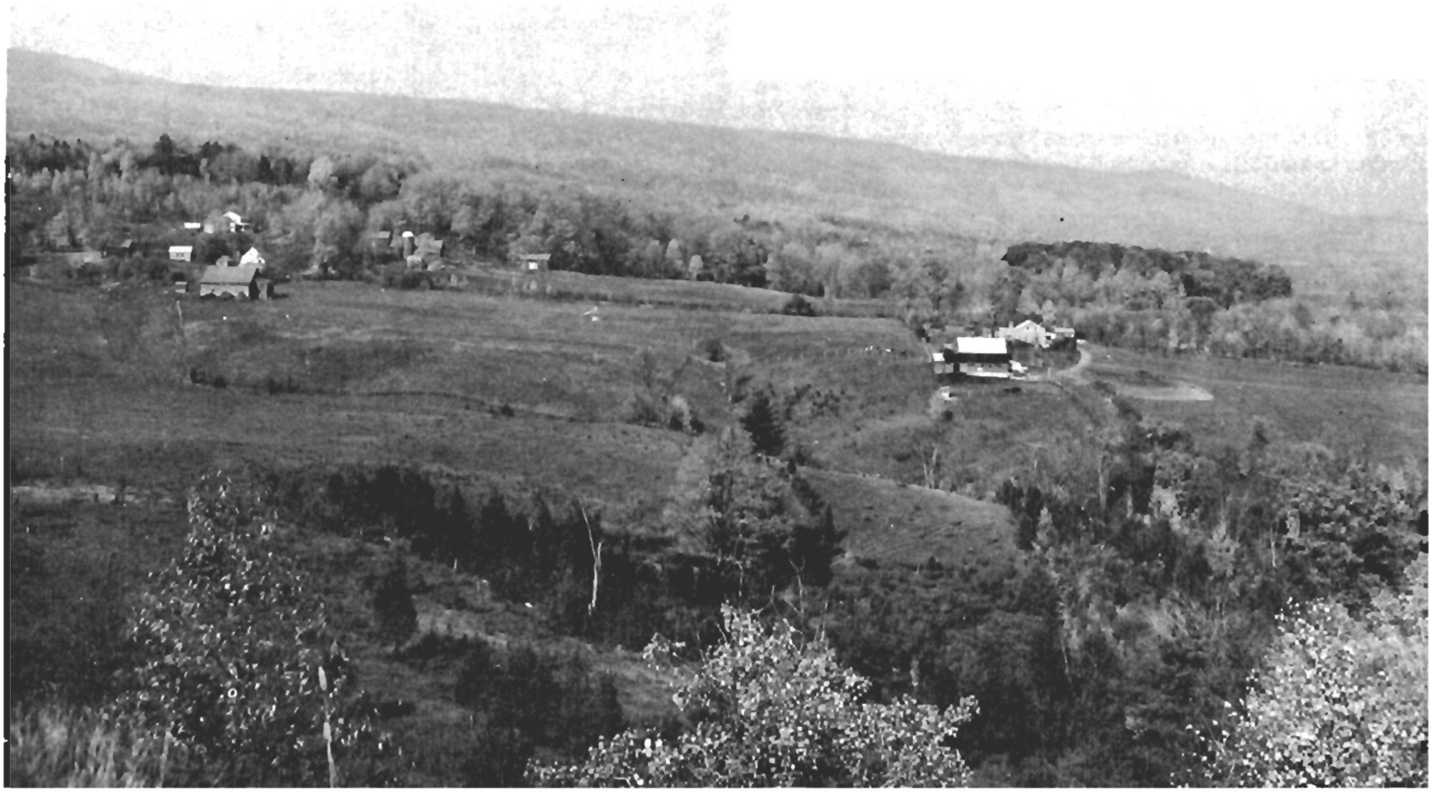

Figure 3.—Farms on Vergennes-Kingsbury association, nearly level through sloping. Forested Adirondacks in background.

Most of this association is cleared and used for dairy farming. Seasonal wetness is the main limitation that affects farm and most nonfarm uses.

Dominantly Shallow Soils Formed in Glacial Till over Bedrock on Uplands

The associations in this group are mainly on uplands in the Adirondack Mountains in the northwestern part of the county and on the hilly slate belt that makes up more than the eastern half of the county. A few areas protrude above the lake plain in Champlain Valley. The eight associations in this group make up about 47.4 percent of the county. The soils are dominantly shallow. Those in the Adirondacks formed in sandy loam or loam till derived mainly from gneiss, and those in the other areas formed in silt loam or loam till derived mainly from slate, shale, phyllite, limestone, and sandstone. Rock outcrops are a prominent feature of the landscape in many places. The soils range from nearly level through very steep and from somewhat excessively drained through moderately well drained. Many areas are forest. Areas that have been cleared are pasture or are idle. Very few are cropped.

7. *Farmington-Rock outcrop association, nearly level through moderately steep*

Shallow, well-drained, medium-textured soils formed in glacial till; and rock outcrop

This association occupies flattop hills that are parts of small to large islands protruding above the lake plain. It is mainly in the wide lake plain belt of Champlain Valley that extends northward from Smiths Basin into Vermont. Rock outcrops of limestone are a prominent feature of the landscape. Slopes range from 0 to 25 percent. Elevations are generally less than 400 feet above sea level.

This association makes up about 4 percent of the county. It is about 50 percent Farmington soils, 20 percent Rock outcrop, and 30 percent less extensive soils.

Farmington soils are shallow, well-drained, medium-textured soils that formed in thin deposits of glacial till derived mainly from limestone. Limestone bedrock is commonly at a depth of 10 to 20 inches, but the depth varies considerably within short distances. Very rocky areas dominate the landscape. In many the soil is less than 10 inches deep over bedrock.

Intermingled with Farmington soils are exposures of limestone bedrock that make up the Rock outcrop part of this association. In places the outcrops are short, vertical escarpments.

Of minor extent in this association are the deep, well-drained Pittsfield soils and moderately well drained Amenia soils. These deeper soils are intermingled with Farmington soils and Rock outcrop at the higher elevations. Around fringe areas adjacent to the lake plain are small areas of the somewhat poorly drained Kingsbury soils and the moderately well drained Vergennes soils, which formed in thin veneers of glacial lake or estuarine clay over the rock.

Much of this association is either wooded or idle. Some is used for spring pasture. The shallow, droughty soil conditions and the numerous rock outcrops are the main limiting features.

8. Hollis-Charlton association, gently sloping and sloping

Shallow, somewhat excessively drained, medium textured soils and deep, well drained, moderately coarse textured soils; all formed in glacial till from syenite and granite gneiss

This association occupies gently sloping and sloping hilltops and hillsides in the Adirondack Mountains. Slopes mainly range from 3 to 15 percent. Elevations are mainly less than 600 feet above sea level, but in a few places are about 1,000 feet.

This association makes up about 3 percent of the county. It is about 55 percent Hollis soils, 15 percent Charlton soils, and 30 percent less extensive soils.

Hollis soils are shallow, somewhat excessively drained, mainly medium-textured soils that formed in thin deposits of glacial till. Hard gneiss bedrock is within 10 to 20 inches of the surface. Very rocky phases dominate these landscapes. Approximately 10 to 25 percent of the surface area is exposed rock and soil too thin over rock for plant growth.

Intermingled with Hollis soils in deeper areas are the well-drained, moderately coarse textured Charlton soils. These soils formed in deep deposits of glacial till derived mainly from syenite and granite gneiss. Stones and boulders are a prominent feature of the landscape. They are spaced about 5 to 30 feet apart on the surface.

Less extensive in this association are Carlisle muck, Sun soils, and spots of Rock outcrop. The Carlisle and Sun soils are very poorly drained and poorly drained and are in low swampy areas.

This association is mainly in forest. Very few areas are cleared. Stoniness and the shallowness over bedrock are the principal limiting features that affect both farm and nonfarm uses of the major soils of this association.

9. Hollis association, moderately steep and steep

Shallow, somewhat excessively drained, medium-textured soils formed in glacial till from syenite and granite gneiss

This association occupies moderately steep and steep mountainsides in the Adirondack Mountains in the northwestern part of the county. Rock outcrops are a prominent feature of the landscape. Many stones and boulders are on the surface. Elevations range from about 400 to 2,000 feet above sea level.

This association makes up about 10 percent of the county. It is about 90 percent Hollis soils and 10 percent less extensive soils.

Hollis soils are shallow, somewhat excessively drained, medium-textured soils that formed in thin deposits of glacial till derived mainly from gneiss. Hard bedrock is at a depth of 10 to 20 inches. Very rocky phases dominate these landscapes. Approximately 10 to 25 percent of the surface area is exposed rock and soil too thin over rock for plant growth. Also, many stones and boulders are scattered over the surface. Slopes mainly range from 15 to 70 percent.

Less extensive in this association are the Charlton, Carlisle, and Sun soils and Rock outcrop. The well-drained Charlton soils are intermingled in deeper areas, and the very poorly drained and poorly drained Carlisle and Sun soils are in swampy pockets and around seeps. Scattered spots of Rock outcrop occur throughout the association.

Most of this association is in forest (fig. 4). The moderately steep and steep slopes and the very rocky and shallow or very stony soil features are the main limiting factors.

10. Nassau-Bernardston association, undulating through hilly

Shallow, somewhat excessively drained, medium-textured soils and deep, well drained and moderately well drained, medium-textured soils; all formed in glacial till from shale, slate, and sandstone

This association occupies undulating and hilly uplands on the hilly slate belt that makes up more than the eastern half of the county. Much of the relief is affected by folded slate, shale, and phyllite bedrock. Complex slopes are a prominent feature of the landscape. Slopes mainly range from 3 to 25 percent. Elevations range from about 300 to more than 1,100 feet above sea level.

This is the most extensive association in the county. It makes up about 22 percent of the acreage. It is about 65 percent Nassau soils, 15 percent Bernardston soils, and 20 percent less extensive soils.

Nassau soils are shallow, somewhat excessively drained, medium-textured soils that formed in thin deposits of glacial till derived from slate, shale, phyllite, and some sandstone. Slaty bedrock is within 10 to 20 inches of the surface, and outcrops are common. Also, many slate fragments occur throughout the soil.

Intermingled with Nassau soils in deeper pockets between the folds of slaty bedrock and on long, oval, drumlinlike hills are areas of Bernardston soils. These are deep, well drained and moderately well drained, medium-textured soils that formed in deeper deposits of the same kind of slaty till in which Nassau soils formed. They have a dense fragipan that impedes drainage and restricts roots at a depth of 18 to 30 inches. They have a seasonal high water table that is perched on the slowly permeable fragipan and fluctuates between depths of 18 and 30 inches. Except for the long, drumlinlike hills, the landscape is undulating and hilly.

Less extensive in this association are mainly the Hudson, Rhinebeck, Scriba, and Sun soils. The dominantly moderately well drained Hudson soils and the somewhat poorly drained Rhinebeck soils are along lake plain fringes. The somewhat poorly drained Scriba soils and the poorly drained and very poorly drained Sun soils are in low areas on uplands.

Figure 4.—**Densely forested mountainsides on the Hollis association, moderately steep and steep.**

Much of this association is cleared and used for dairy farming. Some is in forest. The varying depth of the soil over bedrock and the varying relief and drainage are the main limitations.

11. Nassau-Rock outcrop association, steep and very steep

Shallow, somewhat excessively drained, medium-textured soils formed in glacial till from shale, slate, and sandstone; and rock outcrop

This association occupies steep and very steep uplands, mainly in the eastern and southern parts of the county along the Vermont State line. The relief is affected by folded slate, shale, and phyllite bedrock. Outcrops of this bedrock are a prominent feature of the landscape. Slopes mainly range from 25 to 70 percent. Elevations are mainly between 600 and 1,200 feet above sea level, but range to as much as 1,700 feet in places.

This association makes up about 6 percent of the county. It is about 70 percent Nassau soils, 15 percent Rock outcrop, and 15 percent less extensive soils.

Nassau soils are shallow, somewhat excessively drained soils that formed in thin deposits of glacial till derived mainly from slate, shale, or phyllite and some sandstone. Slaty bedrock is at a depth of 10 to 20 inches, and many fragments of this rock occur throughout the soil. Very rocky phases dominate these landscapes, and depth to bedrock is highly variable from place to place.

Intermingled with Nassau soils are many exposures of folded slaty bedrock, which make up the Rock outcrop part of this association.

Less extensive in this association are the well-drained to very poorly drained Bernardston, Scriba, and Sun soils in areas of deeper till. Bernardston soils are on hilltops and hillsides, and Scriba and Sun soils are along lower slopes and in depressions.

Most of this association is either forested or idle. The steep and very steep slopes, droughtiness, and numerous rock outcrops are very limiting features that affect both farm and nonfarm use.

12. Palatine-Vergennes association, gently sloping and sloping

Moderately deep, well drained and somewhat excessively drained, medium textured soils formed in calcareous dark shale, and deep, moderately well drained, moderately fine textured soils formed in lake-laid or estuarine clay

This association occupies gently sloping and sloping knolls that project above lake or estuarine plains of Champlain Valley in the vicinity of Fort Ann. Slopes range from 2 to 15 percent. Elevations are generally less than 300 feet above sea level.

This association makes up less than 0.1 percent of the county. It is about 65 percent Palatine soils, 20 percent Vergennes soils, and 15 percent less extensive soils.

Palatine soils are moderately deep, well-drained to somewhat excessively drained, medium-textured soils. They formed in thin deposits of till derived mainly from the underlying calcareous, dark-colored shale bedrock. This bedrock, which is fairly soft and generally rippable, is at a depth of 20 to 40 inches. The soils contain many fragments of shale. They are gently sloping and sloping. They are on knolls above Vergennes soils where the relief is affected by the underlying bedrock.

The gently sloping and sloping Vergennes soils are on lake or estuarine plains around the fringes of the Palatine soils on knolls. They are deep, moderately well drained, moderately fine textured soils that have a fine textured subsoil. They formed in calcareous lake or estuarine clay. They have convex slopes where runoff is somewhat slow and some runoff water accumulates. These soils have a seasonal high water table that is perched on the very slowly permeable subsoil and substratum and fluctuates between depths of 18 and 24 inches.

Less extensive in this association are the well-drained to somewhat poorly drained Kingsbury, Farmington, and Pittsfield soils. Kingsbury soils are associated with Vergennes soils on lake or estuarine plains. They are wetter than those soils. The shallow Farmington soils and the deep Pittsfield soils are intermingled with the Palatine soils on upland knolls.

Most of this association is cleared and used for dairy farming. Varying drainage patterns, soil texture, and depth are the main limiting features that affect both farm and nonfarm uses.

13. Rock outcrop-Hollis association, moderately steep through very steep

Mainly bare rock and some shallow, somewhat excessively drained, medium-textured soils formed in glacial till from syenite and granite gneiss

This association occupies moderately steep through very steep landscapes in the Adirondack Mountains in the northwestern part of the county. The area is dominated by exposures of bare bedrock, and vertical bedrock escarpments are numerous. Slopes mainly range from 15 to 70 percent. Elevations range from about 400 feet to 2,646 feet above sea level at Black Mountain, which is the highest point in the county.

This association makes up about 2 percent of the county. It is about 70 percent Rock outcrop, 20 percent Hollis soils, and 10 percent less extensive soils.

Rock outcrop is mainly exposures of syenite or granite gneiss bedrock. In places the rock exposures are vertical.

Intermingled with Rock outcrop are the shallow, somewhat excessively drained, mainly medium-textured Hollis soils. These soils formed in thin deposits of glacial till that is 10 to 20 inches thick over hard gneiss bedrock. Very rocky phases dominate these landscapes. In many areas the soil is too thin over rock for plant growth.

Less extensive in this association are the Carlisle and Sun soils. These very poorly drained and poorly drained soils are in swampy depressions or around seeps.

Much of this association is sparsely vegetated because large areas of bedrock are exposed. Intersoil areas are mostly in forest. The hazard of windthrow is high because the soils are shallow. The numerous rock outcrops, the shallowness of the soils, and the steep slopes are limiting factors.

14. Rock outcrop-Vergennes association, gently sloping and sloping

Rock outcrop and deep, moderately well drained, moderately fine textured soils formed in lake or estuarine deposits of high clay content

This association occupies areas of the lake or estuarine plain that are dotted with protrusions of Rock outcrop. It is in Champlain Valley, mainly north of Whitehall. Slopes range from about 2 to 12 percent. Elevations are generally less than 400 feet above sea level.

This association makes up about 0.3 percent of the county. It is about 30 percent Rock outcrop, 30 percent Vergennes soils, and 40 percent less extensive soils.

Rock outcrop is exposures of bare bedrock that is limestone, gneiss, quartzite, or folded slate and shale, depending on the area of the county covered by the association. In places short escarpments of bedrock are vertical.

Intermingled with Rock outcrop are deeper pockets of the deep, moderately well drained, moderately fine textured Vergennes soils. These soils have a fine-textured subsoil. They formed in calcareous lake or estuarine clay. They are mainly gently sloping and sloping and are on convex slopes where runoff is somewhat slow and some runoff water accumulates. They have a seasonal high water table that is perched on the very slowly permeable subsoil and substratum and fluctuates between depths of 18 and 24 inches.

Less extensive in this association are the wetter Kingsbury and Covington soils, which formed in the same kind of lacustrine or estuarine deposits as Vergennes soils, and soils that are similar to the Vergennes soils but less than 40 inches deep over bedrock.

This association is used to a limited extent for grazing. Some areas are forested, and others are idle. The numerous rock outcrops, the clayey texture, and seasonal wetness are limiting factors that affect most uses.

Dominantly Deep Soils, without a Fragipan, that Formed in Glacial Till on Uplands

The associations in this group are on uplands in the Adirondack Mountains and the Adirondack border area in the northwestern part of the county. The three associations in this group make up about 10.5 percent of the county. The soils are dominantly deep. They formed in sandy loam or loam till derived mainly from gneiss in the mountain area and from gneiss, sandstone, and limestone in the mountain border area. They are gently sloping through steep and are dominantly well drained. Areas in the Adirondack Mountains are mainly forest, and those in the Adirondack border area are mainly dairy farms.

15. *Charlton-Hollis association, gently sloping and sloping*

Deep, well drained, moderately coarse textured soils and shallow, somewhat excessively drained, medium textured soils; all formed in glacial till from syenite and granite gneiss

This association occupies gently sloping and sloping hilltops and hillsides in the Adirondack Mountains. Slopes mainly range from 3 to 15 percent. Elevations are about 400 through 1,400 feet above sea level.

This association makes up about 5 percent of the county. It is about 38 percent Charlton soils, 30 percent Hollis soils, and 32 percent less extensive soils.

Charlton soils are deep, well-drained, moderately coarse textured soils that formed in deep deposits of glacial till derived mainly from syenite and granite gneiss. Stones and boulders are common. They are spaced about 5 to 30 feet apart on the surface.

Intermingled with Charlton soils are the shallow, somewhat excessively drained, medium-textured Hollis soils. These soils formed in thin deposits of glacial till that is 10 to 20 inches thick over hard gneiss bedrock. Very rocky phases dominate these landscapes. Approximately 10 to 25 percent of the surface area is exposed rock and soil too thin over rock for plant growth.

Less extensive in this association are the Vergennes and Sun soils. Sun soils are poorly drained and very poorly drained and are in wet depressions and around seeps in the uplands. The clayey Vergennes soils are moderately well drained and fringe lake plains.

Most of this association is forest. A few areas have been cleared, but numerous surface stones limit use. Stoniness and the shallowness over bedrock are the principal limiting features that affect both farm and nonfarm uses of the major soils of this association.

16. *Charlton-Hollis association, moderately steep and steep*

Deep, well drained, moderately coarse textured soils and shallow, somewhat excessively drained, medium textured soils; all formed in glacial till from syenite and granite gneiss

This association occupies moderately steep and steep mountainsides in the Adirondacks in the northwestern part of the county. Slopes mainly range from 15 to 35 percent, but in places are as much as 70 percent. Elevations range from about 400 to 1,800 feet above sea level.

This association makes up about 5 percent of the county. It is 40 percent Charlton soils, 35 percent Hollis soils, and 25 percent less extensive soils.

Charlton soils are deep, well-drained, moderately coarse textured soils that formed in deposits of glacial till derived mainly from syenite and granite gneiss. Stones and boulders are prominent features of the landscape. They are spaced about 5 to 30 feet apart on the surface.

Intermingled with Charlton soils are the shallow, somewhat excessively drained, medium-textured Hollis soils. These soils formed in thin deposits of glacial till and are only 10 to 20 inches deep over hard gneiss bedrock. Very rocky phases dominate these landscapes. Approximately 10 to 25 percent of the surface area is exposed rock and soil too thin over rock for plant growth.

Less extensive in this association are the Sun and Vergennes soils and Rock outcrop. Sun soils are very poorly drained and poorly drained and are in swampy depressions or around seeps in the uplands. The moderately well drained, clayey Vergennes soils are at lower elevations and fringe lake plains. Scattered areas of Rock outcrop occur throughout the association.

Most of this association is in forest, to which it is fairly well suited. Excessive stoniness and, in places, shallowness of the soil and steep slopes are limiting factors that affect farm and many nonfarm uses.

17. *Pittsfield association, gently sloping and sloping*

Deep, well-drained, moderately coarse textured soils formed in glacial till

This association occupies low, smooth, islandlike hills that rise above the Champlain Lake Plain in the Adirondack border area in the northwestern part of the county. Slopes range from 3 to 15 percent. Elevations range from about 300 to 500 feet above sea level.

This association makes up about 0.5 percent of the county. It is about 80 percent Pittsfield soils and 20 percent less extensive soils.

Pittsfield soils are deep, well-drained, moderately coarse textured soils that are stony or very stony. They formed in glacial till derived mainly from syenite and granite gneiss, sandstone, and limestone. They are on uplands and are mainly gently sloping and sloping.

Less extensive in this association are the Farmington, Amenia, Vergennes, and Kingsbury soils. The shallow, well drained Farmington soils and the deep, moderately well drained Amenia soils are intermingled with the Pittsfield soils in the uplands. The moderately well drained Vergennes soils and the somewhat poorly drained Kingsbury soils fringe lake or estuarine plains.

Most of this association is cleared and used for dairy farming. Few limitations affect farm uses. Erosion is a hazard on the more sloping soils if they are left bare, and surface stones are numerous in places.

Dominantly Deep Soils, with a Fragipan, that Formed in Glacial Till on Uplands

The associations in this group are on uplands, mainly in the hilly slate belt that covers more than the eastern half of the county. The three associations in this group make up about 17 percent of the county. The soils are dominantly deep, but most have a fragipan within 30 inches of the surface that impedes drainage and restricts rooting. They formed in loam or silt loam till derived mainly from slate, slaty shale, phyllite, and sandstone. They are nearly level through very steep and range from well drained through very poorly drained. Many cleared areas are dairy farms. Steeper areas are mainly forested or idle.

18. Scriba-Sun association, nearly level through sloping

Deep, somewhat poorly drained through very poorly drained, medium-textured soils formed in glacial till from shale, slate, and sandstone

This association occupies nearly level through smoothly sloping uplands in the southern part of the county. Some areas are very stony. Others have only a few stones on the surface. Slopes range from 0 to 15 percent. Elevations are about 400 to 800 feet above sea level.

This association makes up about 1 percent of the county. It is about 45 percent Scriba soils, 40 percent Sun soils, and 15 percent less extensive soils.

Scriba soils are deep, somewhat poorly drained, medium-textured soils that formed in glacial till derived mainly from slate, shale, and sandstone. A firm, dense fragipan that impedes drainage and restricts roots is at a depth of 12 to 26 inches. These soils are nearly level to sloping. They have a seasonal high water table that is perched on the slowly or very slowly permeable fragipan and fluctuates between depths of 6 and 18 inches. They are on the lower slopes of hillsides or on flat hilltops where runoff is slow and runoff water accumulates.

Intermingled with Scriba soils in depressions are the poorly drained and very poorly drained Sun soils. These soils formed in deep deposits of glacial till derived mainly from slate, shale, and sandstone. The water table is perched on the slowly permeable substratum. In spring and during wet periods, it is at or near the surface for long periods.

Less extensive in this association are the Bernardston, Nassau, and Madalin soils. Bernardston and Nassau soils are intermingled with Scriba and Sun soils on uplands. They are generally on higher landscapes that contribute runoff to the Scriba and Sun soils. The poorly drained and very poorly drained Madalin soils fringe lake plains.

Cleared areas of this association are used mainly for hay and pasture in support of dairying. Many areas are in forest. Wetness and, in places, stoniness are the main limitations that affect farm and many nonfarm uses.

19. Bernardston association, steep and very steep

Deep, dominantly well drained, medium-textured soils formed in glacial till from shale, slate, and sandstone

This association occupies steep and very steep, long, oval, drumlinlike areas on uplands in the southern and eastern half of the county. Slopes mainly range from 25 to 50 percent. Elevations range from about 600 to 1,200 feet above sea level.

This association makes up about 2 percent of the county. It is about 85 percent Bernardston soils and 15 percent less extensive soils.

Bernardston soils are deep, well drained and moderately well drained, medium-textured soils, some of which are very stony. They formed in glacial till derived mainly from shale, slate, and sandstone. They have a dense fragipan that impedes water movement and restricts roots at a depth of 18 to 30 inches. Typically they have a seasonal high water table that is perched on the slowly permeable fragipan and fluctuates between depths of 18 and 30 inches. The Bernardston soils in this association, however, are mainly well drained because runoff is rapid on the steep and very steep, drumlinlike landscape. Also, the water table in this association is seldom within 24 inches of the surface.

Less extensive in this association are mainly the Nassau, Scriba, and Sun soils, which are intermingled with the Bernardston soils on uplands. The shallow, somewhat excessively drained Nassau soils are in irregularly shaped areas where folded, slaty bedrock is within 20 inches of the surface. The somewhat poorly drained Scriba soils are along foot slopes, and the very poorly drained to poorly drained Sun soils are in wet depressions.

Many areas of this association are in forest. Cleared areas are in native pasture or are idle. Some are being reforested. The steep slopes, the hazard of erosion, and, in places, stoniness are the limiting factors that affect most uses.

20. Bernardston-Nassau association, gently sloping and sloping

Deep, well drained and moderately well drained, medium-textured soils and shallow, somewhat excessively drained, medium-textured soils; all formed in glacial till from shale, slate, and sandstone

This association is on uplands in the hilly slate belt that makes up more than the eastern half of the county. The landscape is one of long, oval, drumlinlike hills intermingled with areas of complex slopes where the relief is affected by folded slaty bedrock. This rock crops out in places. Slopes mainly range from 3 to 15 percent. Elevations range from about 400 to 1,200 feet above sea level.

This association makes up about 14 percent of the county. It is about 60 percent Bernardston soils, 25 percent Nassau soils, and 15 percent less extensive soils.

Bernardston soils are deep, well drained and moderately well drained, medium-textured soils that formed in till derived mainly from shale, slate, and sandstone. They are gently sloping and sloping and are on smooth, drumlinlike landscapes. They have a dense fragipan that impedes drainage and restricts roots at a depth of 18 to 30 inches. They also have a seasonal high water table that is perched on the slowly permeable fragipan and fluctuates between depths of 18 and 30 inches.

Intermingled with Bernardston soils in shallow, undulating and rolling areas where the relief is affected by folded slaty bedrock are Nassau soils. They are somewhat excessively drained, medium-textured soils that formed in thin deposits of till that is the same slaty material in which Bernardston soils formed. Slaty bedrock is at a depth of 10 to 20 inches, and outcrops of rock are common.

Less extensive in this association are the Scriba, Sun, and Hoosic soils. The somewhat poorly drained Scriba soils and the poorly drained and very poorly drained Sun soils are on upland foot slopes and in wet depressions. The somewhat excessively drained Hoosic soils are on gravelly outwash deposits that are commonly around the south end of drumlins, mainly in Hudson Valley.

Many areas of this association are dairy farms. The hazard of erosion and, in places, the shallowness over bedrock and the resulting lack of moisture are the main limiting features that affect both farm and nonfarm uses of these soils.

Deep Soils Formed on Plains, Terraces, Kames, Eskers, and Deltas in Glacial Outwash Deposits in Valleys

The associations in this group are scattered throughout the county. They are on glacial outwash deposits along most of the larger tributary valleys of the Hudson River and Champlain Valley drainageways and in a few areas along the Hudson River. The three associations in this group make up about 6 percent of the county. The soils are deep. They formed in water-sorted deposits of gravel and sand. They are nearly level to sloping and are somewhat excessively drained or excessively drained. Many areas are farms. Most of the villages in the county are on these associations, and so are practically all of the sand and gravel pits.

21. Hoosic-Otisville association, nearly level

Deep, somewhat excessively drained and excessively drained, moderately coarse textured gravelly soils formed in water-sorted deposits from slate, shale, and quartzite

This association occupies nearly level gravelly glacial outwash terraces, mainly along valleys in the eastern and south-central parts of the county. Elevations range from about 300 to 750 feet above sea level.

This association makes up about 1 percent of the county. It is about 60 percent Hoosic soils, 20 percent Otisville soils, and 20 percent less extensive soils.

Hoosic soils are nearly level, deep, somewhat excessively drained, moderately coarse textured soils that formed in water-sorted glacial outwash derived mainly from slate, shale, and quartzite. They are rapidly permeable or very rapidly permeable throughout.

Intermingled with Hoosic soils are the slightly coarser textured Otisville soils. These soils are excessively drained and formed in the same gravelly outwash materials as Hoosic soils. They are very rapidly permeable throughout.

Less extensive in this association are the moderately well drained to very poorly drained Herkimer, Fredon, and Halsey soils, which formed in the same gravelly outwash material as Hoosic and Otisville soils. These soils are wetter than Hoosic and Otisville soils and generally are on the lower parts of the terraces.

Most of this association is used for dairy farming. Droughtiness, low fertility, and the high content of gravel in the surface layer are limiting features that affect most uses. The association is generally a good source of sand and gravel. It is well suited to many nonfarm uses that require nearly level relief and good drainage. Water pollution, however, is a hazard if sewage disposal is by the septic tank method.

22. Hoosic-Otisville association, gently sloping and sloping

Deep, somewhat excessively drained and excessively drained, moderately coarse textured gravelly soils formed in water-sorted deposits from slate, shale, and quartzite

This association occupies gently sloping and undulating or rolling glacial outwash terraces, deltas, and kames along the valleys in the eastern and south-central parts of the county. Slopes mainly range from 3 to 15 percent. Elevations range from about 300 to 900 feet above sea level.

This association makes up about 3 percent of the county. It is 75 percent Hoosic soils, about 15 percent Otisville soils, and 10 percent less extensive soils.

Hoosic soils are deep, somewhat excessively drained, moderately coarse textured soils that formed in water-sorted glacial outwash derived mainly from slate, shale, and quartzite. They are gently sloping or undulating and rolling. They are rapidly permeable or very rapidly permeable throughout.

Intermingled with Hoosic soils are the slightly coarser textured Otisville soils. These soils are excessively drained and formed in the same gravelly outwash material as Hoosic soils. They are very rapidly permeable throughout.

Less extensive in this association are the moderately well drained to very poorly drained Herkimer, Fredon, and Halsey soils, which formed in the same gravelly outwash material as the Hoosic and Otisville soils. They are generally in low or depressional areas of the outwash deposits and are wetter than those soils.

Most of this association is used for dairy farming. Excessive droughtiness, low fertility, and the high content of gravel in the surface layer are limiting features that affect most uses. Also, erosion is a slight hazard if more sloping soils are left without protective cover. The association is generally a good source of sand and gravel. It is suited to many nonfarm uses that require good drainage. Water pollution, however, is a hazard if sewage disposal is by the septic tank method.

23. Oakville-Otisville association, nearly level and gently sloping

Deep, excessively drained, coarse textured and moderately coarse textured soils formed in water-sorted deposits from shale, slate, sandstone, and gneiss

This association occupies nearly level and gently sloping deltaic areas of glacial lakes. Two of the largest areas of this association are on huge sandy deltas, one at the mouth of the Batten Kill and the other where the Hudson River comes out of the Adirondacks at Hudson Falls. Slopes are mainly 0 to 5 percent, but range to as much as 8 percent in places. Elevations range from about 150 to 500 feet above sea level.

This association makes up about 2 percent of the county. It is about 60 percent Oakville soils, 25 percent Otisville soils, and 15 percent less extensive soils.

Oakville soils are deep, excessively drained, coarse-textured soils that formed in water-sorted sandy deposits on deltas or in subsequent wind-sorted deposits. They are very rapidly permeable throughout. They are nearly level or gently sloping and are on deltas away from the mouths of the glacial streams, where gravel has been deposited by melt water.

The very gravelly Otisville soils formed near the mouths of these glacial streams, where gravel and sand are common in the deltaic deposits. They are nearly level or gently sloping, deep, excessively drained, and moderately coarse textured. They are very rapidly permeable throughout.

Less extensive in this association are the somewhat excessively drained to somewhat poorly drained Hoosic, Herkimer, Fredon, Claverack, and Cosad soils. Hoosic, Herkimer, and Fredon soils formed in the same kinds of gravelly deposits as Otisville soils and are closely associated with them on the landscape. Claverack and Cosad soils fringe deltas, where lake-laid clay is at a depth of 20 to 40 inches.

This association is used for crops. Lack of moisture and low fertility are limiting factors. Many sand pits are in this association. The villages of Hudson Falls and Fort Edward are in one of the larger areas.

Deep Soils Formed in Recent Alluvium on Flood Plains

The associations in this group are on flood plains of streams throughout the county. The two associations in this group make up about 2 percent of the county. The soils are deep. They formed in recent alluvium that is high in content of silt and very fine sand. They are nearly level and range from well drained through very poorly drained. Most areas are farmed. Some of the most fertile soils in the county are on these associations.

24. Limerick-Saco-Fluvaquents association, nearly level

Deep, poorly drained and very poorly drained, medium-textured soils formed in recent alluvium high in silt and very fine sand

This association occupies nearly level, low, generally long and narrow areas on flood plains of streams throughout the county. Elevations range from about 100 to 750 feet above sea level.

This association makes up about 1 percent of the county. It is about 40 percent Limerick soils, 30 percent Saco soils, 20 percent Fluvaquents, and 10 percent less extensive soils.

Limerick and Saco soils are deep, medium-textured soils that formed in gravel-free alluvial deposits that are high in content of silt or silt and very fine sand. The Limerick soils are poorly drained, and the Saco soils are very poorly drained. The water table is at or near the surface for long periods, and these soils are subject to frequent flooding.

Intermingled with the Limerick and Saco soils on flood plains is Fluvaquents, which is also subject to frequent flooding. Fluvaquents consists of deep deposits of alluvial material that is generally stratified and ranges from gravel and sand to clay. It is generally poorly drained or very poorly drained. In many areas it is cut by old drainage channels.

Less extensive in this association are the Teel and Hamlin soils on higher areas of the flood plains and the Hartland soils on old stream terraces above flood plains. They are well drained to somewhat poorly drained.

Some of this association is used for pasture and hay for dairy farming. Others are covered with water-tolerant woody vegetation. Excess wetness and frequent flooding are limiting features that affect use of these soils.

25. Teel-Hamlin association, nearly level

Deep, somewhat poorly drained through well drained, medium-textured soils formed in recent alluvium high in silt and very fine sand

This association occupies nearly level flood plains along streams throughout the county. Areas are narrow along the smaller streams and wide along the larger ones. Elevations range from about 100 to 600 feet above sea level.

This association makes up about 1 percent of the county. It is about 50 percent Teel soils, 30 percent Hamlin soils, and 20 percent less extensive soils.

Teel and Hamlin soils formed in deep, recent alluvial deposits that are high in content of silt and very fine sand and are essentially free of gravel. The Teel soils are moderately well drained to somewhat poorly drained. They have a seasonal high water table, at a depth of 18 to 24 inches, that is affected by the water level of the adjacent streams. The Hamlin soils are well drained and have a water table at a depth of more than 2 feet. Both Teel and Hamlin soils are subject to flooding, but rarely are flooded during the growing season.

Less extensive in this association are the Limerick, Saco, and Hartland soils and Fluvaquents, which is mainly along old channels. The Limerick and Saco soils are associated with Teel and Hamlin soils on flood plains. They are wetter than those soils. The Hartland soils are well drained and are on old stream terraces above the flood plains.

This association is mainly used for crops, to which it is very well suited. The soils are easy to till and respond well to management. They are subject to flooding, but are rarely flooded during the growing season. They are an excellent source of topsoil. The flood hazard is a major limitation that affects many nonfarm uses.

Soils Formed in Organic Deposits and Saprists, Aquepts, and Aquents

The associations in this group are in swampy depressions throughout the county and along Lake Champlain. The two associations in this group make up about 1.3 percent of the county. The soils are deep. They formed mainly in deposits of decomposed or partly decomposed plant and animal remains that have accumulated in depressions. All the soils are level and very wet, and most are covered with swamp forest or marsh vegetation. The few cleared areas are mostly idle.

26. Carlisle-Palms association, nearly level

Deep, very poorly drained organic soils in waterlogged bogs within lake or estuarine plains, outwash plains, and glaciated uplands

This association occupies swampy depressions in lake or estuarine plains, outwash plains, and uplands. It occurs as scattered areas throughout the county. Elevations range from about 200 to 1,000 feet above sea level.

This association makes up about 1 percent of the county. It is about 75 percent Carlisle muck, 15 percent Palms muck, and 10 percent less extensive soils.

Carlisle and Palms soils are deep, very poorly drained organic soils that formed in deposits of well-decomposed and partly decomposed organic matter that has accumulated in boggy depressions. The organic deposits in the Carlisle soil are more than 51 inches thick over a mineral soil layer. The water table is at or near the surface most of the year, except in the few small areas that have been drained. In places, these soils are ponded. Permeability of the organic material is moderately rapid, and that of the underlying mineral material is variable.

Less extensive in this association are the Nassau, Hollis, and Sun soils on uplands; the Madalin and Covington soils on lake or estuarine plains; and the Halsey soils on outwash plains. Nassau and Hollis soils are somewhat excessively drained. The rest are mainly poorly drained or very poorly drained.

Most of this association is forest of water-tolerant trees and shrubs. A few small areas have been cleared and drained for crops. Excessive wetness and high compressibility of the organic material are limiting features that affect most uses. If the deeper muck deposits are adequately drained, they have a high potential for vegetable or sod crops.

27. Saprists, Aquepts, and Aquents association, level

Low-lying areas ponded with shallow water

This association occupies low-lying, level areas, mainly along Lake Champlain, that are shallowly ponded most of the year. The areas support a plant cover of sedges, rushes, marsh grasses, cattails, and other water-tolerant plants. Elevations are mainly about 100 feet above sea level along Lake Champlain, but they range to as much as 900 feet in beaver meadows on uplands.

This association makes up about 0.3 percent of the county. It is about 90 percent the land type Saprists, Aquepts, and Aquents and 10 percent mainly the wet, organic Carlisle and Palms soils.

This association provides excellent habitat for waterfowl, muskrat, and other animals that live near water.

Descriptions of the Soils

This section describes the soil series and mapping units in Washington County. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless 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. Color terms are for moist soil unless otherwise stated. The profile described in the series is representative of mapping units in that series. If the profile of a given mapping unit differs from the one described for the series, differences are stated in describing the mapping unit or they are apparent in the name of the mapping unit.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Fluvaquents and Rock outcrop, for example, do not belong to a soil series but nevertheless, are 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 each description of a mapping unit are the capability unit and woodland group in which the mapping unit has been placed. The page for the description of each capability unit can be found 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 at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*13*).

Amenia Series

The Amenia series consists of deep, moderately well drained, medium-textured soils that are high in content of lime. These soils formed in calcareous glacial till derived mainly from calcic limestone and sandstone. They are gently sloping and are on uplands and hilltops and at the base of hillsides.

A representative profile in a cultivated area has a surface layer of dark-brown silt loam 9 inches thick. The subsoil is brown, neutral, friable silt loam that is mottled in the lower part. At a depth of 21 inches, it merges with a substratum of firm, calcareous, mottled dark grayish-brown till of gravelly silt loam texture that extends to a depth of 50 inches or more.

Water moves at a moderate rate through the subsoil

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

Soil	Area	Extent
	Acres	*Percent*
Amenia silt loam, 3 to 8 percent slopes	300	0.1
Belgrade silt loam, 0 to 2 percent slopes	290	.1
Belgrade silt loam, 2 to 6 percent slopes	1,140	.2
Bernardston gravelly silt loam, 3 to 8 percent slopes	9,840	1.2
Bernardston gravelly silt loam, 8 to 15 percent slopes	17,520	3.2
Bernardston gravelly silt loam, 15 to 25 percent slopes	13,730	2.6
Bernardston-Nassau shaly silt loams, 3 to 8 percent slopes	6,600	1.2
Bernardston-Nassau shaly silt loams, 8 to 15 percent slopes	11,220	2.1
Bernardston-Nassau shaly silt loams, rolling and hilly	9,840	1.8
Bernardston very stony soils, gently sloping through moderately steep	5,360	1.0
Bernardston soils, steep and very steep	12,370	2.3
Carlisle muck	6,900	1.3
Charlton association, very stony, gently sloping and sloping	12,000	2.4
Charlton association, very stony, moderately steep and steep	12,010	2.4
Claverack loamy fine sand, 0 to 2 percent slopes	870	.2
Claverack loamy fine sand, 2 to 6 percent slopes	930	.2
Cosad fine sandy loam	820	.2
Covington silty clay loam	5,960	1.1
Farmington loam, 0 to 8 percent slopes	1,210	.2
Farmington-Rock outcrop association, nearly level through moderately steep	10,700	2.0
Farmington-Rock outcrop association, steep and very steep	4,460	.8
Fluvaquents	5,200	1.0
Fredon silt loam	1,880	.4
Halsey mucky silt loam	860	.2
Hamlin silt loam	1,760	.3
Hartland very fine sandy loam, 0 to 2 percent slopes	530	.1
Hartland very fine sandy loam, 2 to 6 percent slopes	340	.1
Hartland very fine sandy loam, 6 to 12 percent slopes	320	.1
Hartland very fine sandy loam, 12 to 20 percent slopes	150	.1
Herkimer gravelly silt loam, 0 to 3 percent slopes	800	.1
Herkimer gravelly silt loam, 3 to 8 percent slopes	360	.1
Hollis-Charlton association, moderately steep and steep	63,850	11.9
Hollis-Rock outcrop association, gently sloping and sloping	18,710	3.5
Hoosic gravelly sandy loam, 0 to 3 percent slopes	6,360	1.2
Hoosic gravelly sandy loam, 3 to 8 percent slopes	5,970	1.1
Hoosic gravelly sandy loam, 8 to 15 percent slopes	2,560	.5
Hoosic gravelly sandy loam, rolling and hilly	4,780	.9
Hoosic and Otisville soils, steep and very steep	2,760	.5
Hudson silt loam, 2 to 6 percent slopes	2,790	.5
Hudson silt loam, 6 to 12 percent slopes	560	.1
Hudson silt loam, 12 to 20 percent slopes	440	0.1
Hudson and Vergennes soils, steep and very steep	20,160	3.8
Kingsbury silty clay, 0 to 2 percent slopes	16,610	3.1
Kingsbury silty clay, 2 to 6 percent slopes	5,560	1.0
Limerick silt loam	4,400	.8
Madalin silty clay loam	1,170	.2
Nassau shaly silt loam, undulating through hilly	41,560	7.8
Nassau-Rock outcrop association, undulating through hilly	47,060	8.8
Nassau-Rock outcrop association, steep and very steep	44,460	8.3
Oakville loamy fine sand, 0 to 5 percent slopes	3,400	.6
Oakville loamy fine sand, 5 to 15 percent slopes	3,440	.6
Oakville loamy fine sand, moderately steep and steep	1,280	.2
Orthents and Psamments	950	.2
Otisville gravelly sandy loam, 0 to 3 percent slopes	1,710	.3
Otisville gravelly sandy loam, 3 to 8 percent slopes	910	.2
Otisville gravelly sandy loam, rolling and hilly	1,380	.3
Palatine shaly silt loam, 3 to 8 percent slopes	430	.1
Palatine shaly silt loam, 8 to 15 percent slopes	150	.1
Palms muck	1,250	.2
Pittsfield stony fine sandy loam, 3 to 8 percent slopes	290	.1
Pittsfield stony fine sandy loam, 8 to 15 percent slopes	230	.1
Pittsfield-Amenia association, very stony, gently sloping through moderately steep	2,160	.4
Rhinebeck silt loam, 0 to 2 percent slopes	2,990	.5
Rhinebeck silt loam, 2 to 6 percent slopes	730	.1
Rock outcrop-Hollis association, moderately steep through very steep	12,150	2.3
Rock outcrop-Vergennes association, gently sloping through moderately steep	2,110	.4
Rock outcrop-Vergennes association, steep and very steep	590	.1
Saco silt loam	3,020	.5
Saprists, Aquepts, and Aquents	2,050	.4
Scriba gravelly silt loam, 0 to 3 percent slopes	1,280	.2
Scriba gravelly silt loam, 3 to 8 percent slopes	3,500	.7
Scriba very stony soils, nearly level through sloping	1,110	.2
Sun loam	4,840	.9
Sun very stony soils	1,330	.2
Teel silt loam	3,520	.7
Vergennes silty clay loam, 2 to 6 percent slopes	17,770	3.4
Vergennes silty clay loam, 6 to 12 percent slopes	8,700	1.6
Vergennes silty clay loam, 12 to 20 percent slopes	4,900	.9
Wallington silt loam, sandy substratum	1,480	.3
Total	535,680	100.0

and slowly through the substratum. The depth of rooting is limited mainly to the upper 24 inches and is influenced by the seasonal water table, which rises to within 18 to 24 inches of the surface. Few roots extend below this depth as the water table recedes. Available moisture capacity is moderate to high. The capacity of the soils to supply nitrogen, phosphorus, and potassium is medium.

Representative profile of Amenia silt loam, 3 to 8 percent slopes, in a cornfield; town of Kingsbury, one-fourth mile south of Kingsbury Road, 50 feet east of Hendee Road:

Ap—0 to 9 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; friable; many fine roots; 5 percent coarse fragments; neutral; abrupt, smooth boundary.

B21—9 to 15 inches, brown (10YR 4/3) silt loam; weak, fine, subangular blocky structure; friable; common fine roots; 5 percent coarse fragments; neutral; clear, wavy boundary.

B22—15 to 21 inches, brown (10YR 4/3) silt loam; common, medium, distinct, yellowish-brown (10YR 5/6) and very pale brown (10YR 7/3) mottles; weak, fine, subangular blocky structure; friable; few fine roots; few fine pores; neutral; 5 percent coarse fragments; clear, wavy boundary.

C—21 to 50 inches, dark grayish-brown (2.5Y 4/2) gravelly silt loam; common, medium, distinct, yellowish-brown (10YR 5/6) and light-gray (10YR7/2) mottles; moderate, thick, platy structure; firm; no roots; 30 percent coarse fragments of shale, slate, and limestone; moderately alkaline; calcareous.

Thickness of the solum and depth to carbonates range from 19 to 30 inches. The depth to bedrock is generally more than 3½ feet. Reaction in the solum is slightly acid or neutral. Alkalinity increases with increasing depth. The content of coarse fragments ranges from 5 to 30 percent in the solum; the amount of gravel increases with increasing depth. In places large stones occur throughout the solum.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) through brown (10YR 4/3) and has weak or moderate granular structure. The B horizon ranges from brown (10YR 5/3) through olive brown (2.5Y 4/4) and from silt loam through fine sandy loam; has weak or moderate, fine or medium, subangular blocky structure; and is slightly acid or neutral. The B22 and C horizons contain distinct or prominent mottles ranging from light gray (10YR 7/2) through strong brown (7.5YR 5/8). The C horizon ranges from dark grayish brown (2.5Y 4/2) through brown (10YR 5/3) and from silt loam through fine sandy loam, has weak or moderate platy structure or is massive, and is firm or very firm.

Amenia soils formed in material similar to that in the closely associated, well-drained Pittsfield soils and the shallow Farmington soils. They are also near Vergennes and Kingsbury soils, which formed in clayey lake-laid or estuarine sediments on the Champlain Lake Plain.

Amenia silt loam, 3 to 8 percent slopes (AmB).—This soil is on rounded hilltops and on lower hillsides where surface runoff is somewhat slow or accumulates for short periods. Most of the hills are islands of till surrounded by the clayey sediments of the Champlain Lake Plain. Areas are oval shaped and about 10 acres in size.

Included with this soil in mapping are areas where the surface layer is loam or fine sandy loam, small areas that are more sloping than this soil, and spots of the deep, well-drained Pittsfield soils on knolls and the shallow Farmington soils. Also included, near the lake plain, are spots of the clayey Kingsbury and Vergennes soils and, in places, small areas of a similar soil that is medium acid through neutral but not calcareous.

If adequately fertilized and limed, this Amenia soil is well suited to most crops. It is also suited to pasture and woodland. Wetness sometimes delays planting for a short period in spring. The erosion hazard is slight to moderate if the soil is cultivated and not protected. Capability unit IIw-3; woodland group 3o2.

Belgrade Series

The Belgrade series consists of deep, moderately well drained, medium-textured soils. These soils formed in lacustrine or old alluvial stream terrace deposits that are high in content of silt and very fine sand. They are nearly level and gently sloping and are on lake plains and old stream terraces.

A representative profile has a surface layer of very dark grayish-brown silt loam about 8 inches thick. The subsoil extends to a depth of 24 inches. The upper 6 inches is light olive-brown, friable silt loam. The lower part is mottled olive and light olive-brown silt loam that is friable to a depth of 18 inches and firm below. The substratum is light olive-brown, firm silt loam that extends to a depth of 65 inches or more. The profile contains few or no gravel fragments.

In spring and during wet periods, the water table rises to within 18 to 24 inches of the surface in undrained areas. Permeability is moderate in the surface layer and subsoil and moderate to slow in the substratum. In spring, roots are confined mainly to the upper 18 to 20 inches, but as the season progresses and the water table recedes, they extend throughout the profile. Available moisture capacity is high. Water runs off at a medium to slow rate. These soils are low in content of lime. Their capacity to supply nitrogen and phosphorus is medium. Their capacity to furnish potassium is low.

Representative profile of Belgrade silt loam, 0 to 2 percent slopes, in an idle field; town of White Creek, 50 feet east of old Route 22, one-fourth mile north of County Route 69 at old N.Y. Route 22:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate to fine, granular structure; friable; many roots; no coarse fragments; slightly acid; abrupt, smooth boundary.

B21—8 to 14 inches, light olive-brown (2.5Y 5/4) silt loam; moderate, medium, subangular blocky structure; friable; common roots; common pores; no coarse fragments; medium acid; clear, wavy boundary.

B22—14 to 18 inches, olive (5Y 5/4) silt loam; common, medium, distinct mottles of light gray (10HR 7/1) and common, fine, distinct mottles of dark yellowish brown (10YR 4/4); weak, medium, subangular blocky structure; friable; few roots; few pores; few patchy clay films in pores; less than 5 percent coarse fragments; strongly acid; clear, wavy boundary.

B23—18 to 24 inches, light olive-brown (2.5Y 5/4) silt loam; common, medium, distinct mottles of light gray (10YR 7/1) and common, fine, distinct mottles of dark yellowish brown (10YR 4/4); weak, very thick, platy structure parting to weak, fine, subangular blocky; firm; few pores; few patchy clay films in pores; less than 5 percent coarse fragments; strongly acid; clear, wavy boundary.

C—24 to 65 inches, light olive-brown (2.5Y 5/4) silt loam; weak, very coarse, prismatic structure; strong, medium, platy structure within prisms; firm; few roots along prism faces; few pores; thin, discontinuous silt films on prisms; very thin manganese stains; no coarse fragments; medium acid.

The solum ranges from 20 to 30 inches in thickness. Depth to bedrock is more than 5 feet. Reaction in the solum ranges from strongly acid through medium acid unless the soil is limed. The solum contains few or no coarse fragments.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) through brown (10YR 4/3). The B horizon ranges from dark brown (10YR 4/3) through olive (5Y 5/6), is silt loam or very fine sandy loam, and ranges from strongly acid through medium acid. The B22 horizon has distinct or prominent gray and brown mottles. The C horizon ranges from olive gray (5Y 5/2) through dark yellowish brown (10YR 4/4) and in places is mottled with gray and brown. It is stratified or varved silt loam and very fine sandy loam, has platy structure or is massive, is firm or friable, and ranges from strongly acid through slightly acid. Below a depth of 4 feet, reaction in some profiles ranges through neutral.

Belgrade soils formed in material similar to that of the closely associated, well-drained Hartland soils and the somewhat poorly drained Wallington soils. They are also near Hudson and Rhinebeck soils, but differ in not having the finer textured Bt horizon that is typical of those soils. They are also near the sandy Oakville soils, which are coarser textured throughout than Belgrade soils.

Belgrade silt loam, 0 to 2 percent slopes (BeA).—This soil has the profile described as representative of the series. Areas are wide, oval, and irregularly shaped and are generally less than 10 acres in size. Runoff is slow.

Included with this soil in mapping are small areas where the surface layer is loam or fine sandy loam; small areas of the somewhat poorly drained Wallington soils and the well-drained Hartland soils; spots of Hudson and Rhinebeck soils, both of which have a finer textured subsoil; and areas of the sandy Oakville soils.

This Belgrade soil is well suited to crops, pasture, and woodland. Spot wetness is a limitation in spring. Draining of these spots improves conditions for earlier spring planting. Preparing a seedbed is easy because the soil contains little or no gravel. Capability unit IIw–1; woodland group 3o1.

Belgrade silt loam, 2 to 6 percent slopes (BeB).—This soil has a profile similar to the one described as representative of the series, but in places the depth to mottling is greater. Slopes are smooth, and runoff is medium. This soil is on the lake plain. Individual areas are irregularly shaped and are generally less than 10 acres in size.

Included with this soil in mapping are small areas where the surface layer is loam or fine sandy loam; small areas of the somewhat poorly drained Wallington soils and the well-drained Hartland soils; spots of Hudson and Rhinebeck soils, both of which have a finer textured subsoil; and small areas of the sandy Oakville soils.

This Belgrade soil is well suited to most crops and to pasture and woodland. It responds to lime and fertilizer. It can be worked easily into a seedbed because it contains little or no gravel. Unless protected, it is subject to moderate to severe erosion in cultivated areas. Capability unit IIe–1; woodland group 3o1.

Bernardston Series

The Bernardston series consists of deep, well drained and moderately well drained, medium-textured soils that have a very firm fragipan. These soils formed in glacial till derived from shale, slate, and sandstone. They are gently sloping to very steep and are on uplands. Many are on drumlins (fig. 5).

A representative profile in a cultivated area has a surface layer of very dark grayish-brown gravelly silt loam 9 inches thick. The upper 18 inches of the subsoil is yellowish-brown, friable gravelly silt loam. Below this is a 1-inch, leached layer of light brownish-gray gravelly loam. Between depths of 28 and 72 inches is a dense, slowly permeable fragipan of olive-brown, very firm gravelly loam. The substratum is olive-brown gravelly loam that is less dense and not so firm as the fragipan. It extends to a depth of 92 inches.

In spring and during wet periods, the water table is perched on the slowly permeable fragipan within 18 to 30 inches of the surface. The depth of rooting is limited mainly to the upper 18 to 30 inches. Very few roots penetrate the fragipan (fig. 6). Permeability is moderate above the fragipan. Available moisture capacity is moderate to high. These soils are low or very low in content of lime and need regular applications of lime. Their capacity to supply nitrogen and phosphorus is medium. Their capacity to furnish potassium is low. Although the plow layer is gravelly and contains pieces of shale and slate, these fragments do not interfere greatly with working the soil.

Representative profile of Bernardston gravelly silt loam, 3 to 8 percent slopes, in a hayfield; town of Easton, 50 feet south of Meeting House Road, one-third mile east of South Cambridge Road at Meeting House Road:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) gravelly silt loam; moderate, fine and medium, granular structure; friable; many roots; 20 percent coarse fragments of shale, slate, and sandstone; slightly acid; abrupt, smooth boundary.

B2—9 to 27 inches, yellowish-brown (10YR 5/6) gravelly silt loam; moderate, fine, subangular blocky structure; friable; many roots in upper part, common roots in lower part; 30 percent coarse fragments and a few weathered remnants of sandstone; medium acid; abrupt, wavy boundary.

A′2—27 to 28 inches, light brownish-gray (2.5Y 6/2) gravelly loam; few, fine, distinct mottles of yellowish brown (10YR 5/6); weak, medium, platy structure; friable; few roots; 25 percent coarse fragments of shale and slate and remnants of weathered sandstone; medium acid; abrupt, irregular boundary.

B′x—28 to 42 inches, olive-brown (2.5Y 4/4) gravelly loam; moderate, thick, platy structure within very coarse prisms; prisms are about 24 inches wide and outlined with light brownish-gray streaks bordered with strong brown; very firm and brittle; a few roots in the streaks, none within the prisms; a few thin clay films line the pores; remnants of yellowish-brown (10YR 5/6) and grayish-brown (2.5Y 5/2) weathered sandstone appear as mottles; spots of black manganese stain on plate faces; 25 percent coarse fragments; strongly acid; diffuse, wavy boundary.

Figure 5.—**Bernardston soil on a drumlin.**

C1x—42 to 72 inches, olive-brown (2.5Y 4/4) gravelly loam; moderate, thick, platy structure; very firm and brittle; no roots; no clay films in pores; 25 percent coarse fragments; strongly acid; diffuse, wavy boundary.

C2—72 to 92 inches, olive-brown (2.5Y 4/4) gravelly loam; moderate, medium and thick, platy structure; firm; no roots; spots of dark manganese stain on plates; dark-brown (7.5YR 3/2) bodies of weathered slate and sandstone; 25 percent coarse fragments; slightly acid.

Depth to the fragipan ranges from 18 inches to 30 inches. In places the fragipan is in the C horizon, not the B horizon. The A'2 horizon does not occur in all places. The depth to bedrock ranges from 3½ feet to 5 feet or more. The content of coarse fragments ranges from 20 to 35 percent throughout the soil. Reaction in the solum ranges from very strongly acid through medium acid except where the soil is limed. Reaction in the substratum ranges from strongly acid through moderately alkaline. In places the lower part of the substratum is calcareous. In places large stones and boulders occur throughout the soil.

The A horizon ranges from very dark grayish brown (10YR 3/2) through dark brown (10YR 4/3). The B horizon ranges from dark brown (10YR 4/3) through light olive brown (2.5Y 5/6) and is gravelly loam or gravelly silt loam. The A'2 horizon ranges from grayish brown (2.5Y 5/2) through pale brown (10YR 6/3) and is gravelly loam or gravelly silt loam. The B'x horizon ranges from dark reddish gray (5YR 4/2) through light olive brown (2.5Y 5/4); is gravelly loam or gravelly silt loam; has thin, medium to thick, platy structure within prisms; and is very firm or extremely firm. The C horizon has the same colors as the B'x horizon. It ranges from gravelly fine sandy loam through gravelly silt loam and does not have clay films in the pores.

Some Bernardston soils in Washington County have a higher reaction in the substratum than is defined as the range for the series, but this difference does not affect their usefulness or behavior.

Bernardston soils formed in material similar to that of the closely associated, somewhat poorly drained Scriba soils and the shallow Nassau soils. They are also near the very poorly drained Sun soils.

Bernardston gravelly silt loam, 3 to 8 percent slopes (BnB).—This soil has the profile described as representative of the series. It is on hilltops, convex hillsides, and crests of drumlins in the rolling uplands. Areas are oval and irregularly shaped and are generally less than 10 acres in size.

Included with this soil in mapping are small areas where the surface layer is gravelly loam and small areas of the shallow Nassau soils. Also included in depressions and along drainageways are spots of the somewhat poorly drained Scriba soils and the poorly drained and very poorly drained Sun soils and, in the eastern part of the county, places where the subsoil is slightly redder than is typical.

Figure 6.—**Profile of Bernardston gravelly silt loam showing fragipan that restricts root penetration.**

If adequately limed and fertilized, this Bernardston soil is well suited to all crops grown in the county. It is also suited to pasture and woodland. Unless protected, it is subject to slight to moderate erosion in cultivated areas. Most of the acreage is used for corn, grain, and hay crops for dairy farming. Capability unit IIe–4; woodland group 3o1.

Bernardston gravelly silt loam, 8 to 15 percent slopes (BnC).—This soil has a profile similar to the one described as representative of the series, but in places the upper part of the subsoil is thinner. The soil is on hillsides and hilltops in the uplands. Slopes are convex. Areas are elongated and are generally less than 20 acres in size. Runoff is medium.

Included with this soil in mapping are small areas of eroded soils where the topsoil is thinner than in the profile described as representative of the series. Also included are places where the surface layer is gravelly loam, spots of the shallow Nassau soils and the wetter Scriba and Sun soils along drainageways and seep spots, and, on the southern end of drumlins, small areas of water-sorted sand and gravel.

This Bernardston soil is suited to crops, pasture, and woodland. The hazard of erosion is moderate to severe. Erosion control is needed, especially on long slopes. Capability unit IIIe–5; woodland group 3o1.

Bernardston gravelly silt loam, 15 to 25 percent slopes (BnD).—This soil has a profile similar to the one described as representative of the series, but the upper part of the subsoil is typically thinner. The soil is on hillsides. In places slopes are short and tip in many directions. Most areas are elongated and are less than 20 acres in size. Runoff is medium to rapid.

Included with this soil in mapping are areas where the surface layer is gravelly loam and areas of the shallow Nassau soils. Also included, on the southern end of drumlins, are spots of water-sorted sand and gravel that are more difficult to work than the uniformly sloping soils.

This Bernardston soil is suited to hay, pasture, and woodland. It is subject to erosion and is poorly suited to row crops. It is moderately steep, and the use of farm equipment is dangerous. Most of the acreage is grassland. Capability unit IVe–1; woodland group 3r2.

Bernardston-Nassau shaly silt loams, 3 to 8 percent slopes (BrB).—This complex is about 60 percent Bernardston soil and 40 percent Nassau soil. The Bernardston soil is deep and well drained and moderately well drained. It has a profile similar to the one described as representative of the series, but the surface layer is shaly silt loam, the profile contains more slate and shale, and in a few spots the fragipan is thicker and less dense. The Nassau soil is shallow over bedrock. It has the profile described as representative of the Nassau series.

These are undulating soils, on uplands, over folded shale and slate bedrock. The surface is wavy. The few rock outcrops do not interfere with farm equipment. Individual areas are long and wide and are generally more than 15 acres in size.

Included with these soils in mapping are areas of similar soils that are 20 to 40 inches deep over bedrock; areas in the northeastern part of the county where the subsoil is slightly redder; and, in depressions and around seeps, areas of the wet Scriba and Sun soils.

The soils in this mapping unit are suitable for row crops, hay, and pasture. They tend to be droughty in spots where bedrock is close to the surface. Unless protected, they are subject to slight to moderate erosion in cultivated areas. Contour measures for erosion control are not applicable where slopes are complex. In such areas, sod-forming crops should be favored in the cropping system. The capacity of the soils to supply plant nutrients is low. Regular additions of fertilizer and lime are needed. Most of the acreage is cleared and used for dairy farming. Capability unit IIe–5; woodland group 3o1 Bernardston soil, 5d1 Nassau soil.

Bernardston-Nassau shaly silt loams, 8 to 15 percent slopes (BrC).—This complex is about 60 percent Bernardston soil and 40 percent Nassau soil, which are so intermingled that they could not be mapped separately. The Bernardston soil is deep and well drained and moderately well drained. It has a profile similar to the one described as representative of the series, but the surface layer is shaly silt loam, the profile contains more slate and shale, and in places the fragipan is less dense and is at a greater depth. The Nassau soil is shallow over bedrock. It has the profile described as representative of the Nassau series.

These soils are on uplands over folded shale and slate bedrock. The surface is wavy and bumpy. The few rock outcrops do not interefere greatly with farm equipment. Generally, the Nassau soil is on the tops of the bumps and ridges and part way down the sides, and the Bernardston soil is on the sides and in pockets between the ridges. Areas are fairly long and wide and are generally less than 20 acres in size.

Included with these soils in mapping are areas of similar soils that are 20 to 40 inches deep over bedrock and a few spots where the surface layer has washed away, leaving the subsoil exposed. Also included in the northeastern part of the county are areas where the subsoil is slightly redder and, around seeps, small spots of the wet Scriba and Sun soils.

The soils in this mapping unit are suitable for row crops, hay, and pasture. They tend to be droughty in spots where bedrock is close to the surface and available moisture capacity is low or very low. Unless protected, they are subject to moderate to severe erosion in cultivated areas. Contour measures for erosion control are not applicable where slopes are complex. In such areas, sod-forming crops should be favored in the cropping system. The capacity of the soil to supply plant nutrients is low. Regular additions of fertilizer and lime are needed. Most of the acreage is cleared and used for dairy farming. Capability unit IIIe-6; woodland group 3o1 Bernardston soil, 5d1 Nassau soil.

Bernardston-Nassau shaly silt loams, rolling and hilly (BSCK).—This complex is about 60 percent Bernardston soil and 40 percent Nassau soil. It is the steepest of the Bernardston-Nassau complexes. Slopes range from 8 to 25 percent and tip in many directions. The Bernardston soil is deep and well drained. It has a profile similar to the one described as representative of the series, but the surface layer is shaly silt loam, the profile contains more shale and slate, and in places the fragipan is less dense and is at a greater depth. The Nassau soil is shallow over bedrock. It has the profile described as representative of the Nassau series.

These rolling and hilly soils are on uplands, in fairly long, wide areas about 15 to 20 acres in size. They are underlain by folded shale and slate bedrock. Consequently, surface relief is irregular. Rock crops out in a few places, but does not interefere with farming. Typically, the Nassau soil is on the tops of ridges, and the Bernardston soil is on the sides and in pockets between the ridges.

Included with these soils in mapping are areas of similar soils that are 20 to 40 inches deep over bedrock; small areas where slopes are 15 to 25 percent, are smooth, and tip in one direction; spots where the original surface layer is eroded and the subsoil is exposed; areas of the wet Scriba and Sun soils along drainageways and around seeps; and, in the northeastern part of the county, areas where the subsoil is slightly redder.

The soils in this mapping unit are suited to hay, pasture, and woodland. They are poorly suited to row crops because they are rolling and hilly, have irregular slopes, and are subject to severe erosion. Contour measures for erosion control are generally not applicable. Tillage should be confined largely to the fieldwork needed to renovate hay and pasture. Lack of moisture adversely affects crops in the shallow soil areas. The available moisture capacity is low or very low. Capability unit IVe-1; woodland group 3r2 Bernardston soil, 5d1 Nassau soil.

Bernardston very stony soils, gently sloping through moderately steep (BTC).—These soils have profiles similar to the one described as representative of the Bernardston series, but they have more surface stones and have not been plowed. Surface stones and boulders are common and are spaced about 5 to 30 feet apart. These soils are on hillsides and tops of drumlins in the uplands. Areas are oval and wide and are about 20 acres in size. Runoff is slow to medium.

Included with these soils in mapping are spots of the shallow Nassau soils; spots of the somewhat poorly drained very stony Scriba soils and the poorly drained and very poorly drained very stony Sun soils; and a few spots of less stony soils where the surface stones have been removed.

These soils are suitable for limited pasture and woodland. Surface stones seriously hinder the use of farm equipment. If cleared of stones, the soils can be used for crops. Capability unit VIs-1; woodland group 3r2.

Bernardston soils, steep and very steep (BUF).—These soils are mainly on the sides of drumlinlike hills and mountains. They have profiles similar to the one described as representative of the Bernardston series, but the surface layer ranges from gravelly or shaly silt loam or loam through very stony loam or silt loam. Most areas have never been plowed. Areas are long and wide and are generally less than 20 acres in size. Runoff is rapid.

Included with these soils in mapping are spots of severely eroded soils where the fragipan is near the surface and areas of the shallow Nassau soil.

These soils are too steep for cropping. They are suited to woodland and to some recreational use. In places they provide limited grazing. Unless protected, they are subject to very severe erosion. The use of farm machinery on these steep soils is impractical and dangerous. Capability unit VIIe-1; woodland group 3r4.

Carlisle Series

The Carlisle series consists of deep, very poorly drained organic soils. These soils formed in woody fibrous material that has accumulated in waterlogged bogs. They are nearly level and are in depressions within the glaciated uplands, lake plains, and outwash plains.

A representative profile has a surface layer of black organic material 10 inches thick. Below this is a 15-inch layer of black, massive, well-decomposed organic material. Next is 49 inches of dark reddish-brown, massive, well-decomposed organic material. Between depths of 74 and 80 inches is very dusky red, massive, neutral, fibrous organic material. This is underlain by 6 inches of light-gray, slightly sticky and slightly plastic, calcareous marl and 24 inches of dark-gray, massive, slightly sticky and slightly plastic, calcareous silt.

Water drains through the soil at a moderately rapid rate, but ponds during rainy seasons. The soils are low to high in content of lime.

Excess water is the main limiting factor in farming. Many areas of Carlisle soils are in frost pockets. The high compressibility of the organic material and the high water table also are limitations for nonfarm uses.

Representative profile of Carlisle muck in a wooded area; town of Hartford, Tamarack Swamp, 2 miles south of South Hartford, three-fourths of a mile east of N.Y. Route 40:

Oa1—0 to 10 inches, black (10YR 2/1, broken face) sapric material, dark reddish brown (5YR 2/2, rubbed); 10 percent fibers, 2 percent rubbed; weak, fine, granular structure; nonsticky, nonplastic; many fine roots; neutral; clear, smooth boundary.

Oa2—10 to 25 inches, black (5YR 2/1, broken face) sapric material, dark reddish brown (5YR 2/2, rubbed); 10 percent fibers, 2 percent rubbed; massive; nonsticky, slightly plastic; few roots; neutal; clear, smooth boundary.

Oa3—25 to 63 inches, dark reddish-brown (5YR 2/2, broken face) sapric material, very dusky red (2.5YR 2/2, rubbed); 3 percent fibers, about 3 percent rubbed; massive; nonsticky, slightly plastic; no roots; neutral; clear, smooth boundary.

Oa4—63 to 74 inches, dark reddish-brown (5YR 2/2, broken face and rubbed) sapric material; 20 percent fibers, 4 percent rubbed; massive; nonsticky, slightly plastic; no roots; neutral; clear, smooth boundary.

Oa5—74 to 80 inches, very dusky red (2.5YR 2/2, broken face) sapric material, dark redish brown (5YR 2/2, rubbed); 40 percent fibers, 6 percent rubbed; massive; nonsticky, slightly plastic; no roots; neutral; clear, smooth boundary.

IILca—80 to 86 inches, light-gray (5YR 6/1, broken face) marl, gray (5YR 5/1, rubbed); 3 percent fibers, 1 percent rubbed; massive; slightly sticky, slightly plastic; no roots; moderately alkaline; calcareous; many small shells; abrupt, smooth boundary.

IIIC—86 to 110 inches; dark-gray (N 4/0) silt; massive; slightly sticky, slightly plastic; no roots; moderately alkaline; calcareous; occasional shell.

The depth to bedrock is more than 4½ feet. Reaction in the 12- to 35-inch section ranges from medium acid to mildly alkaline. The content of woody fragments ranges to as much as 30 percent, by volume, throughout the soil.

The surface layer is mainly black sapric material. The subsurface layer is mainly black or dark reddish brown, but ranges from black (5YR 2/1) through dark brown (10YR 3/3). It is mostly sapric material that has a rubbed fiber content of less than 10 percent, by volume. The bottom layer has colors similar to those of the overlying material. Sapric material is dominant throughout, but hemic and fibric material occurs in some places.

In the glaciated uplands Carlisle soils are closely associated with the Nassau and Hollis soils, which are shallow over bedrock. On the lake plain they are near the poorly drained Covington and Madalin soils.

Carlisle muck (Ca).—This soil has the profile described as representative of the series. It consists of well-decomposed organic deposits more than 51 inches deep that have accumulated in wet depressions. These level boggy areas receive runoff from surrounding soils. Runoff is slow, and large quantities of water are stored during snowmelt in spring. Areas vary. They are generally less than 40 acres in size, but range from a few acres to several hundred acres.

Included with this soil in mapping are many areas that are underlain by marl at a depth of 58 to 110 inches and others that are underlain by silt loam and silt at a depth between 54 and 80 inches. Also included are spots of soils that are more acid and a few areas of Palms soils.

This very poorly drained muck must be drained if it is to be used for crops or pasture. After drainage it is subject to settling. Soil blowing occurs in cultivated areas during dry periods. Many areas are in frost pockets. Most of the acreage is forest of red maple and other water-tolerant trees. If adequately drained, the soil has a high potential for specialty vegetables or sod crops. Capability unit IIIw-5; woodland group 5w1.

Charlton Series

The Charlton series consists of deep, well-drained, moderately coarse textured soils. These soils formed in glacial till derived mainly from syenite and granite gneisses. They are gently sloping to steep and are on hilly and mountainous uplands. Surface stones and boulders are common. They are spaced about 5 to 30 feet apart.

A representative profile in a forested area has a 1-inch organic layer of decomposed leaves and twigs and a 2-inch mineral surface layer of very dark grayish-brown sandy loam. The subsoil extends to a depth of 28 inches. The upper 5 inches is dark-brown, friable sandy loam, and the lower 21 inches is yellowish-brown, friable sandy loam. The substratum is light olive-brown, friable gravelly sandy loam that has pockets of loamy fine sand. Stones and boulders are common throughout the soil.

The seasonal water table is deep in this well-drained soil and generally does not influence land use. Water drains through these friable soils at a moderate rate. Plant roots can penetrate deeply because no restricting layers occur. Available moisture capacity is low to high. The soils are low or very low in content of lime. Their capacity to supply nitrogen is medium. Their capacity to supply phosphorus and potassium is low.

Surface stones and boulders and steep slopes are the main limiting factors for farm and nonfarm uses.

Representative profile of Charlton very stony sandy loam, sloping, in woodland; town of Dresden, 1 mile west of N.Y. Route 22, borrow pit south of Cross Road:

O2—1 inch to 0, decomposed leaves and twigs.

A1—0 to 2 inches, very dark grayish-brown (10YR 3/2) sandy loam; weak, fine, granular structure; friable; many roots; 12 percent coarse fragments; strongly acid; abrupt, smooth boundary.

B21—2 to 7 inches, dark-brown (7.5YR 4/4) sandy loam; weak, fine, subangular blocky structure; friable; many roots; 15 percent coarse fragments; strongly acid; clear, wavy boundary.

B22—7 to 14 inches, yellowish-brown (10YR 5/6) sandy loam; weak, fine, subangular blocky structure; friable; common roots; 15 percent coarse fragments; strongly acid; clear, wavy boundary.

B23—14 to 28 inches, yellowish-brown (10YR 5/4) sandy loam; weak, fine, subangular blocky structure; friable; common roots; 15 percent coarse fragments; strongly acid; clear, wavy boundary.

C—28 to 50 inches, light olive-brown (2.5Y 5/4) gravelly sandy loam that has pockets of loamy sand; massive; friable; few roots; 20 percent coarse fragments; strongly acid.

The solum ranges from 20 to 30 inches in thickness. The depth to bedrock is more than 40 inches and is commonly more than 10 feet. Stones and boulders are scattered throughout the soil, and the surface layer ranges from stony to extremely stony. Reaction is very strongly acid or strongly acid.

The A1 horizon ranges from very dark grayish brown (10YR 3/2) through dark brown (10YR 3/3). The Ap horizon, where present, ranges from very dark grayish brown (10YR 3/2) through dark yellowish brown (10YR 4/4). The B21 horizon ranges from dark brown (7.5YR 4/4) through brownish yellow (10YR 6/6), the B22 horizon ranges from dark yellowish brown (10YR 4/4) through olive yellow (2.5Y 6/6), and the B23 horizon ranges from dark yellowish brown (10YR 4/4) through olive yellow (5Y 6/6). The B2 horizon is sandy loam, fine sandy loam, or loam and their gravelly analogs. The C horizon ranges from dark grayish brown (2.5Y 4/2) through pale olive (5Y 6/4), is sandy loam or fine sandy loam and their gravelly analogs, and contains pockets and discontinuous layers of loamy sand.

Charlton soils formed in material similar to that of the closely associated, somewhat excessively drained Hollis soils, which are shallow over bedrock. They are also near the moderately well drained clayey Vergennes soils, which are on lake plains at elevations of 100 to 400 feet.

Charlton association, very stony, gently sloping and sloping (CHC).—This soil association is about 70 percent Charlton very stony sandy loam and 30 percent soils of minor extent. It is in the Adirondacks in the northern part of the county, generally on hillsides and the crests of hills. Surface stones and boulders are numerous. Areas are fairly long and are 30 acres or more in size.

The Charlton soils in this association are deep, well drained, and dominantly moderately coarse textured throughout. They contain numerous stones and boulders, which are spaced about 5 to 30 feet apart on the surface. One of the soils has the profile described as representative of the series. The soils of minor extent formed in material similar to that of Charlton soils. They are mainly moderately well drained, but in spots are somewhat poorly drained to very poorly drained. They are on foot slopes and in depressions where runoff is slow and water accumulates. Also in this association, intermingled with Charlton soils, are the shallow, somewhat excessively drained Hollis soils. They have hard bedrock at a depth of 10 to 20 inches in many places and are about 10 to 25 percent exposed rock.

Included with these soils in mapping are some soils that are less acid than Charlton soils and some soils that have a weak fragipan. The less acid soils are generally at lower elevations in the mountains.

Most of the acreage is forest, to which the soils are well suited. Excessive stoniness limits their use for farming. A few areas have been cleared of stones and are used for hay. Capability unit VIs–1; woodland group 4o1.

Charlton association, very stony, moderately steep and steep (CHE).—This soil asociation is about 70 percent Charlton very stony sandy loam and 30 percent soils of minor extent. It is in the Adirondacks in the northern part of the county, generally on sharply rising hillsides and mountainsides. Surface stones and boulders are numerous. Areas are roughly oblong in shape and are 40 acres or more in size.

The Charlton soils in this association are deep, well drained, and dominantly moderately coarse textured throughout. They contain numerous stones and boulders, which are spaced about 5 to 30 feet apart on the surface. The soils of minor extent formed in material similar to that of Charlton soils. They are no more than moderately well drained. They are on foot slopes in depressions or along drainageways where runoff is slow and water accumulates. Also of minor extent, intermingled with Charlton soils, are the shallow, somewhat excessively drained Hollis soils. They have hard bedrock at a depth of 10 to 20 inches in many places and are about 10 to 25 percent exposed rock.

Included with these soils in mapping are some soils that are less acid than Charlton soils, some soils that have a weak fragipan, and others that have a finer textured subsoil and substratum. The less acid soils are generally in areas at lower elevations in the mountains.

Most of the acreage is forest, to which the soils are well suited. Excessive stoniness and steep slopes are limiting factors for farm and many nonfarm uses. Capability unit VIIs–1; woodland group 4r1.

Claverack Series

The Claverack series consists of deep, moderately well drained, coarse-textured soils. These soils formed in 20 to 40 inches of sandy material over lacustrine silt and clay. They are nearly level and gently sloping and are on lake plains.

A representative profile in a cultivated area has a surface layer of dark grayish-brown loamy fine sand 8 inches thick. The subsoil is very friable or friable loamy fine sand that extends to a depth of 33 inches. It is yellowish brown to a depth of 18 inches, mottled yellowish brown between depths of 18 and 29 inches, and mottled strong brown between depths of 29 and 33 inches. The substratum is mottled dark-brown, firm silty clay loam to a depth of 63 inches. Between depths of 63 and 96 inches or more, the substratum is multicolored brown, firm, varved fine sand, silt, and clay.

In spring and during wet periods, the water table rises to within 18 to 24 inches of the surface. The clayey substratum, which begins at depths of 20 to 40 inches, restricts downward movement of water. Permeability is rapid in the sandy material and very slow in the clayey substratum. The depth of rooting is limited mainly to the upper 20 to 40 inches of the friable sandy material. Available moisture capacity is low to moderate. Water runs off at a slow rate. These soils are low to high in content of lime. Their capacity to supply phosphorus and potassium is low. Their capacity to furnish nitrogen is medium.

Seasonal slight wetness and the slow permeability of the clayey substratum are the limiting factors for farm and nonfarm uses.

Representative profile of Claverack loamy fine sand, 0 to 2 percent slopes, in a hayfield; town of Kingsbury, 50 feet south of Hopkins Road, one-fourth mile northwest of Pattens Mills:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) loamy fine sand; weak, fine, granular structure; very friable; many roots; slightly acid; abrupt, smooth boundary.

B21—8 to 18 inches, yellowish-brown (10YR 5/6) loamy fine sand; weak, medium, granular structure; very friable; many roots; neutral; clear, wavy boundary.

B22—18 to 29 inches, yellowish-brown (10YR 5/6) loamy fine sand; few, fine, faint mottles of gray (10YR 6/1) and few, fine, faint mottles of yellowish brown (10YR 5/8); weak, fine, subangular blocky structure parting to weak, fine, granular; very friable; few roots; neutral; clear, wavy boundry.

B3—29 to 33 inches, strong-brown (7.5YR 5/6) loamy fine sand; common, medium, distinct mottles of gray (10YR 5/1); weak, fine, subangular blocky structure parting to weak, fine, granular; friable; few roots; pockets of dark yellowish-brown (10YR 4/4) fine sandy loam, 2 inches in diameter; neutral; abrupt, wavy boundary.

IIC1—33 to 63 inches, dark-brown (10YR 3/3) silty clay loam; common, fine, distinct mottles of gray (10YR 6/1) and strong brown (7.5YR 5/6); weak, medium, platy structure as depositional varves; firm, slightly plastic and slightly sticky; few roots; lenses of fine sand throughout; neutral; abrupt, smooth boundary.

IIC2—63 to 96 inches, varved, reddish-brown (5YR 5/3) clay, brown (10YR 4/3) fine and very fine sand, and olive-brown (2.5Y 4/4) silt; few, medium, distinct mottles of strong brown (7.5YR 5/6) in sandy and clayey varves; strong, thick, inherited platy structure; firm, slightly plastic and slightly sticky; no roots; varves are ⅛ to 1 inch thick; water table at depth of 96 inches; slightly acid.

Thickness of the solum and depth to the underlying finer textured material range from 20 to 40 inches. Depth to bedrock is more than 6 feet. The soil contains no gravel or stones. Reaction in the solum ranges from strongly acid through neutral. Reaction in the C horizon ranges from slightly acid through moderately alkaline. The C horizon is calcareous in places.

The Ap horizon ranges from dark grayish brown (10YR 4/2) through dark brown (10YR 4/3). The B horizon ranges from dark brown (7.5YR 4/4) through yellowish brown (10YR 5/6), has gray mottles in the lower part, and is loamy fine sand or fine sand. Pockets of dark yellowish-brown (10YR 4/4) fine sandy loam occur in places. The IIC horizon ranges from reddish brown (5YR 5/3) through olive brown (2.5Y 4/4) and from heavy silty clay loam to clay. The material is massive or varved. The varves are thick plates of silt, clay, or sand.

Claverack soils formed in similar materials and are closely associated with the somewhat poorly drained Cosad soils. On the lake plain they are near the clayey Vergennes and Kingsbury soils. In places they are also near the deep, excessively drained sandy Oakville soils.

Claverack loamy fine sand, 0 to 2 percent slopes (ClA).—This soil has the profile described as representative of the series. It is on the lake plain. Areas are wide and oval and are less than 10 acres in size. Runoff is somewhat slow.

Included with this soil in mapping are areas of the similar but somewhat poorly drained Cosad soils in low spots, small areas of sandy loam over clay, a few spots where the clay is either deeper or shallower than in this Claverack soil, and spots of well-drained sand over clay where mottles are much deeper in the profile than in this Claverack soil.

This soil is suited to crops, pasture, and woodland. It is sandy and very friable, contains no coarse fragments, and is easy to work. If adequately limed and fertilized, it is well suited to most crops grown in the area. Wetness sometimes delays planting for a short period in spring. Capability unit IIw-1; woodland group 3s1.

Claverack loamy fine sand, 2 to 6 percent slopes (ClB).—This soil is on the lake plain where some runoff accumulates. Areas are long and wide and are generally less than 10 acres in size.

Included with this soil in mapping are areas of the similar but somewhat poorly drained Cosad soils in low spots; areas of sandy loam over clay; knolls of deep, sandy, excessively drained Oakville soils; areas of well-drained loamy fine sand over clay where mottles are much deeper in the profile than in this Claverack soil; and spots where clay is very close to the surface.

This Claverack soil is suited to crops, pasture, and woodland. If adequately limed and fertilized, it is well suited to most crops grown in the area. Wetness sometimes delays planting for a short period in spring. Unless protected, this soil is subject to slight to moderate erosion in cultivated areas. Capability unit IIW-2; woodland group 3s1.

Cosad Series

The Cosad series consists of deep, somewhat poorly drained soils that formed in lacustrine deposits of sand over clay. These soils are nearly level and are on lake plains where runoff is very slow and runoff water accumulates.

A representative profile in a cultivated area has a surface layer of very dark grayish-brown fine sandy loam 9 inches thick. The subsoil is loamy fine sand that extends to a depth of 30 inches. The upper 9 inches is mottled light olive brown and friable, and the lower 12 inches is mottled grayish brown and very friable. The substratum is light olive-brown, firm clay that extends to a depth of 52 inches or more. Few or no coarse fragments occur throughout the soil.

In spring and during wet periods, a water table is perched on the clay substratum at a depth of 6 to 18 inches. Water drains rapidly through the sand and slowly or very slowly through the clay. The depth of rooting is strongly influenced by depth to the clay and the water table and is limited mainly to the upper 24 inches. Available moisture capacity is low to moderate, but enough moisture is generally available for plant growth. These soils are low through high in content of lime. Their capacity to supply phosphorus and potasium is low. Their capacity to furnish nitrogen is medium.

The seasonal high water table and the slow permeability of the clay substratum are the main limitations for farm and nonfarm uses.

Representative profile of Cosad fine sandy loam, in a pasture; town of Fort Ann, one-half mile south of intersection of West Road and County Road 16, 100 feet west of County Road 16:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) fine sandy loam; moderate, fine, granular structure; friable; many roots; reddish-brown root stains; medium acid; abrupt, smooth boundary.

B21—9 to 18 inches, light olive-brown (2.5Y 5/4) loamy fine sand; common, fine, distinct, strong-brown (7.5YR 5/8) mottles and few, fine, distinct, gray (10YR 5/1) mottles; moderate, fine, subangular blocky structure; friable; common roots; slightly acid; clear, wavy boundary.

B22—18 to 30 inches, grayish-brown (10YR 5/2) loamy fine sand; common, medium, distinct, strong-brown (7.5YR 5/8) mottles and few, fine, distinct, gray (10YR 5/1) mottles; weak, fine, subangular blocky structure; very friable; very few roots; neutral; abrupt, wavy boundary.

IIC—30 to 52 inches, light olive-brown (2.5Y 5/4) clay; massive; firm; sticky and plastic; no roots; neutral.

Thickness of solum and depth to the clayey material range from 20 to 34 inches. The depth to bedrock is more than 5 feet. The sandy B horizon below a depth of 10 inches has an average texture of loamy fine sand or coarser. The soil contains few or no coarse fragments. Reaction in the upper part of the B horizon ranges from strongly acid through slightly acid. Reaction in the lower part of the B horizon ranges from medium acid through neutral. Reaction in the IIC horizon is neutral to moderately alkaline. The IIC horizon is calcareous in places.

The Ap horizon ranges from very dark gray (10YR 3/1) through very dark brown (10YR 2/2). The B horizon ranges from loamy fine sand through loamy sand. The B21 horizon ranges from dark brown (7.5YR 4/4) through light yellowish brown (2.5Y 6/4) and has mottles of both high and low chroma. The B22 horizon ranges from brown (7.5YR 5/4) through dark grayish brown (2.5Y 4/2) mottled with strong brown through gray. The IIC horizon ranges from brown (7.5YR 5/4) through very dark grayish brown (2.5Y 3/2) and from silty clay loam through clay.

Cosad soils formed in material similar to that of the closely associated, moderately well drained Claverack soils. Near sandy deltas they are closely associated with the excessively drained Oakville soils, which do not have the clay substratum that is typical of Cosad soils. In low places on lake plains, Cosad soils are near the Vergennes and Kingsbury soils, which formed in the lacustrine or estuarine clay that underlies Cosad soils.

Cosad fine sandy loam (Cs).—This nearly level soil is in slight depressions on deltas and lake plains. Areas are oblong shaped and generally less than 10 acres in size. Surface runoff is slow or ponded.

Included with this soil in mapping on slight rises are areas of moderately well drained Claverack soils, which formed in similar material. Also included are small areas where the surface layer is loamy fine sand through loamy sand, spots of wetter soils, and areas of soils where the surface layer and subsoil are finer textured. Also included are spots where the clay is closer to the surface and spots where it is at a depth of more than 40 inches.

This Cosad soil is suited to crops, pasture, and woodland. In undrained areas, wetness delays planting and limits the choice of crops. If adequately drained, limed, and fertilized, this soil is suited to most crops grown in the county. Capability unit IIIw-2; woodland group 4w2.

Covington Series

The Covington series consists of deep, poorly drained, moderately fine textured soils that have a fine-textured subsoil. These soils formed in calcareous, clayey lacustrine or estuarine sediments. They are mainly nearly level and are in depressional areas on lake plains.

A representative profile in a cultivated area has a surface layer of very dark gray silty clay loam 6 inches thick. This is underlain by a 7-inch subsurface layer of mottled dark-gray silty clay. The subsoil is mottled grayish-brown, firm, very sticky and very plastic clay that extends to a depth of 27 inches. The substratum is mottled dark grayish-brown, firm, very sticky and very plastic, calcareous clay to a depth of 55 inches. Between depths of 55 and 93 inches or more, the substratum is mottled dark-gray, varved, calcareous clay. Few or no coarse fragments occur throughout the soil.

For long periods in spring and during wet periods, a water table is at or near the surface. It is perched on the very slowly permeable subsoil and substratum. Plant roots are influenced by the water table and are restricted mainly to the upper 10 to 15 inches of soil. A few penetrate to a greater depth as the water table recedes. Available moisture capacity of the main rooting zone is low, but more than enough water is generally available for plant growth. Water runs off these soils slowly, and they receive runoff from surrounding areas. Ponding is common after rainy periods. The surface layer is high in organic-matter content. It contains a large amount of nitrogen, but nitrogen is released very slowly in spring when the soil is wet and cold. These soils are medium to high in content of lime. Their capacity to supply phosphorus is medium. Their capacity to supply potassium is high.

Excess water is the main limiting factor for farm and nonfarm uses. The high content of clay and the very slow permeability also affect use.

Representative profile of Covington silty clay loam, in a hayfield; town of Kingsbury, 25 feet north of County Route 36, one-half mile northwest of U.S. Route 4 at County Route 36:

Ap—0 to 6 inches, very dark gray (10YR 3/1) silty clay loam; moderate, fine, granular structure; firm; many roots; slightly acid; abrupt, smooth boundary.

A2g—6 to 13 inches, dark-gray (N 4/0) silty clay; many, fine, prominent mottles of yellowish brown (10YR 5/4) and few, medium, distinct mottles of very dark grayish brown (2.5Y 3/2); coarse prisms 4 to 8 inches in diameter; strong, medium and coarse, blocky structure within prisms; firm, sticky and plastic; common roots; neutral; clear, wavy boundary.

B2tg—13 to 27 inches, grayish-brown (2.5Y 5/2) clay; common, fine, distinct mottles of dark yellowish brown (10YR 4/4) and few, fine, distinct mottles of gray

(10YR 5/1); very coarse prisms 4 to 8 inches in diameter; strong, medium and coarse, blocky structure within prisms; firm, very sticky and very plastic; few roots; many very fine pores; continuous gray (10YR 5/1) clay films on ped faces and inside pores; neutral; gradual, wavy boundary.

C1g—27 to 55 inches, dark grayish-brown (2.5Y 4/2) clay; common, fine, distinct mottles of gray (N 6/0) and olive brown (2.5Y 4/4); strong, medium, blocky structure; firm, very sticky and very plastic; few roots; mildly alkaline; calcareous; clear, wavy boundary.

C2g—55 to 93 inches, dark-gray (N 4/0), varved clay; common, medium, distinct mottles of yellowish brown (10YR 5/4); moderate, thick, inherited platy structure; firm, very sticky and very plastic; no roots; many light-gray carbonate nodules; mildly alkaline; calcareous.

The solum ranges from 20 to 40 inches in thickness. Depth to bedrock is more than 3½ feet. Depth to carbonates ranges from 20 to 48 inches and is typically about 24 inches. Reaction in the A and B horizons ranges from medium acid to neutral. The C horizon is calcareous. The B horizon averages more than 65 percent clay.

The A horizon ranges from black (10YR 2/1) through very dark grayish brown (10YR 3/2). The A2 horizon is silty clay or clay. The B horizon ranges from olive gray (5Y 5/2) through very dark gray (10YR 3/1). The C horizon ranges from gray (N 5/0) through very dark grayish brown. The B and C horizons are clay. The C horizon ranges from varved platy structure through prismatic and massive. The soil contains few or no coarse fragments.

Covington soils formed in material similar to that of the closely associated, somewhat poorly drained Kingsbury soils and the moderately well drained Vergennes soils.

Covington silty clay loam (Cv).—This level or nearly level soil is in low-lying areas on lake or estuarine plains. Slopes are concave. Areas are narrow and irregularly shaped and are generally less than 10 acres in size. Runoff is very slow, and water accumulates from surrounding higher areas.

Included with this soil in mapping are areas of the similar but somewhat poorly drained Kingsbury soils on slight rises and, where bottom land is nearby, spots of very wet soils. Also included are areas where the surface layer is thicker and darker or is mucky and ranges from silt loam to clay.

Unless drained, this Covington soil is too wet for cultivation. Locating natural outlets is generally difficult. In undrained areas, the soil is suitable for limited midseason pasture and woodland. It is trampled easily if pastured when wet. Capability unit IVw-1; woodland group 5w1.

Farmington Series

The Farmington series consists of shallow, well-drained, medium-textured soils that have limestone bedrock within 10 to 20 inches of the surface. These soils formed in thin deposits of glacial till. They are nearly level to very steep and are on uplands where bedrock affects the relief.

A representative profile in a cultivated area has a surface layer of very dark grayish-brown loam 6 inches thick. The subsoil is yellowish-brown, friable loam. Hard, massive limestone bedrock is at a depth of 18 inches. A few coarse fragments occur throughout the profile.

These soils are friable, and water drains through them at a moderate rate. The root zone is limited by bedrock at a depth of 10 to 20 inches. Available moisture capacity is very low to moderate. These soils are medium in content of lime. Their capacity to supply nitrogen, phosphorous, and potassium is medium.

Shallowness over bedrock is the main limiting factor for farm and nonfarm uses.

Representative profile of Farmington loam, 0 to 8 percent slopes, in an idle hayfield; town of Fort Ann, 100 feet south of Hawk Road, three-fourths of a mile east of Barge Canal:

Ap—0 to 6 inches, very dark grayish-brown (10YR 3/2) loam; moderate, fine, granular structure; friable; many fine roots; 10 percent coarse fragments; medium acid; abrupt, smooth boundary.

B2—6 to 18 inches, yellowish-brown (10YR 5/4) loam; moderate, fine, subangular blocky structure; friable; common fine roots; 10 percent coarse fragments; slightly acid; abrupt, wavy boundary.

R—18 inches +, limestone bedrock.

Thickness of the solum and depth to bedrock range from 10 to 20 inches. The rock is generally limestone, but is hard shale or sandstone in places. The solum is fine sandy loam, loam, and silt loam. In unlimed soil, reaction ranges from medium acid to neutral. No free carbonates are in the fine earth above the bedrock. The content of coarse fragments ranges from 10 to 30 percent, by volume.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) through grayish brown (10YR 5/2). The B horizon ranges from brown (7.5YR 5/2) through olive brown (2.5Y 4/4) and from fine sandy loam through silt loam. It has weak or moderate subangular blocky structure through weak or moderate granular structure and is very friable or friable.

Farmington soils formed in material similar to that of the closely associated, deep, well drained Pittsfield soils and the moderately well drained Amenia soils. On the Champlain Lake Plain, Farmington soils occur as islands surrounded by the clayey, moderately well drained Vergennes soils and the somewhat poorly drained Kingsbury soils. They also are near Palatine soils, which are moderately deep over dark-colored, calcareous shale bedrock.

Farmington loam, 0 to 8 percent slopes (FaB).—This soil has the profile described as representative of the series. It is on rounded hilltops and hillsides in the uplands. The relief is affected by the underlying bedrock. Areas are irregularly shaped and are generally about 15 acres in size.

Included with this soil in mapping are spots of the deep, well drained Pittsfield soils and the moderately well drained Amenia soils and, in low areas on the lake plain, spots of the moderately well drained, clayey Vergennes soils and the somewhat poorly drained, clayey Kingsbury soils. Also included are small areas of moderately deep, very shaly Palatine soils and spots of a soil that is similar to this Farmington soil but is calcareous just above the bedrock.

This soil is suited to crops, pasture, and woodland. Unless protected, it is subject to slight to moderate erosion in cultivated areas. Lack of moisture is also a limiting factor. The few rock outcrops do not interfere greatly with farm equipment. Although this soil is underlain by limestone, in places the plow layer needs lime. Capability unit IIIs-2; woodland group 5d1.

Farmington-Rock outcrop association, nearly level through moderately steep (FCC).—This association is about 50 percent Farmington soil, 20 percent Rock outcrop, and 30 percent soils of minor extent. It is on flat-topped hills that are parts of small to large islands protruding above the lake plain. Areas are irregularly shaped and range from about 40 to more than 200 acres in size.

The Farmington soil in this association has a profile similar to the one described as representative of the series, but very rocky phases dominate the landscape, depth to bedrock is more variable within short distances, and rock outcrops are common. Intermingled throughout the areas are exposures of limestone bedrock, which make up the Rock outcrop part of the association. In places escarpments of this bedrock are short and vertical. Of minor extent are the deep, well drained Pittsfield soils and moderately well drained Amenia soils. These deep soils are intermingled with the Farmington soil and Rock outcrop at higher elevations.

Included with these soils in mapping around fringe areas adjacent to the lake plain are small areas of the somewhat poorly drained Kingsbury soils and the moderately well drained Vergennes soils, which formed in a thin veneer of glacial lake or estuarine clay over rock.

Most of the acreage is in woody vegetation or is idle. Part is used for spring pasture. Shallowness, droughtiness, and the numerous rock outcrops are limitations. Farmington soil in capability unit VIs–2, woodland group 5x1; Rock outcrop in capability unit VIIIs–1, woodland group not assigned.

Farmington-Rock outcrop association, steep and very steep (FCF).—This association is about 70 percent Farmington soil, 20 percent Rock outcrop, and 10 percent soils of minor extent. It is in hilly areas that are parts of small to large islands protruding above the lake plain. Areas are irregularly shaped and range from about 40 to more than 100 acres in size.

The Farmington soil in this association has a profile similar to the one described as representative of the series, but very rocky phases dominate the landscape, depth to bedrock is extremely variable within short distances, and rock outcrops are common. Intermingled throughout the areas are exposures of limestone bedrock, which make up the Rock outcrop part of the association. In places escarpments of this bedrock are vertical. Of minor extent are mainly the deep, well-drained Pittsfield soils. They are intermingled in varying patterns with the shallow Farmington soil and Rock outcrop.

Most of the acreage is in woody vegetation or is idle. Steep and very steep slopes, shallowness, droughtiness, and the numerous rock outcrops are limitations. Farmington soil in capability unit VIIs–2, woodland group 5x2; Rock outcrop in capability unit VIIIs–1, woodland group not assigned.

Fluvaquents

Fluvaquents (FCF) consists of recent, unconsolidated deposits of alluvial material, on flood plains, that is frequently flooded, generally wet, and subject to frequent changes through overflow. The deposits are generally stratified and range from gravel and sand to clay. Drainage ranges from excessive to very poor, but is generally poor or very poor.

Many areas are cut by old drainage channels. Mounds between the channels are typically sandy and gravelly. Sand bars occur along the larger streams. This mapping unit is influenced by the kind of area through which the stream flows. In areas of glacial till, stones are common. Near clay areas the material is finer textured, and near gravelly areas it contains a large amount of gravel.

Because these areas are subject to flooding, are wet, and vary in texture, they are not generally suitable for crops or many nonfarm uses. Some areas are used for pasture. Brush and hardwood trees grow in many places. Capability unit and woodland group not assigned.

Fredon Series

The Fredon series consists of deep, somewhat poorly drained or poorly drained, medium-textured soils. These soils formed in water-sorted sand and gravel deposits. They are nearly level and are in depressions in outwash plains and terraces.

A representative profile in a cultivated area has a surface layer of very dark gray silt loam 7 inches thick. Below this is a 6-inch leached layer of mottled grayish-brown silt loam. The subsoil is mottled gray, friable gravelly fine sandy loam that extends to a depth of 22 inches. The substratum is loose, water-sorted, dark grayish-brown fine gravelly loamy sand that extends to a depth of 50 inches. Between depths of 50 and 80 inches or more, the substratum is interbedded loose very gravelly sand.

In spring and during wet periods, the water table rises to within 6 to 12 inches of the surface. During drier periods it recedes quickly through the rapidly permeable substratum. Permeability is moderate to moderately rapid. The depth of rooting is strongly influenced by the water table. In spring, roots are confined mainly to the upper 8 to 10 inches and, as the season progresses, extend to a depth of 20 to 25 inches or more. Available moisture capacity is only moderate in the main root zone, but the water table fluctuates and plants seldom show moisture stress during periods of normal rainfall. The total content of nitrogen is high, but nitrogen is released very slowly in spring and plants respond to additional applications. These soils are medium to high in content of lime. Their capacity to supply potassium and phosphorus is medium to low.

Seasonal wetness is the main limitation for most farm and nonfarm uses. The substratum of Fredon soils is a possible source of sand and gravel.

Representative profile of Fredon silt loam, in a hayfield; town of Cambridge, 150 feet south of Perry Lane, one-half mile west of Perry Lane at N.Y. Route 372:

Ap—0 to 7 inches, very dark gray (10YR 3/1) silt loam; weak, fine, granular structure; very friable; many roots; less than 5 percent coarse fragments; neutral; abrupt, smooth boundary.

A2g—7 to 13 inches, grayish-brown (10YR 5/2) silt loam; common, fine, distinct mottles of brown (10YR 4/3) and few, medium, distinct mottles of yellowish brown (10YR 5/4); weak, very coarse prisms 3 to 4 inches across parting to moderate, fine, subangular blocky structure; friable; many roots; 5 percent coarse fragments; neutral; clear, wavy boundary.

IIB2g—13 to 22 inches, gray (10YR 5/1) gravelly fine sandy loam; many, medium, distinct mottles of strong brown (7.5YR 5/8); weak, coarse prisms parting to moderate, fine, subangular blocky structure; friable; few roots; thin clay films in pores; 20 percent coarse fragments; neutral; clear, wavy boundary.

IIIC1—22 to 50 inches, dark grayish-brown (2.5Y 4/2) fine gravelly loamy sand; single grained; loose; few roots in upper part, none in lower; 20 percent coarse fragments of fine gravel; discontinuous lenses of light olive-brown (2.5Y 5/4) very fine sand; neutral; abrupt, smooth boundary.

IVC2—50 to 80 inches, interbedded very dark grayish-brown (10YR 3/2) and dark grayish-brown (2.5Y 4/2) very gravelly sand; single grained; loose, nonplastic and nonsticky; no roots; 40 percent coarse fragments; water table at depth of 78 inches; moderately alkaline; calcareous.

Thickness of the solum and depth to stratified sand and gravel range from 22 to 35 inches. The depth to bedrock is more than 6 feet. The content of gravel ranges from 2 through 25 percent in the solum and from 20 through 75 percent in the C horizon. The fine earth material ranges from silt loam through sandy loam in the solum. Reaction in the C horizon ranges from neutral through moderately alkaline.

The Ap horizon is very dark gray (10YR 3/1) or dark grayish brown (10YR 4/2). The A2 horizon, where present, ranges from brown (10YR 5/3) through light brownish gray (2.5Y 6/2) and has distinct brown (10YR 5/3) and yellowish-brown (10YR 5/6) mottles. The B horizon ranges from gray (10YR 6/1) through olive gray (5Y 5/2), has distinct light yellowish-brown (10YR 6/4) through strong-brown (7.5YR 5/8) mottles, and has weak or moderate coarse prismatic through fine subangular blocky structure. The C horizon ranges from olive brown (2.5Y 4/4) through dark brown (10YR 4/4) and from fine gravelly loamy sand through very gravelly sand. It contains free lime in places.

Fredon soils formed in material similar to that of the closely associated, somewhat excessively drained Hoosic soils and the dominantly moderately well drained Herkimer soils. They are also closely assocated with the very poorly drained Halsey soils and the excessively drained Otisville soils, which formed in glacial outwash.

Fredon silt loam (Fr).—This nearly level soil is in depressions in outwash plains or old stream terraces. Areas are rectangular and are generally less than 10 acres in size. Runoff is slow.

Included with this soil in mapping are the moderately well drained to well drained Herkimer soils, the very poorly drained Halsey soils, and spots of the somewhat excessively drained Hoosic soils and the excessively drained Otisville soils. Also included are spots of nongravelly, wet sandy soils; spots of soils that are much deeper over sand and gravel than this Fredon soil; places where the surface layer is gravelly or is sandy loam, fine sandy loam, or loam; and a few places where the soil is strongly acid.

This Fredon soil is suited to crops, pasture, and woodland. In undrained areas, planting is delayed and the choice of crops is limited. If properly drained and fertilized, this soil is well suited to row crops and hay. Capability unit IIIw-2; woodland group 3w3.

Halsey Series

The Halsey series consists of deep, very poorly drained, medium-textured soils. These soils formed in water-sorted glacial outwash. They are nearly level, have slow runoff, and are in depressions in outwash plains or terraces.

A representative profile has a surface layer of very dark grayish-brown mucky silt loam 7 inches thick. This is underlain by a 2-inch leached layer of mottled gray silt loam. The subsoil extends to a depth of 23 inches. The upper 9 inches is mottled light brownish-gray, friable gravelly loam. The lower part is mottled dark grayish-brown, very friable gravelly fine sandy loam. The substratum is dark grayish-brown, loose, stratified very gravelly medium and coarse sand that extends to a depth of 50 inches or more.

In spring and during wet periods, the water table is at or near the surface. This soil is saturated with water most of the year. During dry periods the water table can drop more than 3 feet. Permeability is moderate to moderately rapid in the subsoil and rapid in the substratum. Plant roots are mostly limited to the upper 10 to 15 inches. During dry periods a few extend below this depth. Available mositure capacity of this zone is low to moderate, but normally more than enough moisture is available for plant growth. Water runs off these soils at a slow rate, and they receive considerable runoff from adjacent soils. The total nitrogen content is high, but nitrogen is released slowly. These soils are medium in content of lime. Their capacity to supply phosphorus and potassium is medium.

The seasonal high water table is the main limiting factor for farm and nonfarm uses.

Representative profile of Halsey mucky silt loam, in a cultivated area; town of Easton, 660 feet east of County Route 74 at 74A and 1,320 feet west of farmhouse:

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) mucky silt loam; weak, medium, granular structure; friable; many roots; 5 percent coarse fragments; slightly acid; abrupt, smooth boundary.

A2g—7 to 10 inches, gray (10YR 6/1) silt loam; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; friable; common roots; 10 percent coarse fragments; neutral; clear, wavy boundary.

B2g—10 to 19 inches, light brownish-gray (2.5Y 6/2) gravelly loam; many, coarse, distinct, yellowish-brown (10YR 5/4) mottles; weak, medium, subangular blocky structure; friable; few roots; 15 percent coarse fragments; neutral; clear, wavy boundary.

B3—19 to 23 inches, dark grayish-brown (2.5Y 4/2) gravelly fine sandy loam; few, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, fine, granular structure; very friable; no roots; 30 percent coarse fragments; neutral; abrupt, wavy boundary.

IIC— 23 to 50 inches, dark grayish-brown (2.5Y 4/2) very gravelly medium and coarse sand; 40 percent coarse fragments of sandstone, shale, and slate, some of which are well rounded; single grained; loose; no roots; neutral.

Thickness of the solum and depth to stratified sand and gravel range from 22 to 34 inches. Depth to bedrock is more than 5 feet. The content of gravel ranges from 5 through 30 percent in the solum and from 35 to 80 percent in the C horizon. Reaction in the solum ranges from medium acid through neutral. Reaction in the C horizon ranges from slightly acid through moderately alkaline. In places the C horizon is calcareous.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) through black (N 2/0). The A2g horizon is gray that ranges from 10YR 6/1 through N 6/0. The fine earth material ranges from silt loam through fine sandy loam. The B horizon ranges from gray (10YR 6/1) through olive gray (5Y 4/2) and has medium or coarse mottles that range from strong brown (7.5YR 5/6) through light olive brown (2.5Y 5/4). The fine earth material ranges from loam through fine sandy loam and their gravelly analogs. The C horizon ranges from gray (10YR 6/1) through olive gray (5Y 4/2). It is stratified sand and gravel.

Halsey soils formed in material similar to that of the closely associated, somewhat excessively drained Hoosic soils; the moderately well drained to well drained Herkimer soils; and the somewhat poorly drained or poorly drained Fredon soils. In places they are near the similar, very poorly drained Sun soils, which have a C horizon of firm glacial till in contrast to the loose sand and gravel of Halsey soils.

Halsey mucky silt loam (Ha).—This nearly level soil is in depressions in outwash plains and terraces. Areas are oval in shape and are less than 10 acres in size. Runoff is slow.

Included with this soil in mapping are the moderately well drained to well drained Herkimer soils, the somewhat poorly drained or poorly drained Fredon soils, which formed in similar material, and areas of a similar soil that is more acid. Also included are spots of soils that have a thicker muck surface layer and spots of the very poorly drained Sun soils, which formed in glacial till.

Unless drained, this Halsey soil is too wet for cultivation. If adequately drained, it is suitable for crops. Drainage outlets are difficult to locate in places. Undrained areas are limited mainly to pasture and woodland. Capability unit IVw-2; woodland group 5w1.

Hamlin Series

The Hamlin series consists of deep, well-drained, medium-textured soils. These soils formed in recent alluvium on flood plains. They are nearly level and have very slow runoff.

A representative profile in a cultivated area has a surface layer of very dark grayish-brown silt loam 10 inches thick. The subsoil is dark yellowish-brown, friable silt loam that extends to a depth of 33 inches. The substratum extends to a depth of 50 inches or more. The upper 13 inches is yellowish-brown, friable silt loam, and the lower part is brown, friable fine sandy loam. Few or no coarse fragments occur.

These soils are subject to flooding, but are rarely flooded during the growing season. Permeability is moderate. The friable subsoil provides a deep root zone and high available moisture capacity. Depth to the seasonal water table, except during flooding, is more than 2 feet. These soils are medium in content of lime. Their capacity to supply nitrogen, phosphorus, and potassium is medium.

Flooding is the main limiting factor for farm and nonfarm uses. Hamlin soils are an excellent source of topsoil.

Representative profile of Hamlin silt loam, in a hayfield; town of Whitehall, one-half mile south of Grays Corner, 60 feet west of road:

Ap—0 to 10 inches, very dark grayish-brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; weak, medium and fine, granular structure; very friable; many roots; medium acid; clear, smooth boundary.

B2—10 to 33 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, medium, subangular blocky structure; friable; common roots; neutral; clear, smooth boundary.

C1—33 to 46 inches, yellowish-brown (10YR 5/4) silt loam; massive; friable; few roots; neutral; abrupt, smooth boundary.

C2—46 to 50 inches, brown (10YR 5/3) fine sandy loam; massive; friable; few roots; few pockets of fine sand; thin lenses of black organic matter; neutral; abrupt, smooth boundary.

The Ap horizon ranges from very dark gray (10YR 3/1) through brown (10YR 4/3). The B and C horizons range from dark grayish brown (10YR 4/2) through olive (5Y 5/4). They are friable or very friable and are silt loam or very fine sandy loam to a depth of 40 inches and range from silt loam through loamy fine sand below that depth. In places the soil is mottled below a depth of 30 inches. The B horizon has weak to moderate, granular or subangular blocky structure. Occasional lenses of black organic matter occur in the C horizon.

Hamlin soils formed in material similar to that of the closely associated, moderately well drained to somewhat poorly drained Tell soils; the poorly drained Limerick soils; and the very poorly drained Saco soils.

Hamlin silt loam (Hb).—This nearly level soil is along large rivers and smaller streams on flood plains. Areas are long and narrow along the smaller streams and broad and wide along the larger waterways and are 10 to 20 acres in size.

Included with this soil in mapping are the moderately well drained to somewhat poorly drained Teel soils, the poorly drained Limerick soils, wet pockets of the very poorly drained Saco soils, and mounds of the coarser textured Hoosier and Otisville soils. Also included are small areas where the surface layer is very fine sandy loam and, along the smaller streams, areas where layers of sand and gravel in variable patterns are closer to the surface.

This Hamlin soil is suited to crops, pasture, hay, and woodland. It is one of the better soils for farming in the county. It has very little erosion or runoff, and it is easy to work. Flooding is the major limiting factor for farm use, but it rarely occurs during the growing season. Capability unit I-2; woodland group 2o1.

Hartland Series

The Hartland series consists of deep, well-drained, medium-textured soils. These soils formed in water-sorted silt and very fine sand. They are nearly level through moderately steep and are on old stream terraces, lake plains, and deltas.

A representative profile in a cultivated area has a surface layer of dark-brown very fine sandy loam 10 inches thick. The subsoil is yellowish-brown and dark yellowish-brown, friable or very friable very fine sandy loam that extends to a depth of 26 inches. The substratum is light yellowish-brown, pale-brown, and dark yellowish-brown very fine sandy loam that extends to a depth of 75 inches or more.

These well-drained soils dry out early in spring and are among the first that are ready to work. Water drains through the friable subsoil at a moderate rate and through the substratum at a moderate to moderately slow rate. The water table is deep, generally more than 4 feet below the surface. Roots can easily penetrate the friable soil and extend to a depth of 40 inches and more. Available moisture capacity is high. These soils are low to medium in content of lime. Their capacity to supply phosphorus and potassium is low. Their capacity to furnish nitrogen is medium. Crops respond well to applications of lime and fertilizer.

Plowing and preparing a seedbed are easy because the soil contains no coarse fragments. These are excellent soils for farming. The upper 12 inches is a good source of topsoil.

Representative profile of Hartland very fine sandy loam, 0 to 2 percent slopes, in an idle area; town of Easton, 250 feet north of old Schuylerville Road, three-fourths of a mile east of Hudson River:

Ap—0 to 10 inches, dark-brown (10YR 4/3) very fine sandy loam; very weak, fine, granular structure; very friable; many roots; 2 percent fine gravel; medium acid; abrupt, smooth boundary.

B2—10 to 15 inches, yellowish-brown (10YR 5/6) very fine sandy loam; weak, medium, subangular blocky structure; friable; common fine roots; many fine pores; common firm nodules, 1 centimeter to 2 centimeters in diameter, that have black and reddish-brown interiors; less than 5 percent fine gravel; neutral; clear, wavy boundary.

B3—15 to 26 inches, yellowish-brown (10YR 5/6) and dark yellowish-brown (10YR 4/4) very fine sandy loam; massive; very friable; common fine roots; many very fine pores; neutral; gradual, wavy boundary.

C1—26 to 40 inches, light yellowish-brown (10YR 6/4) and dark yellowish-brown (10YR 4/4) very fine sandy loam; massive; very friable; common fine roots; many fine pores; slightly acid; gradual, wavy boundary.

C2—40 to 53 inches, dark yellowish-brown (10YR 4/4) and light yellowish-brown (10YR 6/4) very fine sandy loam; massive; very friable; few fine roots; many fine pores; slightly acid; gradual, wavy boundary.

C3—53 to 75 inches, mixed dark yellowish-brown (10YR 4/4) and pale-brown (10YR 6/3) very fine sandy loam; massive; very friable; few fine roots; few fine pores; slightly acid.

The solum ranges from 14 to 30 inches in thickness. Depth to bedrock is more than 6 feet. The content of coarse fragments ranges from 0 to 5 percent, by volume, throughout the soil. To a depth of 50 inches the soil is silt loam, very fine sandy loam, or loamy very fine sand. It is very friable or friable throughout. Below a depth of 30 inches thin lenses of fine sand or silt occur in places. Reaction ranges from strongly acid through neutral in all horizons.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) through dark brown (10YR 4/3). The B horizon ranges from dark yellowish brown (10YR 4/4) through light olive brown (2.5Y 5/6). The C horizon ranges from very dark grayish brown (10YR 3/2) through olive yellow (5Y 6/6).

Hartland soils formed in material similar to that of the closely associated, moderately well drained Belgrade soils and the somewhat poorly drained Wallington soils. They are at higher elevations than the well-drained Hamlin soils, which formed in recent alluvium on flood plains. They are also near the sandier Oakville soils and the Vergennes and Hudson soils, which have a clayey Bt horizon.

Hartland very fine sandy loam, 0 to 2 percent slopes (HcA).—This soil has the profile described as representative of the series. It is on lake plains, deltas, and old stream terraces. Areas are generally oval in shape and are less than 10 acres in size. Runoff is slow.

Included with this soil in mapping, on the lake plain, are the moderately well drained Belgrade soils and the somewhat poorly drained Wallington soils and, in deltaic deposits, spots of the sandier Oakville soils. Also included are small areas where the surface layer is silt loam.

This Hartland soil is suited to crops, pasture, and woodland. It is excellent for farming. Capability unit I–1; woodland group 3o1.

Hartland very fine sandy loam, 2 to 6 percent slopes (HcB).—This soil has a profile similar to the one described as representative of the series, but in places the upper part of the subsoil is thinner. The soil is on lake plains and old alluvial stream terraces adjacent to flood plains. Slopes are smooth. Areas are oval in shape and are generally less than 10 acres in size. Runoff is medium.

Included with this soil in mapping, on the lake plain, are the moderately well drained Belgrade soils and the somewhat poorly drained Wallington soils and, in deltaic deposits, spots of the sandier Oakville soils. Also included are small areas where the surface layer is silt loam.

This Hartland soil is suited to crops, pasture, and woodland. It is subject to erosion. Control of runoff is needed. If erosion is controlled and lime and fertilizer are added, it is an excellent soil for farming. Capability unit IIe–1; woodland group 3o1.

Hartland very fine sandy loam, 6 to 12 percent slopes (HcC).—This soil has a profile similar to the one described as representative of the series, but in many places the upper part of the subsoil is thinner. The soil is on smooth stream terraces. Areas are long and narrow and are generally less than 10 acres in size. Runoff is medium.

Included with this soil in mapping are the moderately well drained Belgrade soils, which formed in similar material, and spots of the excessively drained sandy Oakville soils. Also included in some areas are spots of the finer textured Vergennes and Hudson soils and spots of eroded soils.

This Hartland soil is suited to crops, pasture, and woodland. It is highly susceptible to erosion. Control of runoff is needed in cultivated areas. Erosion is the main limitation for farm use. Capability unit IIIe–3; woodland group 3r1.

Hartland very fine sandy loam, 12 to 20 percent slopes (HcD).—This soil has a profile similar to the one described as representative of the series, but in most places the upper part of the subsoil is thinner. The soil is on stream terraces. Areas are long and narrow and are generally less than 10 acres in size. Runoff is rapid.

Included with this soil in mapping are the moderately steep, finer textured Hudson and Vergennes soils, which formed in lake-laid material, and areas of the sandy, moderately steep Oakville soils. Also included are spots of eroded soils where the underlying layer is sandy or clayey material and small areas where the surface layer is silt loam.

This Hartland soil is suited to pasture or woodland. Slope and the hazard of erosion are the main limiting factors for farm uses. Tillage should be limited mainly to renovation for hay or pasture. Gullies make use of farm equipment hazardous. Capability unit IVe-4; woodland group 3r3.

Herkimer Series

The Herkimer series consists of deep, dominantly moderately well drained, medium-textured soils. These soils formed in glacial outwash derived mainly from water-sorted shale, slate, and sandstone. They are nearly level to gently sloping and are in slight depressions in outwash plains, terraces, and old alluvial fans.

A representative profile has a surface layer of dark grayish-brown gravelly silt loam about 8 inches thick. The subsoil is brown, friable very gravelly loam that extends to a depth of about 21 inches. The substratum extends to a depth of 50 inches or more. The upper 10 inches is dark grayish-brown, loose very gravelly loamy sand; the middle 14 inches is brown, very friable very gravelly loam; and the lower 5 inches or more is very dark brown, loose very gravelly sand.

In spring and during wet periods, the water table rises to within 18 to 24 inches of the surface. Permeability is moderate in the surface layer and subsoil and rapid or very rapid in the substratum. The depth of rooting is influenced by the water table and is mainly limited to the upper 18 to 24 inches in spring. A few roots penetrate to a greater depth as the water table recedes. Available moisture capacity is low to moderate. These soils are low to medium in content of lime. Their capacity to supply nitrogen, phosphorus, and potassium is generally medium.

The seasonal high water table is one of the main limiting factors for farm and nonfarm uses. The substratum is a possible source of sand and gravel.

Representative profile of Herkimer gravelly silt loam, 0 to 3 percent slopes, in a pasture; town of Cambridge, 500 feet southeast of Cobble Hill Road at County Road 59:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) gravelly silt loam; moderate, fine, granular structure; friable; many fine roots; 25 percent gravel; medium acid; abrupt, smooth boundary.

B2—8 to 21 inches, brown (10YR 4/3) very gravelly loam; moderate, medium, granular structure; friable; many fine roots; 50 percent shale fragments and gravel; medium acid; clear, wavy boundary.

IIC1—21 to 31 inches, dark grayish-brown (10YR 4/2) very gravelly loamy sand; single grained; loose; few roots; 60 percent gravel and shale fragments; medium acid; clear, smooth boundary.

IIIC2—31 to 45 inches, brown (10YR 4/3) very gravelly loam; massive; very friable; few roots; 60 percent gravel and shale fragments; slightly acid; clear, wavy boundary.

IVC3—45 to 50 inches, very dark brown (10YR 2/2) very gravelly sand; single grained; loose; no roots; 50 percent gravel and shale fragments; neutral.

The solum ranges from 20 to 36 inches in thickness. The depth to bedrock is more than 60 inches. Coarse fragments of shale, slate, sandstone, and quartzite make up 20 to 50 percent of the solum and increase with increasing depth to 60 percent in the C horizon. Reaction in the upper part of the solum ranges from strongly acid through neutral. Reaction in the lower part of the solum and in the C horizon ranges from medium acid through mildly alkaline and increases with increasing depth. No free carbonates are within 50 inches of the surface. Although the soil is mainly moderately well drained, mottles are inconspicuous and do not occur in all places. Where mottles do occur, they are yellowish brown or gray, few or common, fine or distinct in the lower part of the B horizon and in the C horizon.

The A horizon ranges from very dark gray (10YR 3/1) through dark brown (10YR 4/3). The B horizon ranges from very dark gray (10YR 3/1) through olive brown (2.5Y 4/4) and from silt loam through sandy loam and their gravelly analogs and is friable. The C horizon ranges from loam through sand and their gravelly analogs, is single grained or massive, and is loose or very friable.

Herkimer soils in Washington County contain more coarse fragments in the 10- to 40-inch section than is defined as the range for the series. This difference affects the available moisture capacity somewhat.

Herkimer soils formed in material similar to that of the closely associated, somewhat excessively drained Hoosic soils; the excessively drained Otisville soils; the somewhat poorly drained or poorly drained Fredon soils; and the very poorly drained Halsey soils.

Herkimer gravelly silt loam, 0 to 3 percent slopes (HeA).—This soil has the profile described as representative of the series. It is in slight depressions in outwash terraces or plains. Areas are long, range from narrow to wide, and are about 10 to 15 acres in size. Most water enters the soil, and runoff is slow.

Included with this soil in mapping are spots of the better drained Hoosic and Otisville soils and the wetter Fredon and Halsey soils. Also included are small areas where the surface layer is gravelly loam; spots of soils that have less gravel and higher soil reaction; and small areas of coarser textured, moderately well drained soils that formed in outwash.

This Herkimer soil is suited to crops, hay, pasture, and woodland. If wet spots are adequately drained and lime and fertilizer are applied, the soil is suited to most crops. Wetness sometimes delays planting for a short period. Coarse fragments in the surface layer interfere with precision cultivation of some crops. Capability unit IIw-1; woodland group 3o1.

Herkimer gravelly silt loam, 3 to 8 percent slopes (HeB).—This soil is on outwash terraces or plains. Areas are long, range from narrow to wide, and are about 5 to 10 acres in size. Runoff is medium.

Included with this soil in mapping are spots where the surface layer ranges from gravelly loam through gravelly sandy loam and small areas of the better drained Hoosic and Otisville soils and the somewhat poorly drained or poorly drained Fredon soils. Also included are spots where the soil has less gravel and higher reaction and small areas of coarser textured, moderately well drained soils that formed in outwash material.

This Herkimer soil is suited to crops, hay, pasture, and woodland. In most places wetness delays planting for a short period. Unless protected, the soil is subject to slight erosion in cultivated areas. It is suited to most crops grown in the county. Coarse fragments cause some difficulty in plowing and preparing the seedbed. Capability unit IIw–3; woodland group 3o1.

Hollis Series

The Hollis series consists of shallow, somewhat excessively drained, medium-textured soils that formed in glacial till. Granitic bedrock is within 10 to 20 inches of the surface. These soils are gently sloping through steep and are in the Adirondack Mountains.

A representative profile has a surface layer of dark-brown loam 4 inches thick. The upper 4 inches of the subsoil is strong-brown, friable fine sandy loam, and the lower 11 inches is yellowish-brown, friable fine sandy loam. Syenite gneiss is at a depth of 19 inches.

Water drains through this soil moderately rapidly. Bedrock, which is within 10 to 20 inches of the surface, restricts root growth. Available moisture capacity is low to moderate. The soils are very low in content of lime. Their capacity to supply nitrogen is medium. Their capacity to furnish phosphorus and potassium is low. Bedrock covers as much as 50 percent of the surface area in places.

Shallowness over bedrock and rock outcrops are the main limiting factors for farm and many nonfarm uses.

Representative profile of Hollis very rocky loam, 3 to 15 percent slopes, from an area of Hollis-Rock outcrop association, gently sloping and sloping, in a forest; town of Putnam, 1,000 feet west of intersection 845, 50 feet south of road, 1½ miles northeast of Record Hill:

Ap—0 to 4 inches, dark-brown (10YR 4/3) loam; weak, fine, granular structure; friable; many roots; 5 percent coarse fragments; strongly acid; abrupt, smooth boundary

B21—4 to 8 inches, strong-brown (7.5YR 5/6) fine sandy loam; weak, fine, granular structure; friable; common roots; 10 percent coarse fragments; strongly acid; clear, wavy boundary.

B22—8 to 19 inches, yellowish-brown (10YR 5/6) fine sandy loam; weak, fine, granular structure; friable; common roots; 10 percent coarse fragments; strongly acid; abrupt, wavy boundary.

R—19 inches, syenite gneiss bedrock.

Thickness of the solum and depth to bedrock range from 10 to 20 inches. The content of coarse fragments ranges from 5 to 25 percent. Reaction in the solum is strongly acid or very strongly acid. The solum ranges from sandy loam through loam.

The A horizon is generally very dark grayish brown (10YR 3/2), but ranges through brown (10YR 4/3). The B21 horizon ranges from dark brown (7.5YR 4/4) through yellowish brown (10YR 5/8). The B22 horizon ranges from dark yellowish brown (10YR 4/4) through yellowish brown (10YR 5/6). The B horizon has weak granular or weak blocky structure and is very friable or friable.

Hollis soils formed in glacial till similar to that of the closely associated, deep, well-drained Charlton soils. They are also near Rock outcrop and the swampy Carlisle muck soils.

Hollis-Charlton association, moderately steep and steep (HLE).—This association is about 60 percent Hollis soil, 30 percent Charlton soil, and 10 percent soils of minor extent. It is on mountainsides in the Adirondacks in the northern part of the county. Granitic bedrock affects much of the relief. Areas are long and wide and are 20 to 30 acres or more in size.

The Hollis soil in this association is shallow, somewhat excessively drained, and mainly medium textured. Hard bedrock is within 10 to 20 inches of the surface. Very rocky phases dominate the landscape. About 10 to 25 percent of the surface is exposed rock, including soil too thin over rock for plant growth.

Intermingled with the Hollis soil in deeper areas is the Charlton soil. It is deep, well drained, and mainly moderately coarse textured throughout. It contains numerous stones and boulders, which are spaced about 5 to 30 feet apart on the surface.

The minor soils have a profile similar to those described as representative of the Hollis and Charlton series, but are less acid and have a surface layer that ranges from loam through sandy loam. Rock outcrop is also a minor part of this association.

Most of the association is forested. Slope, rockiness, and shallowness are limiting factors for most uses. Hollis soil in capability unit VIIs–2, woodland group 5x1; Charlton soil in capability unit VIIs–1, woodland group 4r1.

Hollis-Rock outcrop association, gently sloping and sloping (HNC).—This association is about 70 percent Hollis soil, 15 percent Rock outcrop, and 15 percent soils of minor extent. It is on the hilltops and hillsides in the Adirondacks, in the northern part of the county. The relief is affected by the granitic bedrock. Outcrops of bedrock are numerous. Areas are irregularly shaped and are 15 to 25 acres or more in size.

The Hollis soil in this association has the profile described as representative of the Hollis series. It is shallow, somewhat excessively drained, and medium textured. Hard bedrock is at a depth of 10 to 20 inches. Intermingled throughout the area are exposures of granitic bedrock that make up the Rock outcrop part of this association and areas of soil that is too thin over rock to be useful for plant growth. In places escarpments of this bedrock are short and vertical.

The soils of minor extent are the deep, well-drained Charlton soils, the very poorly drained to poorly drained Sun soils, and the very poorly drained Carlisle muck soils. The Charlton soils are intermingled in deeper pockets where no runoff accumulates, and the wetter soils are in depressions where water accumulates.

Most of this association is forested. Shallowness, droughtiness, and numerous rock outcrops are limiting factors for most uses. Hollis soil in capability unit VIs–2, woodland group 5x1; Rock outcrop in capability unit VIIIs–1, woodland group not assigned.

Hoosic Series

The Hoosic series consists of deep, somewhat excessively drained, moderately coarse textured soils. These soils formed in water-sorted glacial outwash derived mainly from slate, shale, and quartzite. They are nearly level through very steep and are on glacial outwash plains, terraces, and kames.

A representative profile in a cultivated area has a surface layer of very dark grayish-brown gravelly sandy loam 8 inches thick. The subsoil extends to a depth of 35 inches. The upper 5 inches is dark yellowish-brown, very friable very gravelly sandy loam. The lower part is dark yellowish-brown, very friable very gravelly loamy sand. The substratum is loose, water-sorted, very dark grayish-brown very gravelly sand that extends to a depth of 83 inches or more. Gravel is common throughout the soil.

This somewhat excessively drained soil dries out early in spring. It is very friable, and water drains through it rapidly or very rapidly. The water table is typically at a depth of several feet, but in places it fluctuates to within 3 feet of the surface.

The depth of rooting is mainly in the top 30 inches, but some roots extend to a greater depth. Roots are influenced by the rapid downward movement of water and plant nutrients. These soils tend to be droughty, and plants show moisture stress after short dry periods. Available moisture capacity is very low to low. These soils are low or very low in content of lime. Their capacity to supply nitrogen is medium. Their capacity to furnish phosphorus and potassium is low.

Droughtiness and the large number of coarse fragments are the main limitations for farm uses. Hoosic soils are generally an excellent source of sand or gravel (fig. 7).

Representative profile of Hoosic gravelly sandy loam, 0 to 3 percent slopes, in a hayfield; town of Cambridge, 500 feet east of Cambridge Creek at Greenwich Road, 1,000 feet north of N.Y. Route 372 at Greenwich Road:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) gravelly sandy loam; weak, fine, granular structure; very friable; many fine roots; 30 percent coarse fragments; slightly acid; abrupt, smooth boundary.

B21—8 to 13 inches, dark yellowish-brown (10YR 4/4) very gravelly sandy loam; weak, medium, granular structure; very friable; medium acid; clear, wavy boundary.

IIB22—13 to 35 inches, dark yellowish-brown (10YR 4/4) very gravelly loamy sand; weak, fine, granular structure; very friable; common fine roots; 50 percent coarse fragments, about 5 percent cobblestones; strongly acid; gradual, wavy boundary.

IIC—35 to 83 inches, very dark grayish-brown (10YR 3/2) very gravelly sand; single grained, loose; few roots in upper part, none in lower; 55 percent coarse fragments, about 5 percent cobblestones; strongly acid in upper part and mildly alkaline with increasing depth.

The solum ranges from 22 to 36 inches in thickness. The depth to bedrock is more than 6 feet. The content of coarse fragments ranges from 10 to 50 percent in the solum and

Figure 7.—Gravel pit in Hoosic soil, which formed in water-sorted glacial outwash.

from 35 to 70 percent in the substratum. In unlimed soil, reaction is strongly acid to a depth of 30 inches, generally increases to medium acid between depths of 30 inches and 7 feet, and in places increases to mildly alkaline below a depth of 7 feet.

The Ap horizon ranges from dark brown (7.5YR 3/2) through brown (10YR 4/3). The B horizon ranges from light olive brown (2.5Y 5/6) through dark brown (7.5YR 4/4). The fine earth material ranges from sandy loam through loam in the upper part and from sandy loam to loamy sand in the lower part. It has weak granular to blocky structure. The IIC horizon ranges from light olive brown (2.5Y 5/4) through dark grayish brown (10YR 4/2) and from very gravelly loamy sand through stratified sand or gravel. The material is single grained and loose.

Hoosic soils formed in material similar to that in the closely associated, excessively drained Otisville soils; the dominantly moderately well drained Herkimer soils; the somewhat poorly drained or poorly drained Fredon soils; and the very poorly drained Halsey soils. They are also near the excessively drained sandy Oakville soils.

Hoosic gravelly sandy loam, 0 to 3 percent slopes (HoA).—This soil has the profile described as representative of the series. It is on glacial outwash plains and terraces. Areas are broad and are more than 10 acres in size. Runoff is slow.

Included with this soil in mapping are small areas of the very gravelly, excessively drained Otisville soils and the moderately well drained Herkimer soils and spots of the somewhat poorly drained or poorly drained Fredon soils and the very poorly drained Halsey soils, all of which formed in similar material. Also included are spots of nongravelly sandy Oakville soils; spots where the loose, stratified material is closer to the surface than in this Hoosic soil; and small areas where the surface layer is gravelly silt loam or gravelly fine sandy loam.

This Hoosic soil is suited to crops, pasture, and woodland. Droughtiness and the coarse fragments on the surface are the main limitations for crops. Applied lime and fertilizer are rapidly leached from this soil; consequently, response is generally better to smaller but more frequent or more timely applications than to one large application. Capability unit IIs–1; woodland group 3o1.

Hoosic gravelly sandy loam, 3 to 8 percent slopes (HoB).—This soil is on outwash plains and terraces. Areas are oval and wide and are more than 10 acres in size. Runoff is medium.

Included with this soil in mapping are small areas of the excessively drained Otisville soils, the moderately well drained Herkimer soils, and the somewhat poorly drained or poorly drained Fredon soils, all of which formed in similar material. Also included are spots of nongravelly sandy Oakville soils, small areas where the surface layer is gravelly fine sandy loam or gravelly silt loam, and spots where the substratum is closer to the surface than in this Hoosic soil.

This soil is suited to crops, pasture, and woodland. Droughtiness and gravel in the surface layer are the main limitations for row crops. Also, under intensive farming practices the hazard of erosion is moderate. Applied lime and fertilizer are rapidly leached from this soil. Response, therefore, is generally better to smaller but more frequent or more timely applications than to one large application. Capability unit IIs–1; woodland group 3o1.

Hoosic gravelly sandy loam, 8 to 15 percent slopes (HoC).—This soil has a profile similar to the profile described as representative of the series, but in places the upper part of the subsoil is thinner. The soil is on the sides of kames and terraces. Areas are long and narrow and are less than 10 acres in size. Runoff is medium.

Included with this soil in mapping are small areas where the surface layer is gravelly fine sandy loam or gravelly silt loam, areas of the excessively drained very gravelly Otisville soils and nongravelly sandy Oakville soils, and spots of eroded soils that have stratified material on the surface.

This Hoosic soil is suited to crops, pasture, and woodland. The hazard of erosion, droughtiness, and coarse fragments in the surface layer are the main limitations for row crops. Because applied lime and fertilizer are rapidly leached from this soil, response is generally better to smaller but more frequent or more timely applications than to one large application. Capability unit IIIe–2; woodland group 3o1.

Hoosic gravelly sandy loam, rolling and hilly (HSDK).—This soil has a profile similar to the profile described as representative of the series, but the degree of stratification varies more from place to place. The soil is on hummocks and kames. Areas are irregularly shaped and generally are less than 10 acres in size. Slopes range from 8 to 25 percent. Surface runoff is medium to rapid.

Included with this soil in mapping are small areas where the surface layer is gravelly fine sandy loam or gravelly silt loam; spots of the excessively drained, very gravelly Otisville soils and the excessively drained, nongravelly sandy Oakville soils; and spots, in pockets between the kames, of the somewhat poorly drained or poorly drained Fredon soils.

This Hoosic soil is well suited to early pasture and woodland. It is poorly suited to crops because it is droughty, has complex slopes, and is subject to erosion. Contouring to control erosion and conserve moisture is generally not feasible. Capability unit IVe–5; woodland group 3r2.

Hoosic and Otisville soils, steep and very steep (HTF).—These soils are mainly on glacial outwash terrace escarpments, kames, and eskers. Each has a profile similar to the one described as representative of its series, but in places the material is not so well sorted. Some areas are Hoosic soils, some are Otisville soils, and some contain both soils. Areas are long and narrow or irregularly shaped and are generally less than 10 acres in size. Slopes range from 25 to 70 percent. Surface runoff is rapid.

Included with these soils in mapping are areas of soils so severely eroded that the stratified substratum material is at the surface, small areas where the surface layer is gravelly loamy sand through gravelly silt loam, and spots of steep sandy Oakville soils.

The soils in this mapping unit are not suited to crops because they are steep and subject to erosion. In places they provide limited grazing. They are droughty in summer, and grazing is limited to early in spring and late in fall. They are suited to trees and some kinds of wildlife habitat. Use of farm machinery on these steep soils is impractical and dangerous. Capability unit VIIs–1; woodland group 3r4 Hoosic soil, 4s3 Otisville soil.

Hudson Series

The Hudson series consists of deep, dominantly moderately well drained soils that have a medium-textured surface layer and a finer textured subsoil. These soils formed in lake-laid silt and clay. They are gently sloping through very steep and are on dissected lake plains.

A representative profile has a surface layer of brown silt loam 4 inches thick. Below this is a 5-inch leached layer of pale-brown, friable silt loam. The subsoil extends to a depth of 26 inches. The upper 9 inches is yellowish-brown, firm silty clay loam, and the lower 8 inches is brown, firm silty clay mottled with yellowish brown. The substratum is mottled dark grayish-brown, varved silty clay that extends to a depth of 50 inches or more. Few or no coarse fragments occur.

In spring and during wet periods, the water table is perched on the dense, slowly permeable or very slowly permeable subsoil and substratum. The seasonal high water table is 18 to 24 inches below the surface. Plant roots are mostly limited to the 18 inches above the heavy dense clay. A few penetrate to a greater depth along cracks in the clay. Available moisture capacity is high. These soils are high or medium in content of lime. Their capacity to supply nitrogen and phosphorus is medium. Their capacity to furnish potassium is high.

The high content of clay makes it difficult to maintain good tilth. The soil becomes cloddy if it is worked when it is too wet or too dry. Slow permeability and seasonal wetness are limitations for farm and nonfarm uses.

Representative profile of Hudson silt loam, 2 to 6 percent slopes, in a hayfield; town of Easton, road cut east of County Route 113, 0.9 mile south of Wright Road:

Ap—0 to 4 inches, brown (10YR 4/3) silt loam; moderate, fine, granular structure; friable; many roots; slightly acid; clear, smooth boundary.

A2—4 to 9 inches, pale-brown (10YR 6/3) silt loam; moderate, fine, subangular blocky structure; friable; many roots; neutral; clear, wavy boundary.

B&A—9 to 12 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, fine, subangular blocky structure; firm, plastic and sticky; common roots; peds are coated with pale-brown (10YR 6/3) silt 2 to 4 millimeters thick; neutral; clear, wavy boundary.

B21t—12 to 18 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, fine, subangular blocky structure; firm, plastic and sticky; common roots; thin, continuous clay films on peds; neutral; clear, wavy boundary.

B22t—18 to 26 inches, brown (10YR 4/3) silty clay; few, medium, distinct, yellowish-brown (10YR 5/6) mottles; strong, medium, angular blocky structure; firm, sticky and plastic; few roots; thin, continuous clay films on peds; neutral; clear, wavy boundary.

C—26 to 50 inches, dark grayish-brown (10YR 4/2), varved silty clay; many, medium, distinct, yellowish-brown (10YR 5/6) and brown (7.5YR 4/4) mottles; strong, medium, platy structure; firm, slightly sticky and plastic; few roots; few, thin, discontinuous clay films in upper part; moderately alkaline; calcareous.

The solum ranges from 24 to 40 inches in thickness. The depth to bedrock is generally more than 50 inches, but in places folded bedrock is within 40 inches of the surface. The soil has few or no coarse fragments. Depth to carbonates is generally about 30 inches, but ranges from 24 to 48 inches. Reaction in the solum ranges from medium acid to neutral. In some areas that have been plowed, no A2 horizon is evident.

The Ap horizon ranges from dark grayish brown (10YR 4/2) through brown (10YR 5/3). The B&A horizon ranges from yellowish brown (10YR 5/4) through pale brown (10YR 6/3). The B horizon ranges from dark grayish brown (2.5Y 4/2) through brown (7.5YR 5/4). It is silty clay, clay, or heavy silty clay loam and is 35 to 55 percent clay. The substratum is varved silt and clay that contains lenses of fine sand in places.

Hudson soils formed in lake plain material similar to that of the closely associated, somewhat poorly drained Rhinebeck soils and the poorly drained and very poorly drained Madalin soils. They are also near the shallow Nassau soils and the silty Belgrade soils, which do not have a clayey Bt horizon. They are similar to Vergennes soils, but have less clay in the Bt horizon.

Hudson silt loam, 2 to 6 percent slopes (HvB).—This soil has the profile described as representative of the series. It is on lake plains. Slopes are convex. Areas are long and wide and are generally 10 to 15 acres in size. Runoff is medium.

Included with this soil in mapping, in low places, are spots of the somewhat poorly drained Rhinebeck soils, which formed in similar materials. Also included are small areas where the surface layer is silty clay loam; some gravelly areas that adjoin the uplands or gravelly terraces; a few spots of the shallow Nassau soils; small areas of the silty, moderately well drained Belgrade soils; and small areas where the surface layer is loamy fine sand and is underlain by clay.

This Hudson soil is suited to crops, pasture, and forest. It is subject to erosion. Control of runoff is needed. Wetness sometimes delays planting for a short period in spring. If tilled at the wrong moisture content, the soil clods and puddles easily. Capability unit IIe–2; woodland group 3o2.

Hudson silt loam, 6 to 12 percent slopes (HvC).—This soil has a profile similar to the one described as representative of the series, but the leached subsurface layer does not occur in most places and slopes are shorter and in places tip in many directions. The soil is on lake plains. Drainageways are common. Areas are less long and less wide than those of the representative soil and are generally less than 10 acres in size.

Included with this soil in mapping are the somewhat poorly drained Rhinebeck soils, which formed in similar materials and are in low-lying places near drainageways. Also included are small areas where the surface layer is silty clay loam; spots of eroded soils where clay is exposed; some gravelly areas near the uplands or gravelly terraces; scattered spots of the shallow Nassau soils throughout some areas; areas of

Belgrade soils, which have similar drainage but contain more silt and fine sand and less clay; and small areas where the surface layer is loamy fine sand and is underlain by clay.

This Hudson soil is suitable for crops, pasture, and forest. It is subject to runoff and erosion. Complex slopes are common. In such areas the use of contour measures for control of runoff is not feasible, and sod-forming crops should be favored in the rotation. Capability unit IIIe–1; woodland group 3r1.

Hudson silt loam, 12 to 20 percent slopes (HvD).—This soil has a profile similar to the one described as representative of the series, but the leached subsurface layer does not occur in most places. The soil is generally in narrow strips on dissected lake plains. Slopes are short and in many places are cut by drainageways. Areas are generally less than 10 acres in size. Runoff is rapid.

Included with this soil in mapping are spots of the shallow Nassau soils. Also included are small areas where the surface layer is loamy fine sand and is underlain by clay and a few areas of eroded soils where clay is exposed.

This Hudson soil is suitable for hay, pasture, and forest. It is moderately steep, subject to severe erosion, and difficult to work. These characteristics make it poorly suited to row crops. Capability unit IVe–2; woodland group 3r3.

Hudson and Vergennes soils, steep and very steep (HWE).—These soils are mainly on the walls of deep dissections in the lake plain (fig. 8). Each has a profile similar to the one described as representative of its series, but erosion and mass slippage have made the material extremely variable from place to place. The surface layer ranges from silt loam to clay. Some areas are Hudson soils, some are Vergennes soils, and some contain both soils. Areas are long and narrow and are generally more than 20 acres in size.

Included with these soils in mapping along the drainageways that dissect the lake plain are small areas of Fluvaquents. These alluvial deposits consist mainly of clayey and silty material eroded from the Hudson and Vergennes soils.

These Hudson and Vergennes soils are too steep for cropping. They provide some limited grazing and are suitable for woodland. Runoff is rapid. Unless protected, the soils are highly susceptible to erosion. Mass slippage is a hazard, especially where slopes are more than 24 percent. Roads that traverse or are adjacent to such areas are difficult to maintain. Capability unit VIIe–1; woodland group 3r3 Hudson soil, 3c3 Vergennes soil.

Figure 8.—Steep and very steep Hudson soils on deeply dissected lake plain.

Kingsbury Series

The Kingsbury series consists of deep, somewhat poorly drained, fine-textured soils. These soils formed in calcareous estuarine or lake-laid deposits. They are nearly level to gently sloping and are on lake plains where runoff is slow or water accumulates.

A representative profile in a cultivated area has a surface layer of very dark grayish-brown silty clay 6 inches thick. Below this is a 2-inch leached layer of mottled grayish-brown, friable silty clay. Between depths of 8 and 28 inches is a subsoil of dark grayish-brown, firm clay. It is distinctly mottled to a depth of 18 inches and faintly mottled below this. The substratum is calcareous, dark grayish-brown, firm clay that extends to a depth of 50 inches or more.

During wet periods, free water is within 6 to 18 inches of the surface. The firm clay restricts the downward movement of water. Permeability is very slow. Plant roots are mainly limited to the upper 15 to 20 inches. A few penetrate deeper as the water table recedes. Available moisture capacity is only low to moderate, but more than enough water is normally available for plant growth. Surface cracks are common if the soil becomes dry. Although the content of nitrogen is high, nitrogen is released very slowly if the soil is cold and wet. These soils are high to medium in content of lime. Their capacity to supply phosphorus is medium. Their capacity to furnish potassium is high. Although these soils are calcareous in the lower part, lime is needed in the seedbed in many areas.

Seasonal wetness and the slow permeability are the main limitations for farm and nonfarm uses.

Representative profile of Kingsbury silty clay, 0 to 2 percent slopes, in a pasture; town of Fort Edward, 2.4 miles east of Fort Edward on County Highway 197, 50 feet north of highway and about one-eighth mile west of Fort Edward and Argyle town line:

Ap—0 to 6 inches, very dark grayish-brown (10YR 3/2) silty clay, light brownish gray (10YR 6/2) crushed, smoothed, and dry; strong, medium, granular structure; friable; many fine roots; few pores; no coarse fragments; strongly acid; clear, smooth boundary.

A2—6 to 8 inches, grayish-brown (10YR 5/2) silty clay; 60 percent fine, faint, brown mottles and fine, distinct, yellowish-brown mottles if broken across peds; grayish-brown (10YR 5/2) ped faces; moderate, medium and fine, subangular blocky structure; friable, sticky and plastic; common fine roots; common fine pores; no coarse fragments; strongly acid; clear, wavy boundary.

B21tg—8 to 18 inches, dark grayish-brown (10YR 4/2) clay; 50 percent medium, distinct, yellowish-brown (10YR 5/4) mottles; moderate, medium and coarse, subangular blocky structure parting to moderate, fine, angular blocky; firm, very sticky and plastic; few roots; common fine pores lined with clay; grayish-brown silty coatings on coarser peds in upper 2 inches; thin dark-gray (10YR 4/1) clay films on coarse and fine peds in lower 8 inches; no coarse fragments; medium acid; gradual, wavy boundary.

B22tg—18 to 28 inches, dark grayish-brown (10YR 4/2) clay; many, medium, faint, brown and dark-gray mottles; moderate, coarse and very coarse blocks parting to strong, fine, angular blocks; firm, very sticky and very plastic; few roots; few pores; dark-gray (10YR 4/1) clay films on ped faces; no coarse fragments; slightly acid; clear, wavy boundary.

C—28 to 50 inches, dark grayish-brown (10YR 4/2) clay; many, fine, faint, dark-gray and gray threadlike mottles; moderate, very fine, angular blocky structure; firm, very sticky and very plastic; no roots; few, discontinuous, vertical seams of light-gray segregated lime; moderately alkaline; calcareous.

The solum ranges from 20 to 36 inches in thickness. The depth to carbonates ranges from 20 to 50 inches. The depth to bedrock is generally more than 6 feet, but in places bedrock is within 3½ feet of the surface. The content of clay is more than 60 percent in the Bt horizon. The soil contains few or no coarse fragments. Reaction in the solum ranges from strongly acid through mildly alkaline. Reaction in the C horizon ranges from neutral to moderately alkaline. The C horizon becomes calcareous with increasing depth.

The Ap horizon ranges from brown (7.5YR 5/2) through very dark gray (10YR 3/1) when moist, but has a value of 6 when dry, crushed, and smoothed. It has strong or moderate granular structure, is friable or firm, and is strongly acid through slightly acid. The A2 horizon, where present, ranges from gray (10YR 5/1) through dark grayish brown (10YR 4/2) and is 40 to 60 percent distinct or faint mottles of higher chroma. The B horizon ranges from grayish brown (2.5Y 5/2) through dark brown (10YR 4/3) and has common or many, faint or distinct, high-chroma mottles. It is clay; has medium or coarse blocky structure parting to moderate or strong, fine, angular blocks; and is firm and plastic and very sticky. The C horizon ranges from grayish brown (2.5Y 5/2) through dark brown (10YR 4/3). It is firm and very plastic clay.

Kingsbury soils formed in material similar to that of the closely associated, moderately well drained Vergennes soils and the poorly drained Covington soils. They are also closely associated with the shallow Farmington and Hollis soils and the deep, well-drained Charlton and Pittsfield soils, all of which formed in glacial till.

Kingsbury silty clay, 0 to 2 percent slopes (KbA).—This soil has the profile described as representative of the series. It is on lake plains or estuarine plains. Slopes are concave. Areas are broad and are generally less than 20 acres in size. The soil receives runoff from adjacent slopes.

Included with this soil in mapping are the moderately well drained Vergennes soils on knolls and the poorly drained Covington soils in low areas, both of which formed in similar material. Also included are spots of the shallow Farmington soils; small areas in the northern part of the county of the shallow Hollis soils and the deep, well-drained Charlton soils; and spots where the surface layer is finer textured or coarser textured.

This Kingsbury soil is suited to hay, pasture, and woodland. Unless drained, it is poorly suited to row crops. Also, it has a high enough clay content that it becomes cloddy if plowed when wet or dry. Capability unit IIIw-1; woodland group 3w1.

Kingsbury silty clay, 2 to 6 percent slopes (KbB).—This soil has a profile similar to the one described as representative of the series, but the leached subsurface layer generally does not occur. The soil is on lake plains or estuarine plains. Areas are wide and long and generally less than 20 acres in size. Runoff is slow, and some runoff accumulates.

Included with this soil in mapping are spots of the moderately well drained Vergennes soils and, along drainageways, spots of the poorly drained Covington soils, both of which formed in similar material. Also included are small areas of the shallow Farmington soils; spots in the northern part of the county of the shallow Hollis soils and the deep, well-drained Charlton soils; and small areas where the surface layer is finer textured or coarser textured.

This Kingsbury soil is suitable for hay, pasture, and woodland. Unless drained, it is poorly suited to row crops. It is easily eroded. Erosion control is needed in cultivated areas. The clay content is high enough that the soil becomes cloddy if worked when wet. Capability unit IIIw–1; woodland group 3w1.

Limerick Series

The Limerick series consists of deep, poorly drained, medium-textured soils. These soils formed in alluvial deposits of silt and very fine sand. They are nearly level and are in low areas on flood plains.

A representative profile has a surface layer of very dark grayish-brown silt loam about 3 inches thick. This is underlain by a substratum of friable silt loam that extends to a depth of 50 inches or more. The substratum is mottled grayish brown to a depth of 14 inches, mottled olive gray between depths of 14 and 26 inches, and mottled gray below.

The seasonal high water table is at or near the surface for extended periods. Annual flooding generally occurs in spring, but can occur during any period of high water. The high water table restricts the depth of rooting mainly to the upper 12 inches in spring. A few roots extend below this depth as the water table recedes. Permeability is moderate. Available moisture capacity is moderate to high. These soils are low to medium in content of lime. Their capacity to supply phosphorus and potassium is generally low to medium. The total content of nitrogen is high, but nitrogen is released slowly in spring when the soil is wet and cold.

The hazard of flooding and the poor drainage are the main limitations for farm and many nonfarm uses.

Representative profile of Limerick silt loam, in a pasture; 3 miles north of village of Cambridge, 1,000 feet west of N.Y. Route 313 on Batten Kill flood plain:

Ap—0 to 3 inches, very dark grayish-brown (10YR 3/2) silt loam; common reddish-brown root stains; moderate, fine, granular structure; friable; many fine roots; no coarse fragments; medium acid; abrupt, smooth boundary.

C1g—3 to 14 inches, grayish-brown (2.5Y 5/2) silt loam; common, fine, distinct mottles of yellowish red (5YR 4/6) and few, fine, distinct mottles of gray (10YR 5/1); common reddish-brown root stains in upper part of horizon; moderate, medium, subangular blocky structure; friable; common fine roots; few fine pores; no coarse fragments; medium acid; clear, wavy boundary.

C2g—14 to 26 inches, olive-gray (5Y 5/2) silt loam; common, fine, distinct mottles of yellowish brown (10YR 5/6) and few, fine, distinct mottles of gray (10YR 6/1); massive parting to weak, fine, subangular blocky structure; friable, nonsticky and slightly plastic; few fine roots; no coarse fragments; water table at depth of 23 inches; neutral; clear, wavy boundary.

C3g—26 to 50 inches, gray (5Y 5/1) silt loam; common, medium, distinct mottles of strong brown (7.5YR 5/8) and light olive brown (2.5Y 5/4); massive; friable, nonsticky and slightly plastic; no roots; no coarse fragments; neutral.

To a depth of 40 inches, the soil is silt loam or very fine sandy loam. Between depths of 10 and 40 inches, it has few or no coarse fragments. Depth to bedrock is generally more than 5 feet. Reaction ranges from strongly acid in the upper part of the soil to neutral in the lower part.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) through olive (5Y 4/3); has weak or moderate, fine or medium, granular structure; and is friable or very friable. To a depth of 30 inches the C horizon ranges from dark gray (5Y 4/1) through grayish brown (2.5Y 5/2). Below that depth it ranges from dark gray (5Y 4/1) though light olive brown (2.5Y 5/4). The C horizon has dark reddish-brown to gray mottles that range from few, fine, distinct to many, coarse, prominent. The C horizon is silt loam or very fine sandy loam; has weak to moderate, fine to medium, subangular blocky or granular structure or is massive; and is friable or very friable.

Limerick soils formed in material similar to that of the closely associated, well drained Hamlin soils; the moderately well drained to somewhat poorly drained Teel soils; and the very poorly drained Saco soils.

Limerick silt loam (Lm).—This soil is in low places on flood plains. It is generally flooded for a few days in spring and fall. Areas are oblong, in many places are long and narrow, and are generally 10 to 25 acres in size.

Included with this soil in mapping are small mounds of the better drained Hamlin and Teel soils and, in the lowest areas, the wetter Saco soils. Included soils near Smiths Basin contain more organic matter, and those near the canal have less flooding. Also included are small areas where gravel is on the surface, areas where gravelly layers are within 40 inches of the surface, and spots where the surface layer is very fine sandy loam.

This poorly drained Limerick soil is suited to crops, pasture, and woodland. Unless the soil is drained, the choice of crops is limited. If adequately drained, limed, and fertilized, the soil is fairly well suited to most crops grown in the county. Planting and harvesting are sometimes delayed by flooding. Capability unit IIIw–4; woodland group 4w1.

Madalin Series

The Madalin series consists of deep, poorly drained and very poorly drained soils that have a moderately fine textured surface layer and a fine textured or moderately fine textured subsoil. These soils formed in calcareous deposits of lake-laid silt and clay. They are nearly level and are in low positions on lake plains.

A representative profile in a cultivated area has a surface layer of very dark gray silty clay loam 6 inches thick. The subsoil extends to a depth of 36 inches. The upper 10 inches is mottled grayish-brown silty clay, and the rest is mottled gray silty clay. The substratum is mottled gray, calcareous silty clay that extends to a depth of 52 inches or more. The subsoil and substratum are firm when moist and sticky and plastic when wet.

In spring and during wet periods, the water table is perched on the slowly permeable subsoil and substratum and is at or near the surface for extended periods. The seasonal high water table and the clayey subsoil limit the depth of rooting mainly to the upper 15 inches. Available moisture capacity of this zone is low to moderate, but normally more than enough water is available for plant growth. Although the total content of nitrogen is high, nitrogen is released very slowly in spring when the soil is wet. These soils are high to medium in content of lime. Their capacity to supply potassium is high. Their capacity to furnish phosphorus is medium.

Excess water and the slow permeability are the main limitations for farm and many nonfarm uses.

Representative profile of Madalin silty clay loam, in an idle area; town of Easton, 100 yards west of N.Y. Route 40 and one-half mile south of Wilbur Road:

Ap—0 to 6 inches, very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate, fine, granular structure; friable; many roots and reddish-brown root stains; no coarse fragments; neutral; abrupt, smooth boundary.

B21tg—6 to 16 inches, grayish-brown (10YR 5/2) silty clay; common, fine, distinct mottles of yellowish brown (10YR 5/8); strong, medium, blocky structure; firm when moist, sticky and plastic when wet; common roots; many fine pores; thin, patchy, gray clay films lining pores and on ped surfaces; no coarse fragments; neutral; clear, wavy boundary.

B22tg—16 to 36 inches, gray (10YR 5/1) silty clay; many, medium, distinct mottles of yellowish brown (10YR 5/8); strong, medium, blocky structure; firm when moist, sticky and plastic when wet; few roots; common pores; continuous gray clay films lining pores and on ped surfaces; no coarse fragments; neutral; clear, wavy boundary.

Cg—36 to 52 inches, gray (N 5/0), varved silty clay; many, medium, distinct mottles of yellowish brown (10YR 5/8); moderate, medium, platy structure; firm when moist, sticky and plastic when wet; no roots; no pores or clay films; no coarse fragments; moderately alkaline; calcareous.

Thickness of the solum and depth to carbonates range from 24 to 48 inches. Depth to bedrock is generally more than 5 feet, but in places bedrock is at a depth of 40 inches. In places glacial till or lenses of sand are below a depth of 52 inches. The soil contains few or no coarse fragments. The content of clay in the B horizon ranges from 35 to 55 percent. Reaction in the solum ranges from medium acid through mildly alkaline. The C horizon is calcareous.

The Ap horizon is black (10YR 2/1) or very dark gray (10YR 3/1). The B horizon ranges from dark grayish brown (10YR 4/2) through light gray (5Y 6/1) and is silty clay, silty clay loam, or clay. The C horizon ranges from gray (N 5/0) through grayish brown (10YR 5/2) and is silty clay, clay, or silty clay loam.

Madalin soils formed in material similar to that of the closely associated, moderately well drained Hudson soils and the somewhat poorly drained Rhinebeck soils.

Madalin silty clay loam (Ma).—This nearly level soil is in the lowest depressions of the lake plain. Areas are oval or are narrow strips and are mostly less than 10 acres in size. Runoff is very slow, or the soil receives surface runoff from surrounding soils. Water often ponds during wet periods.

Included with this soil in mapping, on slightly higher mounds, are small areas of the somewhat poorly drained Rhinebeck soils. Also included are small areas where the surface layer is silt loam, spots where the surface layer is mucky and contains more organic matter than this Madalin soil, and spots of soils that are not calcareous or have a calcareous layer at a greater depth.

This Madalin soil is suited to hay and pasture. Unless drained, in most areas it is too wet for cultivation. In many places drainage outlets are difficult to locate. Unless drained, the soil is better suited to native pasture or woodland than to other uses. It has a high enough clay content that it is hard when dry and sticky when wet. It is difficult to keep in good tilth. Capability unit IVw-1; woodland group 5w1.

Nassau Series

The Nassau series consists of shallow, somewhat excessively drained, medium-textured soils that have shale or slate bedrock within 10 to 20 inches of the surface. These soils formed in thin deposits of glacial till derived mainly from shale, slate, and some sandstone. They are gently sloping to very steep and are on uplands where the relief is affected by folded bedrock.

A representative profile in a cultivated area has a surface layer of dark-brown shaly silt loam 9 inches thick. The subsoil is yellowish-brown, friable very shaly loam. Shale bedrock is below a depth of 19 inches. Many shale fragments occur throughout the soil.

Water drains through the soil at a moderate rate. Plant roots are limited mainly to the 10 to 20 inches above the bedrock. Plants show moisture stress early in dry periods because the capacity of the soil to store moisture is limited. Available moisture capacity is very low to low. These soils are very low in content of lime. Their capacity to supply nitrogen and phosphorus is medium. Their capacity to furnish potassium is low.

Slope and shallowness over bedrock are the main limitations for farm and nonfarm uses.

Representative profile of Nassau shaly silt loam, 3 to 25 percent slopes, in an area of Nassau shaly silt loam, undulating through hilly, in a red pine plantation; town of Greenwich, 200 feet east of Bunker Hill Road, 1,200 feet south of Argyle-Greenwich town line:

Ap—0 to 9 inches, dark-brown (10YR 4/3) shaly silt loam; moderate, medium, granular structure; friable; many roots; 20 percent shale fragments; strongly acid; abrupt, smooth boundary.

B21—9 to 12 inches, yellowish-brown (10YR 5/4) very shaly loam; moderate, fine, subangular blocky structure; friable; common fine roots; many fine pores; 40 percent shale fragments; strongly acid; clear, wavy boundary.

B22—12 to 19 inches, yellowish-brown (10YR 5/4) very shaly loam; weak, medium, subangular blocky structure; friable; common fine roots; many fine and medium pores; 40 percent shale fragments; strongly acid; abrupt, irregular boundary.

R—19 inches +, greenish-gray (5GY 5/1) broken fissile shale that has strong-brown (7.5YR 5/6) ped faces.

Thickness of the solum and depth to bedrock range from 10 to 20 inches. The bedrock is mainly shale or slate, but in places is interbedded with sandstone. Coarse fragments of shale, slate, and sandstone make up 35 to 60 percent of the B horizon. Reaction in the solum is strongly acid or very strongly acid.

The Ap horizon ranges from dark brown (7.5YR 4/2) to very dark grayish brown (2.5Y 3/2). The B horizon ranges from brown (7.5YR 5/4 or 10YR 5/3) through olive brown (2.5Y 4/4) and is very shaly loam or silt loam. In places a thin C horizon of light-gray very shaly loam 2 or 3 inches thick is over the bedrock.

Nassau soils formed in material similar to that of the closely associated, deep Bernardston soils. They are also near the deep Hudson and Rhinebeck soils, which formed in lacustrine silt and clay. Nassau soils in these areas occupy islandlike knolls that protrude above the lake plain.

Nassau shaly silt loam, undulating through hilly (NAC).—This soil has the profile described as representative of the series. It is on uplands where relief is affected by the underlying folded bedrock. Bedrock crops out in places. Slopes are short and complex, tip in many directions, and range from 3 to 25 percent. Areas are generally long and wide and are more than 20 acres in size.

Included with this soil in mapping are small areas of the deep, well drained to moderately well drained Bernardston soils, and adjacent to the lake plain are spots of the deep Hudson and Rhinebeck soils, which formed in lake-laid sediment. Also included are small areas where the soil is more than 20 inches deep, areas of soils in the northeastern part of the county that have redder hues than this Nassau soil, depressions that contain spots of muck, and areas of soils that have a higher reaction than this Nassau soil.

This soil is suited to limited cropping, hay, pasture, and woodland. Unless protected, it is subject to severe erosion in cultivated areas. Also, it is droughty. Contouring to control erosion and conserve moisture is generally not feasible. Tillage should be limited mainly to renovation for hay or pasture. Bedrock outcrops interfere slightly with tillage in places. Capability unit IVe–3; woodland group 5d1.

Nassau-Rock outcrop association, undulating through hilly (NBC).—This association (fig. 9) is about 40 percent Nassau soil, 20 percent Rock outcrop, and 40 percent soils of minor extent. It is on uplands where the relief is affected by folded shale and slate bedrock. Outcrops of this bedrock are common. Slopes are complex and range from about 3 to 25 percent. Areas are irregularly shaped and range from about 40 to more than 100 acres in size.

The Nassau soil in this association has a profile similar to the one described as representative of the Nassau series, but very rocky phases dominate the landscape and depth to bedrock is more variable within short distances. Intermingled throughout the areas are exposures of mainly shale or slate bedrock that make up the Rock outcrop part of the association. In places escarpments of this bedrock are short and vertical.

Figure 9.—**Typical area of Nassau-Rock outcrop association, undulating through hilly.**

Of minor extent are the deep, well drained to moderately well drained Bernardston soils; the somewhat poorly drained Scriba soils; and the very poorly drained and poorly drained Sun soils. The Bernardston soils are interspersed in convex areas where runoff is fairly rapid and little water accumulates. The Scriba and Sun soils are in low areas and depressions where water accumulates. In places the depressional pockets contain muck soils. Also in the association is a moderately deep, well-drained soil that is similar to the representative Nassau soil, but is about 20 to 40 inches deep over bedrock.

Most of this association is in woody vegetation or is idle. Some of it is used for pasture. Most uses are limited by shallowness, droughtiness, and the numerous rock outcrops. Nassau soil in capability unit VIs–2, woodland group 5x1; Rock outcrop in capability unit VIIIs–1, woodland group not assigned.

Nassau-Rock outcrop association, steep and very steep (NBF).—This association is about 50 percent Nassau soil, 30 percent Rock outcrop, and 20 percent soils of minor extent. It is on uplands where the relief is affected by folded shale and slate bedrock. Outcrops of this bedrock are common. Slopes are very complex and range from about 25 to 70 percent. Areas are irregularly shaped and range from about 40 to more than 100 acres in size.

The Nassau soil in this association has a profile similar to the one described as representative of the Nassau series, but very rocky phases dominate the landscape and depth to bedrock is much more variable from place to place. Intermingled throughout the areas are escarpments of exposed bedrock that make up the Rock outcrop part of this association.

Of minor extent are the deep, well drained to moderately well drained Bernardston soils and a moderately deep, well drained soil that is similar to the representative Nassau soil, but ranges from about 20 to 40 inches deep over bedrock. These soils are intermingled with the Nassau soil and Rock outcrop where deposits of glacial till are more than 20 inches deep over bedrock.

Most of this association is in woody vegetation or is idle. Slopes, droughtiness, and numerous rock outcrops are limiting factors for farm and most nonfarm uses. Nassau soil in capability unit VIIs–2, woodland group 5x2; Rock outcrop in capability unit VIIIs–1, woodland group not assigned.

Oakville Series

The Oakville series consists of deep, excessively drained, sandy soils. These soils formed in water-sorted or wind-sorted sandy deposits. They are nearly level to steep and are on deltas and terraces.

A representative profile in a cultivated area has a surface layer of very dark grayish-brown loamy fine sand 9 inches thick. The subsoil is yellowish-brown, loose loamy fine sand that extends to a depth of 24 inches. The substratum is light yellowish-brown, loose fine sand that extends to a depth of 50 inches or more.

The water table normally is several feet below the surface, but in places it fluctuates to within 2 feet of the surface. Plant roots can easily penetrate the loose sandy layers, but available moisture capacity is very low to moderate. These soils are droughty, and water drains through them very rapidly. Fertilizer is leached readily from the root zone. These soils are medium in content of lime. Their capacity to supply nitrogen, phosphorus, and potassium is low.

Unless protected by a plant cover, these loose, sandy soils are subject to soil blowing. Lack of moisture and low natural fertility are the main limiting factors for farm uses.

Representative profile of Oakville loamy fine sand, 0 to 5 percent slopes, in an idle area; town of Fort Edward, sand pit 100 yards southeast of Union Cemetery:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) loamy fine sand; weak, medium, granular structure; very friable; many roots; no coarse fragments; medium acid; abrupt, smooth boundary.

B2—9 to 24 inches, yellowish-brown (10YR 5/6) loamy fine sand; single grained; loose; common roots; no coarse fragments; slightly acid; clear, smooth boundary.

C—24 to 50 inches, light yellowish-brown (2.5Y 6/4) fine sand; single grained; loose; few roots; no coarse fragments; slightly acid.

The solum ranges from 20 to 40 inches in thickness. The depth to bedrock is more than 6 feet. The soil generally contains few or no coarse fragments in the upper 40 inches, but individual horizons are as much as 15 percent fine gravel. Sand sizes are mainly fine and medium, but range to coarse. Below a depth of 3½ feet the soil material is variable, consisting of sand or stratified sand and gravel. In places near the lake plain, silt or clay deposits occur below a depth of 6 feet. Reaction ranges from strongly acid to neutral in the solum and from medium acid to mildly alkaline in the substratum.

The Ap horizon is mainly very dark grayish brown (10YR 3/2) through dark yellowish brown (10YR 4/4). The B horizon ranges from dark yellowish brown (10YR 4/4) through strong brown (7.5YR 5/8). It is loamy fine sand or fine sand; is structureless or has weak, fine, granular or weak subangular blocky structure; and is very friable or loose. The C horizon ranges from light yellowish brown (10YR 6/4) through grayish brown (2.5Y 5/2). Above a depth of 40 inches, the C horizon is mainly loamy fine sand and fine sand, but it ranges to loamy sand and sand.

Oakville soils are closely associated with the gravelly Hoosic and Otisville soils, which formed in water-sorted sand and gravel. They are also near Claverack, Cosad, Hudson, and Vergennes soils. They are better drained than Claverack and Cosad soils and do not have the clayey C horizon that is typical of those soils. They are sandy throughout, in contrast to the clayey Hudson and Vergennes soils.

Oakville loamy fine sand, 0 to 5 percent slopes (OaB).—This soil has the profile described as representative of the series. It is in broad areas on terraces and deltas, commonly adjacent to the lake plain. Areas are generally more than 20 acres in size.

Included with this soil in mapping are small areas of the moderately well drained Claverack soils and the somewhat poorly drained Cosad soils. These included soils are in low areas where lacustrine silt and clay underlie the sand at a depth of 20 to 40 inches. Also included are spots of a similar soil that has thin bands of finer textured soil in the substratum, small areas where the soil contains lenses of gravel within 40 inches of the surface, areas where the surface layer is loamy sand, and areas where the soil is more acid than is defined as the range for the series.

This Oakville soil is suited to crops, hay, pasture, and woodland. It is droughty and in most places requires irrigation. Unless protected, it is subject to soil blowing. Because applied lime and fertilizer are rapidly leached from this soil, response is generally better to smaller but more frequent or more timely applications than to one large application. Capability unit IIIs–1; woodland group 4s1.

Oakville loamy fine sand, 5 to 15 percent slopes (OaC).—This soil has a profile similar to the one described as representative of the series, but the subsoil is thinner in places. The soil is on dunes on sand plains or on terrace escarpments. Slopes are commonly short and complex. Areas are irregularly shaped or long and narrow and are generally less than 10 acres in size.

Included with this soil in mapping are small areas of the gravelly Hoosic and Otisville soils on some of the knolls, spots of a similar soil that has thin bands of finer textured material in the substratum, and areas where the surface layer is loamy sand. Also included are areas where the soil is more acid than is defined as the range for the series.

This Oakville soil is poorly suited to crops. It provides some early hay and pasture and is suited to woodland. It is very droughty and, unless protected, is subject to erosion and soil blowing. In many places contouring to conserve moisture and control erosion is not feasible. Because applied nutrients are rapidly leached from this soil, response is generally better to smaller but more frequent or more timely applications than to one large application. Capability unit IVs–1; woodland group 4s1.

Oakville loamy fine sand, moderately steep and steep (OkE).—This soil has a profile similar to the one described as representative of the series, but the subsoil is thinner in most places. The soil is on terrace escarpments of sand plains. Areas are long and narrow and generally are less than 10 acres in size.

Included with this soil in mapping are small areas of the gravelly Hoosic and Otisville soils and spots of Hudson and Vergennes soils, which formed in clayey lacustrine or estuarine sediments. Also included are small areas where the surface layer is loamy sand and others where the subsoil has been exposed by erosion.

Most of the acreage is too steep for cropping. The use of modern farm machinery is extremely difficult and hazardous. The soil is suited to woodland, and in places it provides some early grazing. It is extremely droughty. Unless protected, it is subject to severe erosion. Capability unit VIIs–1; woodland group 4s2.

Orthents and Psamments

Orthents and Psamments (OP) consist mostly of material dredged and pumped from the Hudson River and Champlain Barge Canal. The material is a variable mixture of dominantly fine gravel and sand and some silt and clay. In places the dredgings are in piles. Along the barge canal level areas are diked to hold pumpings. Areas are generally more than 10 acres in size.

The extreme variability of the material makes onsite investigation necessary in determining potential use. Capability unit and woodland group not assigned.

Otisville Series

The Otisville series consists of deep, excessively drained, very gravelly and sandy soils. These soils formed in glacial outwash derived mainly from slate, shale, and quartzite. They are nearly level to steep and are on glacial outwash terraces, eskers, and kames.

A representative profile has a surface layer of dark-brown gravelly sandy loam 9 inches thick. The subsoil is dark yellowish-brown, very friable very gravelly loamy sand that extends to a depth of 23 inches. Below this and to a depth of 50 inches or more, the substratum is stratified, loose very gravelly loamy coarse sand. Gravel is prominent throughout the soil.

This excessively drained soil dries out early in spring. Water drains very rapidly through it. The water table normally is several feet below the surface, but in places it fluctuates to within 3 feet of the surface. The depth of rooting is mainly in the top 20 inches, but some roots extend to a greater depth. The soils are droughty, and plants show moisture stress after short dry periods. Available moisture capacity is very low. These soils are very low or low in content of lime. Their capacity to supply nitrogen, phosphorus, and potassium is low.

Droughtiness and the large number of coarse fragments are the main limitations for farm uses. Otisville soils are generally an excellent source of sand or gravel.

Representative profile of Otisville gravelly sandy loam, 0 to 3 percent slopes, in an idle area; town of Greenwich, 400 feet west of County Road 49 and 1 mile north of N.Y. Route 29:

Ap—0 to 9 inches, dark-brown (10YR 4/3) gravelly sandy loam; weak, fine, granular structure; friable; many fine roots; 30 percent coarse fragments of slate, shale, and sandstone; strongly acid; abrupt, wavy boundary.

B2—9 to 23 inches, dark yellowish-brown (10YR 4/4) very gravelly loamy sand; weak, coarse, granular structure; very friable; common fine roots; 50 percent coarse fragments of shale, slate, and sandstone; strongly acid; clear, wavy boundary.

IIC—23 to 50 inches, dark grayish-brown (2.5Y 4/2) very gravelly loamy coarse sand; single grained; loose; no roots; 60 percent gravel; strongly acid.

The solum ranges from 15 to 25 inches in thickness. The depth to bedrock is generally more than 6 feet. In places, contrasting deposits of silt and clay occur in the lower part of the C horizon at a depth of more than about 4 feet. The content of coarse fragments ranges from 35 to 50 percent in the solum below a depth of 10 inches and from 35 to 70 percent in the substratum. In unlimed soil, reaction in the solum is strongly acid or very strongly acid. Reaction in the substratum ranges from medium acid through very strongly acid.

The Ap horizon ranges from dark yellowish brown (10YR 4/4) through very dark grayish brown (10YR 3/2). The B horizon ranges from strong brown (7.5YR 5/8) through brown (10YR 4/3) and from very gravelly loamy fine sand to very gravelly loamy coarse sand. The IIC horizon ranges from very dark grayish brown (10YR 3/2) through olive brown (2.5Y 4/4) and from very gravelly loamy sand through stratified sand and gravel.

Otisville soils formed in material similar to that of the closely associated, somewhat excessively drained Hoosic soils; the dominantly moderately well drained Herkimer soils; the somewhat poorly drained or poorly drained Fredon soils; and the very poorly drained Halsey soils. In some areas Otisville soils are near the nongravelly, sandy, excessively drained Oakville soils.

Otisville gravelly sandy loam, 0 to 3 percent slopes (OtA).—This soil has the profile described as representative of the series. It occurs as broad areas on glacial outwash terraces. Areas are generally less than 25 acres in size.

Included with this soil in mapping are small areas of the somewhat excessively drained Hoosic soils on similar landscapes and the wetter Herkimer, Fredon, and Halsey soils in low areas, all of which formed in similar material. Also included are spots of the nongravelly sandy Oakville soils, small areas where the surface layer is very gravelly loamy sand, and others where the surface layer is underlain by stratified sand and gravel.

This Otisville soil is suited to limited cropping, hay, pasture, and woodland. It is an early soil but, unless irrigated, is poorly suited to crops. It is very droughty and has low natural fertility. The gravel in the surface layer interferes with tillage. Because applied nutrients are rapidly leached from this soil, response is generally better to smaller but more frequent or more timely applications than to one large application. Capability unit IVs–1; woodland group 4s1.

Otisville gravelly sandy loam, 3 to 8 percent slopes (OtB).—This soil is in undulating areas and on slope breaks on glacial outwash plains. Areas are oval in shape and are generally less than 25 acres in size.

Included with this soil in mapping are small areas of the somewhat excessively drained Hoosic soils, which occupy similar positions on the landscape, and the wetter Herkimer soils, which are in low areas. All formed in similar material. Also included are spots of the nongravelly sandy Oakville soils and small areas where the surface layer is very gravelly loamy sand or very gravelly sand.

This Otisville soil is suited to limited cropping, hay, pasture, and woodland. It is an early soil but, unless irrigated, is poorly suited to crops. It is very droughty and has low natural fertility. Unless protected, it is subject to slight erosion. The gravel in the surface layer interferes with tillage. Because applied plant nutrients are rapidly leached from this soil, response is generally better to smaller but more frequent or more timely applications than to one large application. Capability unit IVs–1; woodland group 4s1.

Otisville gravelly sandy loam, rolling and hilly (OVDK).—This soil has a profile similar to the one described as representative of the series, but in many places the subsoil is thinner. The soil is commonly on kames and eskers. Slopes are short, in many places are complex, and range mainly from 8 to 25 percent. Areas are irregularly shaped or long and narrow and are generally less than 15 acres in size.

Included with this soil in mapping are small areas of the similar, somewhat excessively drained Hoosic soils and sandy Oakville soils. Included in pockets in kame areas and along the foot slopes of eskers are spots of the somewhat poorly drained or poorly drained Fredon soils. Also included are small areas where the surface layer is very gravelly loamy sand and spots of eroded soils where the stratified gravel and sand substratum is exposed.

This Otisville soil is poorly suited to crops. It provides some early hay and pasture and is suited to woodland. It is extremely droughty and has low natural fertility. Unless protected, it is subject to erosion. The complex, moderately steep slopes are difficult and hazardous to work. In many places contouring to conserve moisture and control erosion is not feasible. Capability unit IVs–1; woodland group 4s2.

Palatine Series

The Palatine series consists of moderately deep, well-drained to somewhat excessively drained, medium-textured soils. These soils formed in thin glacial till derived mainly from the underlying dark-colored, calcareous shale bedrock, which is within 20 to 40 inches of the surface. They are gently sloping to sloping and are on uplands where the relief is affected by the underlying bedrock.

A representative profile in a cultivated area has a surface layer of very dark grayish-brown shaly silt loam 8 inches thick. The subsoil is very dark grayish-brown, friable very shaly silt loam. Dark, calcareous shale bedrock is at a depth of 38 inches.

Water drains through the soil at a moderate rate. Bedrock, which is at a depth of 20 to 40 inches, restricts the depth of rooting. Available moisture capacity is moderate to high. In places a seasonal high water table flows on top of the rock at a depth of 1½ to 3 feet. These soils are high in content of lime. Their capacity to supply nitrogen and phosphorus is medium. Their capacity to furnish potassium is high.

Depth to bedrock is the main limiting factor for farm and nonfarm uses.

Representative profile of Palatine shaly silt loam, 3 to 8 percent slopes, in a hayfield; town of Kingsbury, one-fourth mile north and 25 feet east of U.S. Route 4 at N.Y. Route 149:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) shaly silt loam, dark grayish brown (10YR 4/2) dry; moderate, fine, granular structure; friable; many roots; 15 percent coarse fragments of dark shale; mildly alkaline; abrupt, wavy boundary.

B—8 to 38 inches, very dark grayish-brown (10YR 3/2) very shaly silt loam; moderate, fine, subangular blocky structure; friable; common roots; 55 to 65 percent coarse fragments; mildly alkaline; calcareous; irregular, wavy boundary.

R—38 inches +, dark, calcareous shale bedrock; the upper part can be cut with a spade, the lower part is hard and cannot be dug with a spade.

Thickness of the solum and depth to calcareous shale bedrock is 20 to 40 inches. Reaction in the solum ranges from medium acid through mildly alkaline. Free carbonates occur close to the bedrock. Coarse fragments make up 15 to 35 percent of the surface layer and 35 to 65 percent of the subsoil.

The Ap horizon ranges from black (10YR 2/1) through very dark grayish brown (10YR 3/2). The B horizon ranges from black (5Y 2/1) through brown (10YR 4/3).

The fine earth material ranges from silt loam to loam. It has weak to moderate, fine or medium, subangular blocky structure. The R horizon is very dark brown to black, calcareous shale.

Palatine soils are on islandlike landscapes above the lake plain and are surrounded by the deep, clayey, estuarine or lake-laid Vergennes and Kingsbury soils. They are also near the shallow Farmington soils; the deep, well drained Pittsfield soils; and the moderately well drained Amenia soils.

Palatine shaly silt loam, 3 to 8 percent slopes (PaB).—This soil has the profile described as representative of the series. It is on uplands. Slopes are smooth. Areas are generally oval in shape and are less than 15 acres in size.

Included with this soil in mapping are small areas of the deep, moderately well drained Amenia soils in depressions and along drainageways. Also included are spots of soils that are less than 20 inches deep over bedrock and small areas where the surface layer is shaly or very shaly loam.

This Palatine soil is suited to crops, pasture, and woodland. Unless protected, it is subject to slight to moderate erosion in cultivated areas. The few rock outcrops do not interfere with tillage. Capability unit IIe–3; woodland group 3o2.

Palatine shaly silt loam, 8 to 15 percent slopes (PaC).—This soil has a profile similar to the one described as representative of the series, but in many places it is thinner over bedrock. It is on smooth upland side slopes, commonly adjacent to the lake plain. Areas are long and narrow or oval in shape and are generally less than 15 acres in size.

Included with this soil in mapping are small areas of the deeper Pittsfield and Amenia soils and spots of the shallow Farmington soils, which are underlain by limestone bedrock rather than shale. Also included are small areas of Vergennes and Kingsbury soils that fringe the lake plain and formed in lacustrine or estuarine clay, spots where the surface layer is shaly or very shaly loam, and other spots where bedrock is at a depth of less than 20 inches.

This Palatine soil is suited to crops, hay, pasture, and woodland. Unless protected, it is subject to moderate to severe erosion in cultivated areas. Bedrock outcrops interfere slightly with tillage in places. Capability unit IIIe–4; woodland group 3o2.

Palms Series

The Palms series consists of very poorly drained organic soils underlain by a loamy mineral layer at a depth of 16 to 50 inches. These soils formed in well-decomposed organic material that accumulated in waterlogged bogs. They are nearly level and are in depressions within the glaciated uplands, lake plains, and outwash plains.

A representative profile has a layer of black, well-decomposed organic material 12 inches thick. This is underlain by 13 inches of very dark brown, well-decomposed organic material. Grayish-brown, massive, friable fine sandy loam is at a depth of 25 inches.

This very poorly drained soil is generally ponded during wet periods, and the water table is near the surface during the rest of the year. Unless drained, the soil is too wet for crops. Permeability is moderately rapid in the organic layers and moderate in the loamy material. These soils are medium to high in content of lime. Their capacity to supply nitrogen is high, but nitrogen is released very slowly. Their capacity to furnish phosphorus and potassium is low.

Excess water is the main limiting factor for farm uses. Many areas are in frost pockets. The high compressibility of the organic material and the high water table are limitations for nonfarm uses.

Representative profile of Palms muck, in a forest; town of Kingsbury, Hudson Falls Waterworks, one-fourth mile northwest of U.S. Route 4 and three-fourths mile north of courthouse:

Oa1—0 to 12 inches, black (10YR 2/1 broken face and rubbed) sapric material; about 8 percent fibers rubbed; strong, medium, granular structure; nonsticky, slightly plastic; about 20 percent mineral material; slightly acid; clear, smooth boundary.

Oa2—12 to 25 inches, very dark brown (10YR 2/2 broken face and rubbed) sapric material; about 1 percent fibers rubbed; weak, thick, platy structure; nonsticky, slightly plastic; 10 percent mineral material; medium acid; abrupt, smooth boundary.

IIC—25 to 50 inches, grayish-brown (2.5Y 5/2) fine sandy loam; massive; friable; slightly acid.

Depth to the loamy IIC horizon ranges from 16 to 50 inches. Depth to bedrock is more than 2 feet. Reaction in the Oa2 horizon ranges from medium acid through mildly alkaline.

The Oa1 horizon is mainly black or very dark brown sapric material, but in places it contains less decomposed material. The organic part of the Oa2 horizon and the IIC horizon ranges from black (N 2/0) through dark brown (10YR 3/3). The material is mainly sapric, but hemic and fibric material can total as much as 10 inches. The IIC horizon ranges from dark gray (10YR 4/1) to light brownish gray (2.5Y 6/2) and from fine sandy loam through clay loam. Reaction in the IIC horizon ranges from slightly acid through moderately alkaline.

On lake or estuarine plains Palms soils are closely associated with the poorly drained, clayey Covington and Madalin soils. In the glaciated uplands they are near the shallow Nassau and Hollis soils and the deep Sun soils. In outwash deposits Palms soils are near Halsey soils.

Palms muck (Pm).—This level soil is in wet boggy areas. Many areas are less than 10 acres in size, but in Dunham Basin areas are more than 100 acres in size. Runoff is slow, and large quantities of water are stored during snowmelt in spring.

Included with this soil in mapping are a few spots of soils that are underlain by marl, instead of mineral material, at a depth of less than 50 inches. Also included are spots where the organic deposit is less than 16 inches thick. In the area of Dunham Basin and Wood Creek, for example, the muck is less than 16 inches deep over alluvial silty clay. In other included areas the soil is more acid than this Palms soil.

This very poorly drained muck must be drained if it is to be used for crops or pasture. After drainage it is subject to settling. Soil blowing occurs during dry periods in cultivated areas. Many areas are in frost pockets. Most of the smaller areas are forested. In Dunham Basin some areas are used for crops and others are idle. If adequately drained, the soil has a high potential for specialty vegetable or sod crops. Capability unit IVw–3; woodland group 5w1.

Pittsfield Series

The Pittsfield series consists of deep, well-drained, moderately coarse textured soils that are stony or very stony. These soils formed in glacial till derived mainly from syenite and granite gneiss, sandstone, and limestone. They are gently sloping to moderately steep and are on uplands. Stones more than 10 inches in diameter are spaced about 30 to 100 feet apart on the surface.

A representative profile in a cultivated area has a surface layer of dark grayish-brown fine sandy loam 7 inches thick that contains a few pebbles. The subsoil is friable, gravelly fine sandy loam 13 inches thick. It is yellowish brown in the upper 7 inches and light olive brown in the lower part. The substratum is firm, dark-brown gravelly fine sandy loam that extends to a depth of 77 inches or more.

The water table is normally several feet below the surface, but in places it is seasonally within a depth of 3 feet. Permeability is moderately rapid in the subsoil and moderate in the substratum. Roots penetrate this soil easily, but most are in the top 30 inches. Available moisture capacity is moderate to high. These soils are medium in content of lime. Their capacity to supply nitrogen is medium. Their capacity to furnish phosphorus and potassium is low.

Slope and stoniness are the main limiting factors for farm and many nonfarm uses.

Representative profile of Pittsfield stony fine sandy loam, 3 to 8 percent slopes, in a hayfield; town of Kingsbury, 150 feet north of County Route 35, three-eighths miles east of Warren-Washington County line:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) fine sandy loam; moderate, fine, granular structure; friable; many roots; 10 percent coarse fragments; medium acid; abrupt, smooth boundary.

B21—7 to 14 inches, yellowish-brown (10YR 5/4) gravelly fine sandy loam; weak, medium and fine, granular structure; friable; many roots; 30 percent coarse fragments; medium acid; clear, wavy boundary.

B22—14 to 20 inches, light olive-brown (2.5Y 5/4) gravelly fine sandy loam; weak, medium and fine, subangular blocky structure parting to weak, medium and fine, granular; friable; common roots; 20 percent coarse fragments; slightly acid; clear, wavy boundary.

C1—20 to 43 inches, dark-brown (10YR 3/3) gravelly fine sandy loam; moderate, medium, platy structure; firm in place, friable when removed; common roots; 25 percent coarse fragments; pockets of loamy fine sand; single grained; loose; neutral; diffuse, wavy boundary.

C2—43 to 77 inches, dark-brown (10YR 3/3) gravelly fine sandy loam; moderate, thick, platy structure; firm; no roots; 20 percent coarse fragments; pockets of yellowish-brown (10YR 5/4) loamy sand; discontinuous horizontal bands, ½ inch to 1½ inches wide, of light brownish-gray and dark-brown (7.5YR 4/4) gravelly sandy loam; neutral.

The solum ranges from 20 to 30 inches in thickness. The depth to bedrock is generally more than 6 feet, but in places bedrock is within 40 inches of the surface. The surface layer ranges from nonstony through very stony. An occasional stone or boulder occurs throughout the profile. The content of coarse fragments ranges from 10 to 30 percent in the solum and from 15 to 35 percent in the C horizon. Reaction ranges from medium acid through neutral in the solum and from neutral to moderately alkaline in the C horizon below a depth of 40 inches.

The Ap horizon ranges from dark brown (10YR 4/3) through very dark grayish brown (10YR 3/2). The B21 horizon ranges from brown (7.5YR 4/4) through yellowish brown (10YR 5/6). The fine earth material of the B horizon ranges from loam through sandy loam and has weak or moderate granular through weak or moderate subangular blocky structure. The B22 horizon ranges from brown (10YR 4/3) through light olive brown (2.5Y 5/4). The C horizon ranges from very dark grayish brown (10YR 3/2) through light olive brown (2.5Y 5/4). The fine earth material is sandy loam or fine sandy loam that has pockets and lenses of loamy sand or sand. It is massive or has weak or moderate platy structure. The lower part is friable or firm.

Pittsfield soils formed in material similar to that of the closely associated, shallow Farmington soils and the deep, moderately well drained Amenia soils. Adjacent to the lake plain, Pittsfield soils are surrounded by the clayey Vergennes and Kingsbury soils, which formed in lacustrine or estuarine sediments.

Pittsfield stony fine sandy loam, 3 to 8 percent slopes (PtB).—This soil has the profile described as representative of the series. It is on hilltops in the uplands. Scattered stones and boulders are about 30 to 100 feet apart on the soil surface. Areas are generally oval in shape and about 10 to 15 acres in size.

Included with this soil in mapping are small areas of the moderately well drained Amenia soils and the very poorly drained and poorly drained Sun soils in low areas where water accumulates. Also included are a few spots of the shallow Farmington soils, small areas where the surface layer is loam or is very stony, and areas where the fragipan is below a depth of 40 inches.

This Pittsfield soil is suited to crops, hay, pasture, and woodland. Unless protected, it is subject to slight to moderate erosion in cultivated areas. Most areas are used mainly for hay or pasture. Although the surface layer is stony, the stones are far enough apart that they do not seriously interfere with farming. Capability unit IIe–3; woodland group 3o2.

Pittsfield stony fine sandy loam, 8 to 15 percent slopes (PtC).—This soil has a profile similar to the one described as representative of the series, but the subsoil is thinner in places. The soil is on hillsides in the uplands. Scattered stones and boulders are about 30 to 100 feet apart on the surface. Areas are long and are generally less than 10 acres in size.

Included with this soil in mapping are small areas of the wetter Amenia and Sun soils that are along foot slopes and drainageways and around seeps. Also included are spots where the surface layer is loam or is very stony and small areas of a similar soil that has a fragipan below a depth of 40 inches.

This Pittsfield soil is suited to crops, hay, pasture, and woodland. Unless protected, it is subject to moderate to severe erosion in cultivated areas. Most areas are used for hay or pasture. Although the surface layer is stony, the stones are far enough apart that they do not seriously interfere with farming. Capability unit IIIe–4; woodland group 3o2.

Pittsfield-Amenia association, very stony, gently sloping through moderately steep (PVC).—This association is about 60 percent Pittsfield soil, 20 percent Amenia soil, and 20 percent minor soils. These are undulating and hilly soils on islandlike uplands that protrude above the lake plain. Boulders and large slabs of limestone are common. Slopes are mainly 3 to 10 percent, but range from 3 to 25 percent. Most areas are irregularly shaped and about 10 to 25 acres in size.

The Pittsfield soil in this association has a profile similar to the one described as representative of the Pittsfield series, but very stony phases dominate. This soil is deep, well drained, and gently sloping to moderately steep. It is on hilltops and hillsides where water does not accumulate. Slopes are convex. Stones and boulders are about 5 to 30 feet apart on the surface.

Closely associated with the Pittsfield soil is the deep, moderately well drained, gently sloping Amenia soil. This soil has a profile similar to the one described as representative of the Amenia series, but very stony phases dominate. The soil is on hilltops where runoff is somewhat slow or on foot slopes below the Pittsfield soil where some water accumulates. Stones and boulders are about 5 to 30 feet apart on the soil surface.

The minor soils are the shallow, well-drained Farmington soils, which are intermingled on upland areas where limestone bedrock is at a depth of less than 20 inches. Included areas of Kingsbury soils fringe the lake plain. These are deep, somewhat poorly drained, fine-textured soils that formed a clayey lacustrine or estuarine sediment.

The soils in this association are too stony for safe use of farm equipment. They provide some native pasture and are suited to woodland and some types of wildlife habitat. Capability unit VIs–1; woodland group 3r2.

Rhinebeck Series

The Rhinebeck series consists of deep, somewhat poorly drained soils that have a medium-textured surface layer and a moderately fine textured or fine textured subsoil. These soils formed in lake-laid silt and clay. They are nearly level and gently sloping and are on lake plains.

A representative profile has a surface layer of dark grayish-brown silt loam about 7 inches thick. This is underlain by a thin 3-inch leached layer of mottled grayish-brown, friable silt loam. The subsoil extends to a depth of 26 inches. The upper 11 inches is mottled dark-brown, firm silty clay. The lower part is layers of olive-gray, yellowish-brown, and dark-brown, firm silty clay loam. The substratum is layers of calcareous, firm clay that has thin lenses of silt and very fine sand and extends to a depth of 61 inches or more. These layers are variable and range from gray through reddish brown. The subsoil and substratum are plastic and sticky when wet.

In spring and during wet periods, the seasonal high water table is perched on the slowly permeable subsoil and substratum within 6 to 18 inches of the surface. The depth of rooting is mainly in the top 18 inches. A few roots penetrate to a greater depth along blocky structural faces in the subsoil as the water table recedes. Available moisture capacity is moderate to high. These soils are high to medium in content of lime. Their capacity to supply nitrogen and phosphorus is generally medium. Their capacity to furnish potassium is high.

It is difficult to maintain good tilth because the content of clay is high. These soils clod and puddle easily if they are tilled at the wrong moisture content. Seasonal wetness and the slow permeability are the main limitations for farm and many nonfarm uses.

Representative profile of Rhinebeck silt loam, 0 to 2 percent slopes, in a hayfield; town of Easton, 25 feet south of Wrights Road, 1⅛ miles west of N.Y. Route 40:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; strong, fine, granular structure; friable; many roots; slightly acid; abrupt, smooth boundary.

A2—7 to 10 inches, grayish-brown (10YR 5/2) silt loam; common, fine, distinct, yellowish-brown (10YR 5/6) mottles and few, fine, faint, gray (10YR 6/1) mottles; moderate, medium, subangular blocky structure; friable; common roots; medium acid; clear, wavy boundary.

B2t—10 to 21 inches, dark-brown (7.5YR 4/2) silty clay; common, fine, distinct, yellowish-brown (10YR 5/6) mottles and few, fine, distinct, gray (10YR 6/1) mottles; strong, medium, angular blocky structure in 3- to 4-inch prisms, which are dark brown (10YR 3/3); firm, plastic and sticky; few roots; many fine pores; thin, continuous clay films on ped faces and thicker films on prism faces; slightly acid; clear, smooth boundary.

B3—21 to 26 inches, layers of olive-gray (5Y 5/2), yellowish-brown (10YR 5/4), and dark-brown (7.5YR 4/4) silty clay loam; moderate, coarse prisms parting to strong, thick, inherited platy structure; prism faces are dark brown (10YR 3/3); firm, plastic and sticky; few roots; thin, continuous clay films on prism faces; neutral; clear, smooth boundary.

C—26 to 61 inches, layers of gray (10YR 5/1), reddish-brown (5YR 4/3), brown (10YR 5/3), and yellowish-brown (10YR 5/6), varved clay that has thin lenses of silt and very fine sand; inherited, thin through thick, platy structure in coarse prisms; firm, plastic and sticky; prism faces are gray (10YR 5/1); few roots in upper part, none in lower; moderately alkaline; calcareous.

The solum ranges from 20 to 40 inches in thickness. The depth to bedrock is generally more than 60 inches, but in places bedrock is within 40 inches of the surface. Depth to carbonates is generally about 30 inches, but ranges from 20 to 40 inches. Reaction in the solum ranges from medium acid to neutral. In some areas that have been plowed, no A2 horizon is evident. Typically, the soil contains no coarse fragments, but in places a few occur.

The Ap horizon is dark grayish brown (10YR 4/2) or very dark grayish brown (10YR 3/2). The B horizon ranges from dark brown (7.5YR 3/2) through olive (5Y 5/3) and from heavy silty clay loam through clay that is 35 to 55 percent clay. The C horizon is commonly varved clay, silt, and very fine sand and is variable in color, ranging from gray (10YR 5/1) through reddish brown (5YR 4/3).

Rhinebeck soils formed in lacustrine sediment similar to that of the closely associated, moderately well drained Hudson soils and the poorly drained and very poorly drained Madalin soils. They are near the shallow Nassau soils in areas where uplands protrude above the lake plain and near the Wallington soils, which have similar drainage but formed in siltier lacustrine sediment and do not have a Bt horizon. Rhinebeck soils are similar to Kingsbury soils, but contain less clay in the Bt horizon.

Rhinebeck silt loam, 0 to 2 percent slopes (RhA).—This soil has the profile described as representative of the series. It is on the lake plain. Areas are long and wide and are generally 10 acres or more in size. Runoff is slow, and water accumulates.

Included with this soil in mapping are small areas of the similar, moderately well drained Hudson soils on knolls and the wetter Madalin soils in depressions. Also included were spots of the shallow Nassau soils where folds of shale and slate bedrock protrude above the lake plain and small areas where the surface layer is silty clay loam.

This Rhinebeck soil is suited to crops, hay, pasture, and woodland. Unless the soil is drained, planting is delayed and the choice of crops is limited. The soil clods and puddles easily if tilled at the wrong moisture content. Capability unit IIIw-1; woodland group 3w1.

Rhinebeck silt loam, 2 to 6 percent slopes (RhB).—This soil has a profile similar to the one described as representative of the series, but the leached subsurface layer commonly does not occur. The soil is undulating and smoothly sloping and is on the lake plain. Areas are long and wide and are generally 10 acres or more in size. Runoff accumulates.

Included with this soil in mapping are small areas of the similar, moderately well drained Hudson soils on knolls and the wetter Madalin soils in depressions and along drainageways. Also included are spots of the somewhat poorly drained Wallington soils, which are more silty throughout and have a fragipan that does not occur in Rhinebeck soils, and small areas where the surface layer is silty clay loam or loamy fine sand.

This Rhinebeck soil is suited to crops, hay, pasture, and woodland. Unless the soil is drained, planting is delayed and the choice of crops is limited. Unless protected, the soil is subject to erosion in cultivated areas. It is difficult to maintain good tilth because the soil clods and puddles easily if it is tilled at the wrong moisture content. Capability unit IIIw-1; woodland group 3w1.

Rock Outcrop

Rock outcrop is mapped in areas where bare bedrock covers 90 percent of the surface. In Washington County it is mapped with Farmington, Nassau, Hollis, and Vergennes soils.

Where mapped with Farmington soils, Rock outcrop is mainly limestone or dolomitic limestone. Mapped with Nassau soils, it is mainly slate, shale, or phyllite and, in places, sandstone. Where mapped with Hollis soils, it is mainly syenite or granite gneiss and, in places, quartzite. In areas of Vergennes soils, it can be any of these kinds of rock.

Rock outcrop-Hollis association, moderately steep through very steep (ROF).—This association is about 80 percent Rock outcrop and 20 percent Hollis soil. It is in areas in the Adirondacks that are dominated by exposures of bare bedrock (fig. 10). Areas are irregu-

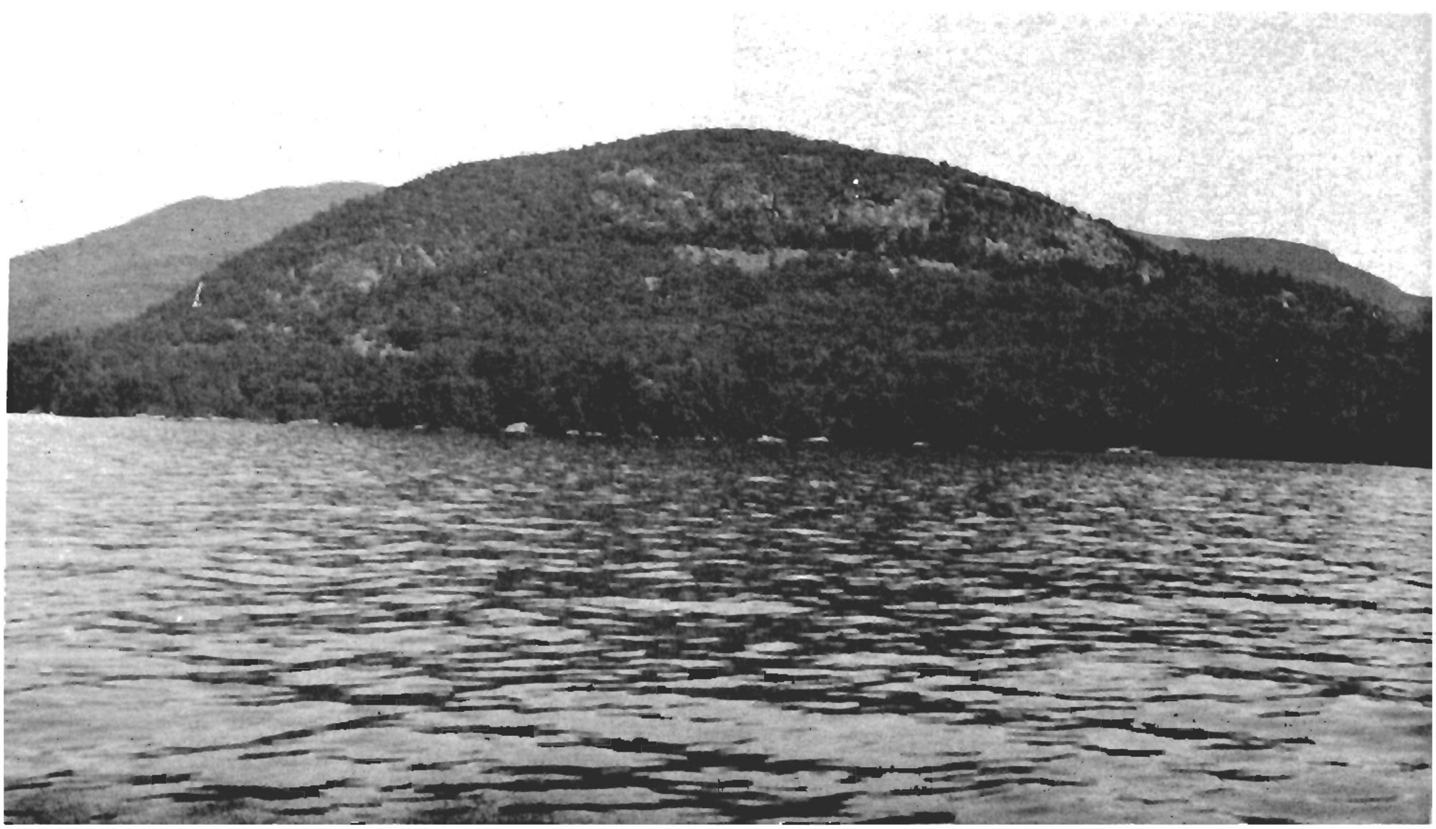

Figure 10.—**Bedrock exposure in Rock outcrop-Hollis association, moderately steep through very steep.**

larly shaped and are 40 acres or more in size. In most places slopes range from about 15 to 70 percent, but in places the rock exposures are vertical.

Rock outcrop in this association is mainly exposures of syenite or granite gneiss bedrock. Intermingled on these mountain landscapes is the shallow and somewhat excessively drained Hollis soil. This soil has a profile similar to the one described as representative of the Hollis series, but depth to bedrock is more variable from place to place and the surface layer is sandy loam or loamy sand in places.

Vegetation is sparse. Intersoil areas are mostly forested. The hazard of windthrow is high because the soils are shallow. Numerous outcrops, shallowness, and slope are limiting factors for most uses. Rock outcrop in capability unit VIIIs–1, woodland group not assigned; Hollis soil in capability unit VIIs–2, woodland group 5x2.

Rock outcrop-Vergennes association, gently sloping through moderately steep (RPC).—This association is about 30 percent Rock outcrop, 30 percent Vergennes very rocky silty clay loam, and 40 percent soils of minor extent. It is on areas of the lake plain that are dotted with protrusions of Rock outcrop. Areas are irregularly shaped and are 10 acres or more in size. Slopes range from 2 to 20 percent.

Numerous exposures of bare bedrock make up the Rock outcrop part of this association. This bedrock is either limestone, gneiss, quartzite, or folded slate and shale, depending on the area. Intermingled throughout the area are deeper pockets of the Vergennes soil. This soil has a profile similar to the one described as representative of the Vergennes series, but very rocky phases dominate the landscape. In places escarpments of bedrock are short and vertical. Of minor extent are the wetter Kingsbury and Covington soils, which formed in the same kind of lacustrine or estuarine deposits as the Vergennes soil; the well-drained Charlton soils in some of the deeper pockets around fringe areas of the Adirondack Mountains; and soils that are similar to the Vergennes soil, but are less than 40 inches deep over bedrock.

The soils in this association are suited to limited grazing, woodland, and some types of wildlife habitat. The numerous rock outcrops, clayey texture, and seasonal wetness are limiting factors for most uses. Rock outcrop in capability unit VIIIs–1, woodland group not assigned; Vergennes soil in capability unit VIs–2, woodland group 3x1.

Rock outcrop-Vergennes association, steep and very steep (RPF).—This association is about 40 percent Rock outcrop, 30 percent Vergennes very rocky silty clay loam, and 30 percent soils of minor extent. It is in areas of the lake plain that are dotted with steep protrusions of Rock outcrop. Areas are commonly long and narrow and are 15 acres or more in size. Slopes range from 20 to 70 percent.

Numerous exposures of bare bedrock make up the Rock outcrop part of this association. This bedrock is either limestone, gneiss, quartzite, or folded slate and shale, depending on the area. Intermingled in deeper pockets is the moderately well drained clayey Vergennes soil. This soil has a profile similar to the one described as representative of the Vergennes series, but very rocky phases dominate the landscape. Of minor extent are the shallow Farmington, Hollis, and Nassau soils and, in places, the deeper, well drained or moderately well drained Bernardston and Charlton soils. Also in the association are soils that are similar to the Vergennes soil but less than 40 inches deep over bedrock.

The soils in this association are suited to woodland. The numerous rock outcrops and the steep and very steep slopes are limiting factors for most uses. Rock outcrop in capability unit VIIIs–1, woodland group not assigned; Vergennes soil in capability unit VIIs–2, woodland group 3x2.

Saco Series

The Saco series consists of deep, very poorly drained, medium-textured soils. These soils formed in silty alluvial sediments. They are nearly level and are in low areas on flood plains that are subject to frequent flooding or in depressions on lake plains and stream terraces that are subject to frequent ponding.

A representative profile has a surface layer of very dark gray silt loam 12 inches thick. The substratum is mottled gray, friable silt loam that extends to a depth of 50 inches or more.

Saco soils are subject to frequent flooding or ponding. The water table is at or near the surface much of the time. Permeability is generally moderate. The depth of rooting is affected by the water table and is mainly in the top 10 to 15 inches. A few roots extend below this depth. Available moisture capacity is moderate, but more than enough water normally is available for plant growth. These soils are low to medium in content of lime. Their capacity to supply phosphorus is generally medium. Their capacity to furnish potassium is low. The total content of nitrogen is high, but nitrogen is released slowly during the long periods of wetness.

Excess water and frequent flooding are the main limiting factors for farm and nonfarm uses.

Representative profile of Saco silt loam, in an idle area; town of Greenwich, one-half mile north of Battenville, 20 feet east of N.Y. Route 29, on Batten Kill flood plain:

A1—0 to 12 inches, very dark gray (10YR 3/1) silt loam; few, fine, distinct, gray (10YR 5/1) mottles; weak, fine, granular structure; very friable; many fine roots and dark yellowish-brown root stains; no coarse fragments; medium acid; abrupt, smooth boundary.

C1g—12 to 30 inches, gray (10YR 5/1) silt loam; common, fine, distinct, gray (N 5/0) and olive-brown (2.5Y 4/4) mottles; massive; friable, slightly sticky and slightly plastic; many fine roots in lower part and strong-brown root stains throughout; many fine pores; no clay films; no coarse fragments; water table at depth of 12 inches; medium acid; clear, wavy boundary.

C2g—30 to 50 inches, gray (N 5/0) silt loam; many, fine, distinct, yellowish-brown (10YR 5/8) mottles; massive; friable, slightly sticky and slightly plastic; no roots; few fine pores; no clay films; no coarse fragments; slightly acid.

To a depth of 40 inches, the soil is mainly silt loam through very fine sandy loam, but lenses of silty clay loam or loamy fine sand occur. The depth to bedrock is generally more than 5 feet. Typically, the soil contains no coarse fragments, but in places it is as much as 3 percent gravel. The content of clay averages less than 15 percent. In unlimed soil, reaction in the A horizon ranges from strongly acid through neutral. Reaction in the C horizon ranges from medium acid through neutral.

The A horizon ranges from very dark gray (10YR 3/1) through very dark brown (10YR 2/2). The C horizon ranges from gray (N 6/0) through dark gray (10YR 4/1). It has weak granular structure or is massive, and it is friable or very friable when moist and slightly sticky and plastic when wet.

Saco soils formed in material similar to that of the closely associated, well-drained Hamlin soils; the moderately well drained to somewhat poorly drained Teel soils; and the poorly drained Limerick soils. They are the wetter associates of the moderately well drained Belgrade soils and the somewhat poorly drained Wallington soils, which formed in silty material on lake plains and old stream terraces.

Saco silt loam (Sa).—This nearly level soil is mainly in the lowest areas of flood plains that are subject to frequent flooding. It also is in frequently ponded depressions on lake plains and old stream terraces. On the flood plains it is in old oxbows or long narrow channels, and on the lake plains it is in oval-shaped areas. Areas are generally less than 10 acres in size.

Included with this soil in mapping on the flood plains are small mounds of the better drained Teel and Limerick soils. Included on the lake plains and stream terraces are spots of the better drained Wallington and Belgrade soils. Also included are areas, especially along the smaller streams, where gravel is within a depth of 40 inches and places where the surface layer is loam or very fine sandy loam.

This Saco soil is poorly suited to farming and woodland because it is wet and frequently flooded or ponded. In most places drainage is not feasible because outlets are difficult to find. The soil provides some limited grazing in dry periods and in places is suited to some types of wildlife habitat. Capability unit VIw-1; woodland group not assigned.

Saprists, Aquepts, and Aquents

Saprists, Aquepts, and Aquents (SB) consists of low-lying, level deposits of organic and mineral soil material, mainly around the edges of lakes and ponds, that is ponded with shallow water most of the year. The vegetation is coarse grasses, rushes, cattails, sedges, and other water-tolerant plants. Some trees grow along the edges. Included in mapping are wooded areas flooded by beaver dams.

This unit provides good habitat for waterfowl and for beaver, muskrat, and other animals that live near water. Capability unit VIIIw-1; woodland group not assigned.

Scriba Series

The Scriba series consists of deep, somewhat poorly drained, medium-textured soils that have a firm, dense fragipan 12 to 18 inches below the surface. These soils formed in glacial till derived mainly from shale, slate, and sandstone. They are nearly level to sloping and are on the lower parts of hillsides and in low-lying places on uplands.

A representative profile in a cultivated area has a surface layer of very dark grayish-brown gravelly silt loam 8 inches thick. This is underlain by a 4-inch leached layer of mottled grayish-brown, firm gravelly loam. The subsoil is a very firm, dense fragipan. It is mainly olive-brown and dark yellowish-brown gravelly loam to a depth of 26 inches. Between depths of 26 and 54 inches, it is mottled dark yellowish-brown and olive fine gravelly loam. The substratum is light olive-brown, firm gravelly loam.

In spring and during wet periods, the water table is perched on the dense, firm fragipan within 6 to 18 inches of the surface. Permeability is moderate above the fragipan and slow or very slow in the pan. Plant roots are limited mainly to the top 12 to 18 inches above the pan. A few enter the upper part and push into the vertical cracks. Available moisture capacity is low to moderate, but moisture is normally sufficient for plant growth. The total content of nitrogen is high, but nitrogen is released so slowly in spring that it is not adequate for plant growth. These soils are low in content of lime. Their capacity to supply phosphorus is medium. Their capacity to furnish potassium is low.

Seasonal wetness is a major limitation for farm uses. The seasonal high water table and the slow permeability are limitations for many nonfarm uses.

Representative profile of Scriba gravelly silt loam, 3 to 8 percent slopes, in a hayfield; town of White Creek, 50 feet west of McCart Road, three-fourths of a mile south of Post Corners:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) gravelly silt loam; moderate, fine and medium, granular structure; friable; many roots; 25 percent gravel; medium acid; abrupt, smooth boundary.

A2—8 to 12 inches, grayish-brown (2.5Y 5/2) gravelly loam; common, fine, faint mottles of light olive brown (2.5Y 5/4) and common, fine, distinct mottles of dark yellowish brown (10YR 4/4); weak, thick, platy structure; firm; common roots; 20 percent gravel; slightly acid; clear, wavy boundary.

Bx1—12 to 26 inches, 40 percent olive-brown (2.5Y 4/4) and 40 percent dark yellowish-brown (10YR 4/4) gravelly loam; many, fine, faint mottles of grayish brown (2.5Y 5/2); very coarse prisms, 18 to 24 inches wide, and strong, thick, platy structure within prisms; prisms separated by very thin streaks that have olive-gray (5Y 5/2) centers and yellowish-brown (10YR 5/6) borders; very firm and brittle; few roots along prism faces; thin, patchy clay films on plate faces and in pores; 25 percent coarse fragments; a few weathered remnants of rock; neutral; clear, wavy boundary.

Bx2—26 to 54 inches, 50 percent dark yellowish-brown (10YR 4/4) and 50 percent olive (5Y 5/3) gravelly loam; common, fine, faint mottles of grayish brown (2.5Y 5/2); very coarse prisms, 18 to 24 inches wide, and weak, thick, platy structure within prisms; prisms separated by thin streaks that have olive-gray centers and yellowish-brown borders; very firm and brittle; no roots; thin, patchy clay films on plate faces and in pores; 25 percent fine gravel; a few weathered remnants of rock; neutral; clear, wavy boundary.

Cx—54 to 64 inches, light olive-brown (2.5Y 5/4) gravelly loam; weak, thick, platy structure; firm, slightly plastic and slightly sticky; no roots; 25 percent gravel; some highly weathered remnants of rock; neutral.

The solum ranges from 36 to 55 inches in thickness. The depth to bedrock is more than 3½ feet. Depth to the fragipan ranges from 12 to 18 inches. The surface layer ranges from nonstony through very stony. Scattered stones and boulders are throughout the soil. Gravel, shale, and coarse fragments make up 10 to 25 percent of the A horizon and 20 to 35 percent of the fragipan and the C horizon. Reaction in the Bx horizon ranges from medium acid through neutral. Reaction in the C horizon ranges from slightly acid through mildly alkaline.

The Ap horizon is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2). The A2 horizon is mottled dark grayish brown (10YR 4/2) through light olive gray (5Y 6/2) and is gravelly loam or gravelly silt loam. The Bx horizon ranges from gray (10YR 5/1) through olive (5Y 5/4). It is gravelly loam or gravelly silt loam and has weak to strong, medium or thick, platy structure within very coarse prismatic structure. It is firm or very firm. The C horizon ranges from dark grayish brown (10YR 4/2) through olive (5Y 5/4) and is generally gravelly loam or gravelly silt loam. It is massive or has platy structure and is firm or very firm.

Scriba soils formed in material similar to that of the closely associated, well drained and moderately well drained Bernardston soils and the wetter Sun soils. On uplands they are also near the shallow Nassau soils. Adjacent to the lake plain and on glacial outwash terraces, they are near the somewhat poorly drained Wallington soils, which formed in silty, water-sorted sediment, and the somewhat poorly drained or poorly drained Fredon soils, which formed in gravelly outwash.

Scriba gravelly silt loam, 0 to 3 percent slopes (ScA).—This soil commonly is between hills in the uplands where runoff water accumulates. Slopes are concave. Areas are generally oval shaped and are 5 to 10 acres in size.

Included with this soil in mapping are areas where the surface layer is gravelly loam. Also included are spots of the shallow Nassau soils; the deep, well drained and moderately well drained Bernardston soils; and the poorly drained and very poorly drained Sun soils. All formed in similar unsorted material. Included in a few small areas are Wallington soils, which formed in silty lacustrine sediment. Also included are some areas of soils that are more acid.

This Scriba soil is suitable for crops, hay, pasture, and woodland. Unless the soil is drained, planting is delayed and the choice of crops is limited. Most of the acreage has been cleared of trees and stones and is used mainly for hay and midseason pasture. Capability unit IIIw–3; woodland group 3w2.

Scriba gravelly silt loam, 3 to 8 percent slopes (ScB).—This soil has the profile described as representative of the series. It commonly is at the base of hillsides and next to drainageways on the uplands where runoff water accumulates. Areas are generally oval shaped and are 5 to 10 acres in size.

Included with this soil in mapping are areas where the surface layer is gravelly loam, spots of the shallow Nassau soils, and spots of the well drained and moderately well drained Bernardston soils. Also included, in a few places where the uplands adjoin the outwash plains, are areas of Fredon soils and, in places, areas of soils that are more acid.

This Scriba soil is suitable for crops, hay, pasture, and woodland. Unless the soil is drained, wetness delays planting and limits the choice of crops. Drainage outlets are generally available. Unless protected, the soil is also subject to slight to moderate erosion in cultivated areas. Most of the acreage has been cleared of trees and stones and is used mainly for hay or midseason pasture. Capability unit IIIw–3; woodland group 3w2.

Scriba very stony soils, nearly level through sloping (SDC).—These soils have a profile similar to the one described as representative of the series, but the surface is more stony. The stones are spaced about 5 to 30 feet apart and prevent the use of modern farm equipment. The soils are in low-lying positions where slopes are concave and runoff is slow or on long smooth slopes on hilly uplands where runoff water accumulates.

Included with these soils in mapping are areas of the shallow Nassau soils and the deep, well drained and moderately well drained Bernardston soils, both of which formed in similar material. Also included are small areas of soils that have been cleared of stones and areas of soils that are more acid.

These Scriba soils are suitable for limited pasture and woodland. Stones prevent reseeding, liming, and fertilizing pastures. Capability unit VIs–1; woodland group 3w2.

Sun Series

The Sun series consists of deep, poorly drained and very poorly drained, medium-textured soils. These soils formed in glacial till drived mainly from shale, slate, and sandstone. They are nearly level and are along the lower parts of hillsides and in low-lying places on uplands.

A representative profile in a cultivated area has a surface layer of mottled dark-gray loam 9 inches thick. The subsoil extends to a depth of 21 inches. The upper 5 inches is mottled gray, friable loam, and the lower part is mottled light olive-brown, firm loam. The substratum is dark-brown, firm gravelly fine sandy loam. A few coarse fragments are scattered throughout the profile.

In spring and during wet periods, the water table is at or near the surface for long periods. It is perched on the slowly permeable substratum. Plant roots are limited mainly to the upper 15 inches. A few penetrate to a greater depth. Available moisture capacity is low to moderate, but more than enough water is available for plant growth. The total content of nitrogen is high, but nitrogen is released slowly. These soils are medium to high in content of lime. Their capacity to supply phosphorus and potassium is low.

Prolonged wetness is a major limitation for farm and nonfarm uses.

Representative profile of Sun loam, 0 to 3 percent slopes, in a pasture; town of Greenwich, 40 feet east of Mahaffy Road, one-half mile north of Mahaffy Road at Ryan Road:

Ap—0 to 9 inches, dark-gray (10YR 4/1) loam; common, fine, distinct, dark-brown (7.5YR 4/4) mottles; moderate, fine, granular structure; friable; many roots; 5 to 10 percent coarse fragments; strongly acid; abrupt, smooth boundary.

B21g—9 to 14 inches, gray (10YR 5/1) loam; few, fine, distinct, yellowish-brown (10YR 5/6) mottles and few, fine, distinct, gray (10YR 6/1) mottles; moderate, medium, subangular blocky structure; friable; common roots; few fine pores; no clay films; 5 to 10 percent coarse fragments; medium acid; clear, wavy boundary.

B22—14 to 21 inches, light olive-brown (2.5Y 5/4) loam; few, fine, distinct, yellowish-brown (10YR 5/6) motttles and few, fine, distinct, gray (10YR 6/1) mottles; moderate, medium, subangular blocky structure; firm; few roots; many fine pores; very thin clay films; 10 to 15 percent coarse fragments; neutral; clear, wavy boundary.

C—21 to 50 inches, dark-brown (10YR 4/3) gravelly fine sandy loam; massive; firm; water table at depth of 21 inches; 25 to 30 percent coarse fragments; neutral.

The solum ranges from 20 to 40 inches in thickness. The depth to carbonates ranges from 40 to 70 inches, and the depth to bedrock is more than 3½ feet. Reaction in the B horizon ranges from medium acid through neutral, and pH increases with increasing depth. The C horizon is neutral or mildly alkaline, or it is calcareous. Coarse fragments make up 5 through 35 percent of the solum and 20 through 50 percent of the C horizon.

The Ap horizon ranges from dark gray (10YR 4/1) through very dark grayish brown (10YR 3/2), has weak or moderate granular structure, and is very friable or friable. The B horizon ranges from light gray (5YR 6/1) through olive (5Y 4/4). It has mottles that range from yellowish brown (10YR 5/6) through gray (10YR 6/1), but the high-chroma mottles are dominant. It ranges from sandy loam through loam, is massive or has moderate subangular blocky structure, and ranges from friable through firm. The C horizon ranges from light gray (5YR 5/1) through olive (5Y 4/3). It has distinct or prominent mottles that range from few through many and decrease with increasing depth. It is sandy loam through loam and is firm or very firm.

Sun soils formed in material similar to that of the closely associated, well drained and moderately well drained Bernardston soils and the somewhat poorly drained Scriba soils. They are also near the shallow Nassau soils.

Sun loam (Su).—This nearly level soil has the profile described as representative of the series. It is in depressions or on foot slopes in the uplands where runoff is slow or water accumulates. Areas are generally oval shaped and are less than 10 acres in size.

Included with this soil in mapping are small areas of the deep, somewhat poorly drained Scriba soils and the shallow, somewhat excessively drained Nassau soils, both of which are on slight rises and knolls. Also included are spots where the surface layer is mucky or gravelly and others where it is sandy loam or silt loam and a few areas of more sloping soils.

Unless drained, this Sun soil is too wet for cropping. In many places drainage outlets are difficult to locate. The soil is suited to pasture during dry periods. Prolonged wetness makes it poorly suited to woodland. Capability unit IVw–2; woodland group 4w1.

Sun very stony soils (SV).—These nearly level soils have a profile similar to the one described as representative of the series, but are very stony and have a surface layer that ranges from silt loam to sandy loam. Stones and boulders are spaced about 5 to 30 feet apart on the surface. These soils are in depressions on uplands where runoff water accumulates. Areas are oval shaped and are generally less than 10 acres in size.

Included with these soils in mapping are small knolls of the deep, somewhat poorly drained Scriba soils and the shallow, somewhat excessively drained Nassau soils. Also included are spots of Sun soils that are not very stony and others that are more acid.

These Sun soils are too wet and too stony for cropping. They provide some limited grazing in dry periods. Prolonged wetness makes them poorly suited to woodland. Capability unit VIIs–3; woodland group 4w1.

Teel Series

The Teel series consists of deep, moderately well drained and somewhat poorly drained, medium-textured soils. These soils formed in recent alluvium. They are nearly level and are in slight depressions on flood plains.

A representative profile in a cultivated area has a surface layer of very dark grayish-brown silt loam 11 inches thick. The subsoil extends to a depth of 25 inches. The upper 8 inches is dark yellowish-brown silt loam, and the lower 6 inches is mottled olive-brown silt loam. The substratum is mottled light olive-brown silt loam that extends to a depth of 50 inches or more.

In spring and during wet periods, the water table rises to within about 18 to 24 inches of the surface. Permeability is moderate. Flooding occurs annually, but generally not during the growing season. The soil is friable, and the root zone is deep. Available moisture capacity is high. These soils are medium in content of lime. Their capacity to supply nitrogen, phosphorus, and potassium is medium.

The hazard of flooding is the main limiting factor for farm and many nonfarm uses. Teel soils are an excellent source of topsoil.

Representative profile of Teel silt loam, in a hayfield; town of White Creek, 2,000 feet west of N.Y. Route 22, 100 feet north of Brownell Corner Road, on Owl Kill flood plain:

Ap—0 to 11 inches, very dark grayish-brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry, crushed, and smoothed; moderate, medium, granular structure; friable; many roots; no coarse fragments; neutral; abrupt, smooth boundary.

B21—11 to 19 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, very fine, subangular blocky structure; friable; many roots; no coarse fragments; neutral; clear, wavy boundary.

B22—19 to 25 inches, olive-brown (2.5Y 4/4) silt loam; common, medium, distinct mottles of gray (10YR 6/1) and yellowish brown (10YR 5/4); moderate, very fine, subangular blocky structure; friable; common roots; no coarse fragments; neutral; clear, wavy boundary.

C—25 to 50 inches, light olive-brown (2.5Y 5/4) silt loam; common, medium, prominent mottles of gray (10YR 6/1); massive; very friable; few roots in upper part; no coarse fragments; neutral.

The solum ranges from 24 to 40 inches in thickness. The depth to bedrock is more than 4 feet. In places strongly contrasting sandy or gravelly material is at a depth of more than 40 inches. The soil generally contains no coarse fragments, but some subhorizons are as much as 20 percent gravel. Reaction ranges from medium acid to neutral. No free carbonates are within 40 inches of the surface. The depth to mottling ranges from 10 to 20 inches. High-chroma mottles generally occur in the upper part of the profile, and mottles that have chroma of 2 or less are within 24 inches of the surface.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) through dark brown (7.5YR 4/2) and has weak or moderate granular structure. The B horizon ranges from light olive brown (2.5Y5/4) through dark brown (10YR 3/3), is very fine sandy loam or silt loam, and has weak or moderate subangular blocky structure. The C horizon ranges from dark gray (10YR 4/1) through olive (5Y 5/4), is very sandy fine loam or silt loam, and has weak or moderate platy structure or is massive.

Teel soils formed in material similar to that of the closely associated, well-drained Hamlin soils and the wetter Limerick and Saco soils.

Teel silt loam (Te).—This nearly level soil is on flood plains close to the level of the stream. In places it occupies entire fields, and in other places it is shaped like a narrow finger. Areas are generally less than 20 acres in size. Runoff is slow.

Included with this soil in mapping on slight mounds are areas of the better drained Hamlin soils. Also included are spots where the surface layer is fine sandy loam to loam, areas of the wetter Limerick and Saco soils in low places, areas of soils along streams that have gravelly and sandy layers below the surface, areas that have spots of gravel on the surface, and areas of soils that are more acid.

This Teel soil is suited to crops, pasture, and woodland. It is well suited to most crops grown in the county. Crops respond well to irrigation and, because the soil is near streams, irrigation water is available. Capability unit IIw-4; woodland group 2o1.

Vergennes Series

The Vergennes series consists of deep, moderately well drained soils that have a fine-textured subsoil. These soils formed in calcareous lake-laid or estuarine-laid clay. They are gently sloping through very steep and are on lake and marine plains and terraces.

A representative profile in a cultivated area has a surface layer that is dark grayish-brown silty clay loam 6 inches thick. Below this is a 3-inch leached layer of light brownish-gray, firm silty clay. The subsoil extends to a depth of 25 inches. The upper 4 inches is mottled brown, firm silty clay. The lower part is mottled dark grayish-brown, firm clay. The substratum to a depth of 50 inches or more is dark grayish-brown, firm clay.

For short periods in spring and fall, a water table is perched on the dense clay within 18 to 24 inches of the surface. Permeability is very slow through the firm clay. The soil is saturated in spring and dries out later. Plant roots are mostly limited to the upper 24 inches. A few penetrate to a greater depth along cracks in the dense clay. Available moisture capacity is high. These soils are medium to high in content of lime. Their capacity to supply nitrogen and phosphorus is medium. Their capacity to furnish potassium is high.

The seasonal high water table and the very slow permeability are the main limitations for farm and nonfarm uses.

Representative profile of Vergennes silty clay loam, 2 to 6 percent slopes, in a pasture; town of Kingsbury, cellar hole about 1½ miles south of Smiths Basin on County Road 41, 100 feet west of road:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silty clay loam; strong, fine and medium, granular structure; friable; many roots; medium acid; clear, wavy boundary.

A2—6 to 9 inches, light brownish-gray (10YR 6/2) silty clay; strong, fine, angular blocky structure; firm, plastic and sticky; common roots; medium acid; gradual, wavy boundary.

B&A—9 to 13 inches, brown (10YR 4/3) silty clay; few, fine, faint, yellowish-brown (10YR 5/6) mottles; weak, coarse, prismatic structure parting to strong, medium, angular blocky; firm, plastic and sticky; common roots; peds coated with light brownish-gray (10YR 6/2) silt, 2 to 4 millimeters thick; medium acid; gradual, wavy boundary.

B2t—13 to 25 inches, dark grayish-brown (10YR 4/2) clay; common, medium, distinct, gray (10YR 5/1) mottles; weak, coarse, prismatic structure parting to strong, medium, angular blocky; firm, plastic and sticky; common roots; thick, continuous clay films on ped faces; slightly acid; gradual, wavy boundary.

C—25 to 50 inches, dark grayish-brown (10YR 4/2) clay; strong, coarse, angular blocky structure; firm, plastic and sticky; few roots; moderately alkaline; calcareous.

The solum ranges from 18 to 30 inches in thickness. The depth to bedrock is more than 3½ feet. The content of coarse fragments ranges from 0 to less than 5 percent, by volume, throughout the soil. Reaction in the A horizon and the upper part of the B horizon ranges from strongly acid to neutral. Reaction in the lower part of the B horizon ranges from medium acid to neutral. The content of clay in the solum is more than 60 percent. In some areas that have been plowed, no A2 horizon is evident.

The Ap horizon ranges from brown (10YR 5/3) through very dark grayish brown (10YR 3/2). The B horizon ranges from dark brown (7.5YR 3/2) through light olive brown (2.5Y 5/4) and has high-chroma mottles. It is silty clay or clay in the upper part and clay in the lower part; has weak through strong, fine through coarse, angular blocky structure; and is firm or very firm, plastic or sticky. The C horizon ranges from dark gray (10YR 4/1) through olive (5Y 5/4) and is mottled in places. It is clay, has blocky structure or is massive, and is firm or very firm.

Vergennes soils formed in material similar to that of the somewhat poorly drained Kingsbury soils and the poorly drained Covington soils and are closely associated with those soils. They are also near the shallow Farmington soils, which formed in till. In the northern part of the county they are closely associated with the shallow Hollis soils and the deep Charlton soils, which also formed in till.

Vergennes silty clay loam, 2 to 6 percent slopes (VeB).—This soil has the profile described as representative of the series. It is on lake plains or estuarine plains. Slopes are convex. Areas are long and fairly wide and are generally less than 20 acres in size. Runoff is medium.

Included with this soil in mapping are spots of the wetter Kingsbury and Covington soils in low places; spots of the shallow Farmington soils on knolls, which occur as isolated islands surrounded by the clay plain; and spots where the texture of the surface layer ranges from clay through silt loam. Also included in the northern part of the county are small areas of the shallow Hollis soils and the deep Charlton soils.

This Vergennes soil is suited to crops, pasture, and woodland. Unless protected, it is subject to erosion in cultivated areas. It has a high enough clay content that it becomes cloddy if plowed when wet. Wetness sometimes delays planting in spring (fig. 11). Most of the acreage is cleared and used for dairy farming. Capability unit IIe–2; woodland group 3c1.

Vergennes silty clay loam, 6 to 12 percent slopes (VeC).—This soil has a profile similar to the one described as representative of the series, but in places the upper part of the subsoil is thinner. The soil is in fairly long and narrow, convex strips. In a few places it is cut by many drainageways, so that short slopes tip in many directions. Areas are generally less than 15 acres in size. Runoff is medium.

Included with this soil in mapping are areas of the wetter Kingsbury soils in low spots and drainageways, the shallow Farmington soils on knolls, and some spots of eroded soils where the surface layer is washed off and clay is closer to the surface. Also included in the northern part of the county are the shallow Hollis soils.

This Vergennes soil is suited to crops, pasture, and woodland. Unless protected, it is subject to erosion in cultivated areas. It has a high enough clay content that it becomes cloddy if plowed when wet. Wetness sometimes delays planting for a short period in spring. Capability unit IIIe–1; woodland group 3c2.

Vergennes silty clay loam, 12 to 20 percent slopes (VeD).—This soil had a profile similar to the one described as representative of the series, but in most places the upper part of the subsoil is thinner. The soil is in narrow strips of deeply dissected lake plains or estuarine plains. Areas are generally less than 10 acres in size. Runoff is rapid.

Included with this soil in mapping are the wetter Kingsbury soils in low places near drainageways, the shallow Farmington soils on knolls, spots of eroded soils where the surface layer and organic matter are washed off, and small areas where the surface layer is silt loam or clay.

This Vergennes soil is suitable for grass, pasture, and woodland. Moderately steep slopes and the hazard of erosion limit its use for crops. Capability unit IVe–2; woodland group 3c3.

Wallington Series

The Wallington series consists of deep, somewhat poorly drained, medium-textured soils. These soils formed in glacial lake or stream terrace deposits of silt and very fine sand. They are nearly level.

A representative profile in a cultivated area has a surface layer of dark grayish-brown silt loam 9 inches thick. The upper 3 inches of the subsoil is mottled olive, friable silt loam. This is separated from the lower part by a 5-inch leached layer of mottled gray, friable silt loam. The lower 31 inches of the subsoil is a firm fragipan. It is mottled dark yellowish-brown silt loam to a depth of 32 inches and mottled gray silt loam below. The substratum to a depth of 66 inches is mottled gray, loose loamy fine sand. Between depths of 66 and 90 inches or more the substratum is stratified fine gravel and loose sand. Few or no coarse fragments are in the upper 40 inches of the profile.

Figure 11.—Fall plowing Vergennes soil eliminates excessive wetness that limits fieldwork in spring.

In spring and during wet periods, the water table is perched on the slowly permeable fragipan. Permeability is moderate above the fragipan and slow within it. The depth of rooting is strongly influenced by the water table and depth to the pan. Plant roots are limited mainly to the upper 8 to 9 inches early in spring. As the season progresses, they are limited to the upper 15 to 24 inches above the pan. A few extend below this depth. Available moisture capacity is moderate to high. Water runs off these soils slowly. These soils are low in content of lime. Their capacity to supply nitrogen is medium. Their capacity to furnish phosphorus and potassium is low.

The seasonal high water table is the main limiting factor for nonfarm uses.

Representative profile of Wallington silt loam, sandy substratum, in a hayfield; town of Hampton, 300 feet north of N.Y. Route 22A, 600 feet south of Poultney River Bridge:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, granular structure; friable; many roots; very strongly acid; abrupt, smooth boundary.

B2—9 to 12 inches, olive (5Y 5/3) silt loam; common, fine, distinct mottles of yellowish brown (10YR 5/8) and common, fine, faint mottles of gray (5Y 5/1); moderate, fine, subangular blocky structure; friable; common roots; common pores; very strongly acid; clear, wavy boundary.

A'2—12 to 17 inches, gray (10YR 5/1) silt loam; few, fine, distinct mottles of dark yellowish brown (10YR 4/4); weak, medium, platy structure; friable; common roots; common pores; strongly acid; clear, wavy boundary.

B'x1—17 to 32 inches, dark yellowish-brown (10YR 4/4) silt loam; common, medium, distinct mottles of gray (10YR 5/1); very coarse prisms separated by ¼- to 1-inch gray streaks that have strong-brown borders; moderate, medium and thick, platy structure within prisms; firm; few roots in streaks; very few, thin, patchy, gray (5Y 5/1) clay films within pores; common pores; strongly acid; clear, wavy boundary.

B'x2—32 to 48 inches, gray (N 6/0) silt loam; many, fine to coarse, distinct mottles of light olive brown (2.5Y 5/6), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6); very coarse prisms separated by strong-brown (7.5YR 5/8) faces; weak, thick, platy structure within prisms; firm; few roots along prism faces; no clay films; few pores; strongly acid; clear, smooth boundary.

IIC1—48 to 66 inches, gray (N 5/0) loamy fine sand; many, fine to coarse, distinct mottles of light olive brown (2.5Y 5/6), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6); single grained; loose; no roots; no pores; few, fine to coarse, dark reddish-brown (5YR 3/2) iron concretions at bottom of horizon; strongly acid; abrupt, smooth boundary.

IIIC2—66 to 80 inches, stratified yellowish-red (5YR 5/6) fine gravel and dark-gray (10YR 4/1) and yellowish-brown (10YR 5/6) coarse sand; single grained; loose; no roots; no pores; 50 percent coarse fragments, mostly less than one-half inch in diameter; neutral; abrupt, smooth boundary.

IVC3—80 to 90 inches, dark-gray (N 4/0) coarse sand; single grained; loose, nonsticky and nonplastic; no roots; no pores; water table at depth of 80 inches; neutral.

The solum ranges from 36 to 56 inches in thickness. The depth to bedrock is more than 6 feet, and depth to the fragipan ranges from 15 to 24 inches. Reaction in the solum ranges from very strongly acid through slightly acid. Reaction in the C horizon ranges from strongly acid through neutral. The soil contains few or no coarse fragments.

The Ap horizon is dark grayish brown (10YR 4/2) or very dark grayish brown (10YR 3/2). The A'2 horizon ranges from gray (10YR 5/1) through grayish brown (2.5Y5/2) and has distinct mottles of higher chroma. It is silt loam or very fine sandy loam. In places an A2 horizon occurs. It has colors and textures similar to those described for the A'2 horizon. The B horizon ranges from olive (5Y 5/3) through dark yellowish brown (10YR 4/4). It is silt loam or very fine sandy loam. The B'x horizon ranges from dark brown (7.5YR 4/4) through gray (N 6/0) and has common distinct mottles. The Bx horizon or B'x horizon has very coarse prismatic structure parting to subangular blocky or platy. The Bx horizon is firm or very firm. The C horizon ranges from dark brown to gray and is structureless and loose, stratified, fine to coarse sand and gravel.

Wallington soils formed in material similar to that of the closely associated, well drained Hartland soils and the moderately well drained Belgrade soils. They are also near the finer textured, moderately well drained Hudson soils and the somewhat poorly drained Rhinebeck soils.

Wallington silt loam, sandy substratum (Wa).—This nearly level soil is in depressions on lake plains and stream terraces. Areas are irregularly shaped and are generally less than 10 acres in size. Runoff is slow.

Included with this soil in mapping on slight rises are the moderately well drained Belgrade soils and the well drained Hartland soils, both of which formed in similar material. Also included are spots of the heavier, somewhat poorly drained Rhinebeck soils and the poorly drained and very poorly drained Madalin soils and other small areas of gently sloping Wallington soils.

This Wallington soil is suited to crops, pasture, and woodland. Unless the soil is drained, planting is delayed and the choice of crops is limited. Most of the acreage has been cleared of trees and is used for hay and midseason pasture. Capability unit IIIw-2; woodland group 3w1.

Use of the Soils for Crops and Pasture [3]

Crops commonly grown in Washington County are in support of dairying. They are mainly corn for silage or grain, oats, alfalfa, birdsfoot trefoil, timothy, bromegrass, and orchardgrass for hay and pasture.

This section defines general principles of the soil management needed in the county. It explains the system of capability classification used by the Soil Conservation Service, in which the soils are grouped according to their suitability for crops, and suggests use and management of the soils by capability units. Table 2 shows estimated yields of principal crops grown in the county under two levels of management.

General Principles of Soil Management

Although the soils in Washington County vary in their suitability for specific crops and require widely

[3] By Harold L. Hansen, agronomist, Soil Conservation Service.

different management, some basic principles of management apply to all the soils suitable for farm crops and pasture throughout the county.

The soils vary in their need for lime and fertilizer. The amounts needed are best determined by the results of soil tests, the needs of the crop, and the expected level of yields. For assistance in making and interpreting tests, farmers and others should consult their Cooperative Extension Agent. Only general lime and nutrient levels of soils are shown in this publication. Figure 12 shows the relationship of the different lime levels noted in the description of the soil series and the capability groups. Also, new research findings are presented in annual revised editions of "Cornell Recommends for Field Crops" and "Cornell Recommends for Vegetables," both prepared by the staff of the New York State College of Agriculture at Cornell University. In the absence of soil tests, the information in these references and in this publication can be used as a guide in determining lime and fertilizer needs.

Most soils in Washington County are fairly high in content of organic matter. In order to maintain the organic-matter content at a high level, however, it is important to apply farm manure and incorporate crop residue into the soil. If crops that produce little residue are grown, the cropping system should provide cover crops and sod crops.

In this county, wetness is a moderate to severe limitation on about 11 percent of the soils suitable for crops, for example, the somewhat poorly drained Kingsbury soils and the poorly drained Covington soils. Wetness sometimes delays planting on the moderately well drained Vergennes and Hudson soils for a short period in spring, but little or no drainage improvement is needed. Crops grow well on most of the somewhat poorly drained, poorly drained, and very poorly drained soils where excess water has been removed by tile drains, surface drains, or both. Land smoothing is also beneficial in places. Figure 13 shows the effect of soil drainage on root development in undrained areas.

Erosion is a principal source of sediment in streams. It ranks above domestic sewage, industrial wastes, and chemicals as a major cause of water pollution. In Washington County, all of the gently sloping and steeper soils are subject to erosion in cultivated areas. On such erodible soils as Belgrade silt loam, 2

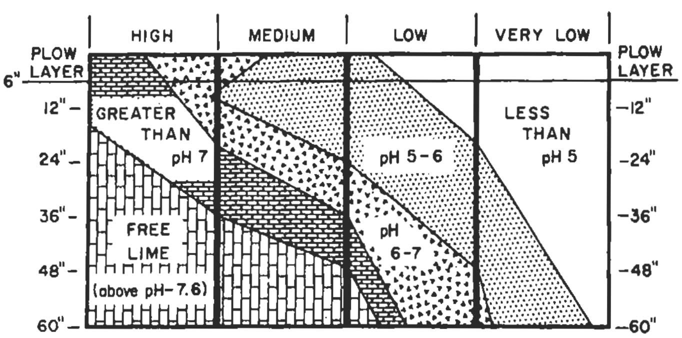

Figure 12.—Four soil profiles in Washington County showing varying lime content.

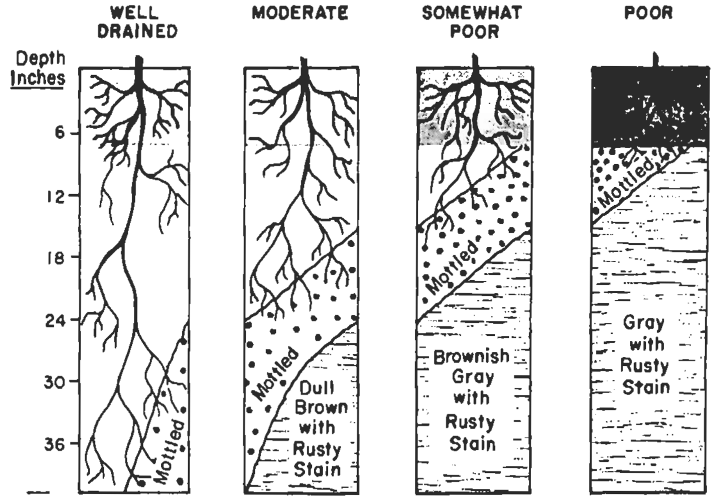

Figure 13.—Effect of soil drainage on root growth.

to 6 percent slopes, or Bernardston gravelly silt loam, 8 to 15 percent slopes, a cropping system that improves or maintains good physical condition of the soil, reduces soil loss to tolerable limits, and controls insects and diseases is needed along with other soil-conserving measures. 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 farmers in planning an effective combination of practices to control erosion.

A high level of pasture management is needed on some soils, such as Hudson silt loam, 12 to 20 percent slopes, or Vergennes silty clay loam, 12 to 20 percent slopes, 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 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 groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management.

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, all kinds of soil are grouped at three levels: the capability class, the subclass, and the unit. These levels are defined in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, 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 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 or range, woodland, or wildlife.
- Class VI soils have severe limitations that make them generally unsuitable for cultivation and limit their use largely to pasture or range, woodland, or wildlife.
- Class VII soils have very severe limitations that make them unsuitable for cultivation and restrict their use largely to pasture or range, woodland, or wildlife.
- Class VIII soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife, water supply, or 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 but not in Washington County, shows that the main limitation is climate that is too cold or too dry.

Class I has 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 or 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 limitations, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Management by capability units

In the following pages the capability units in Washington County are described, and suggestions are given for the use and management of the soils.

CAPABILITY UNIT I-1

Hartland very fine sandy loam, 0 to 2 percent slopes, the only soil in this unit, is a deep, well-drained soil on stream terraces, lake plains, and deltas. Roots readily penetrate this soil to a depth of 40 inches or more. The available moisture capacity is high. This soil is low to medium in content of lime. Its capacity to supply nitrogen is medium. Its capacity to furnish phosphorus and potassium is low.

This soil is among the post productive soils in the county. Crops respond well to fertilizer and lime. Row crops can be grown year after year without damage to the soil if minimum tillage, crop residue, and green manure crops are used to maintain desirable soil structure and a good rate of water intake.

CAPABILITY UNIT I-2

Hamlin silt loam, the only soil in this unit, is a deep, nearly level, well-drained soil on flood plains. The deep root zone has a high available moisture capacity. This soil is medium in content of lime. Its capacity to supply nitrogen, phosphorus, and potassium is medium. Flooding is generally not a hazard during the growing season.

This soil is among the most productive soils in the county. It is easily worked throughout a fairly wide range of moisture content. Crops respond well to fertilizer and lime. Row crops can be grown year after year without damage to the soil if minimum tillage, crop residue, and green manure crops are used to maintain desirable soil structure and a good rate of water intake.

CAPABILITY UNIT IIe-1

This unit consists of deep, gently sloping, loamy soils of the Hartland and Belgrade series. These soils are on stream terraces, lake plains, and deltas. The Hartland soil is well drained. The Belgrade soil is moderately well drained. Roots in the Hartland soil are not restricted. Roots in the Belgrade soil are confined mainly to the upper 18 to 20 inches for short periods in spring, but as the growing season progresses, they extend throughout the profile. Both soils have a high available moisture capacity. Both are low to medium in content of lime. Their capacity to supply nitrogen is medium. Their capacity to furnish potassium is low. Phosphorus reserves are low to medium. The hazard of erosion is severe.

Under proper management, which includes control of erosion, these soils are highly productive. They are suited to all crops commonly grown in the county. They are easily worked throughout a fairly wide range of moisture content. Crops respond well to fertilizer and lime. Generally, the seasonal high water table in the Belgrade soil is not too limiting a factor. Where necessary, it can be lowered by installing a drainage system.

Unless the erosion hazard is reduced by contour farming and contour stripcropping, cropping intensity should not exceed 2 years of successive row crops before seeding to hay for 3 or 4 years. Diversions or terraces and minimum tillage are alternative measures for reducing runoff and erosion. If the soils are farmed intensively, contour farming should be supplemented with the return of crop residue.

CAPABILITY UNIT IIe-2

This unit consists of deep, gently sloping, moderately well drained soils of the Vergennes and Hudson series. These soils formed in silty and clayey lake or estuarine deposits. Roots are concentrated in the upper 18 to 24 inches, but a few penetrate below this depth through cracks in the dense clay. The available moisture capacity is high. The soils are medium to high in content of lime. Their capacity to supply nitrogen and phosphorus is medium. Their capacity to furnish potassium is high. The hazard of erosion is severe.

These soils are suited to most crops grown in the county. They can be worked successfully within only a narrow range of moisture content. If tilled when moist, they become cloddy and puddle easily. Because permeability is slow or very slow, wetness sometimes delays planting and grazing for short periods in spring. This limitation can generally be overcome by installing surface drains and growing deep-rooted crops. Crops respond well to nitrogen and phosphorus. Lime needs vary.

Unless surface runoff and erosion can be controlled by contour farming and contour stripcropping, the cropping intensity should not exceed 2 or 3 years of row crops before seeding to hay for 3 or 4 years. Diversions or terraces along with grassed waterways are alternative measures for reducing erosion.

Managing crop residue is essential in maintaining desirable soil structure and controlling erosion. The use of green manure crops, cover crops, and minimum tillage is also beneficial.

CAPABILITY UNIT IIe-3

This unit consists of deep and moderately deep, gently sloping soils of the Pittsfield and Palatine series. These soils are on uplands. They formed in glacial till that contained lime. The Pittsfield soil is well drained and moderately coarse textured. It is medium in content of lime. Its capacity to supply phosphorus and potassium is low. The Palatine soil is a well drained to somewhat excessively drained, medium-textured soil that is 20 to 40 inches deep over dark, calcareous shale bedrock. It is high in content of lime. Its capacity to supply phosphorus is medium, and its capacity to furnish potassium is high. Both soils have a moderate to high available moisture capacity. Their capacity to supply nitrogen is medium. Unless these soils are protected, the hazard of erosion is slight to moderate in cultivated areas.

These soils are suited to most crops commonly grown in the county. They are easily worked throughout a fairly wide range of moisture content. Crops repond well to fertilizer. Lime needs vary.

Unless erosion and runoff can be controlled by contour farming and contour stripcropping, the cropping intensity should not exceed about 2 years of successive row crops before seeding to hay for 3 or 4 years. Diversions or terraces are alternative measures for reducing runoff and erosion. If the soils are farmed intensively, contour farming should be supplemented with the use of crop residue and minimum tillage.

CAPABILITY UNIT IIe-4

Bernardston gravelly silt loam, 3 to 8 percent slopes, the only soil in this unit, is a deep, well drained and moderately well drained soil on uplands. It has a very firm, slowly permeable fragipan at a depth of 18 to 30 inches that restricts growth of roots and movement of water. The root zone is 18 to 30 inches deep and has a moderate to high available moisture capacity. This soil is low or very low in content of lime. Its capacity to supply nitrogen and phosphorus is medium. Potassium reserves are low. Unless the soil is protected, the hazard of erosion is slight to moderate in cultivated areas.

This soil is well suited to most crops grown in the county. It is easily worked throughout a fairly wide range of moisture content. Crops respond well to fertilizer and lime. Wetness sometimes delays planting for short periods in spring. Spot draining these wet areas keeps the moisture more uniform throughout the entire field.

Unless erosion can be reduced by contour farming and contour stripcropping, the cropping intensity should not exceed 2 years of successive row crops before seeding to hay for 3 or 4 years. Diversions and terraces are alternative measures for reducing runoff and erosion. If the soil is farmed intensively, contour farming should be supplemented with the return of crop residue. Minimum tillage is an alternative measure for reducing erosion.

CAPABILITY UNIT IIe-5

This unit consists of a complex of a gently sloping, deep Bernardston soil and shallow Nassau soil on uplands. The Bernardston soil is well drained and moderately well drained and is medium textured. It has a dense, slowly permeable fragipan at a depth of 18 to 30 inches that restricts growth of roots and movement of water. The Nassau soil is a somewhat excessively drained, very shaly, medium-textured soil that is 10 to 20 inches deep over folded shale bedrock. The available moisture capacity ranges from high in the Bernardston soil to very low in the Nassau soil, and the moisture pattern in this soil complex varies extremely from place to place. Both soils are very low or low in content of lime. Their capacity to supply nitrogen and phosphorus is medium. Potassium reserves are low. Unless the soils are protected, the hazard of erosion is slight to moderate in cultivated areas.

These soils are only fairly well suited to many of the crops grown in the county. They are easily tilled throughout a fairly wide range of moisture content. Response of crops to lime and fertilizer is spotty because moisture is lacking in areas of the shallow Nassau soil. Shale bedrock crops out in places, but not extensively enough to interfere greatly with the use of farm equipment.

Complex slopes are common. In such places, contouring for control of erosion is not feasible. Cropping systems should not exceed 1 year of corn, 1 year of grain, and at least 2 years of hay. Additional measures that help control erosion are the return of crop residue and the use of green manure crops and minimum tillage.

CAPABILITY UNIT IIw-1

This unit consists of deep, nearly level, moderately well drained soils of the Belgrade, Claverack, and Herkimer series. Belgrade and Herkimer soils formed in water-sorted material on deltas, lake plains, and terraces. They are medium textured. Claverack soils formed in 20 to 40 inches of sandy material over clay and are on lake plains. In all of these soils, roots are confined mainly to the top 20 inches in spring. Those of deep-rooted crops generally extend to a greater depth as the season progresses. The available moisture capacity is high in the Belgrade soil and low to moderate in Claverack and Herkimer soils. The Belgrade soil is low in content of lime, the Claverack soil is low to high, and the Herkimer soil is low to medium. All are medium in their capacity to supply nitrogen. The capacity to furnish phosphorus is medium in Belgrade and Herkimer soils and low in the Claverack soil. The capacity to supply potassium is low in the Belgrade and Claverack soils and medium in the Herkimer soil. Wetness sometimes delays planting for short periods in spring.

These soils are fairly well suited to most crops grown in the county. They are easily worked throughout a fairly wide to wide range of moisture content. Crops respond well to fertilizer. Because the Claverack soil is excessively leached in places, response is generally better to smaller but more frequent applications than to one large one. Crops grown on the Belgrade and Herkimer soils and, in places, the Claverack soil respond well to lime. Spot drainage of wetter areas improves the utility of fields made up of these soils. Row crops can be grown year after year without damage to the soil if minimum tillage, crop residue, and green manure crops are used to maintain desirable soil structure and a good rate of water intake.

CAPABILITY UNIT IIw-2

Claverack loamy fine sand, 2 to 6 percent slopes, the only soil in this unit, is a deep, moderately well drained, coarse-textured soil that formed in 20 to 40 inches of sandy material over clay on lake plains, estuaries, and deltas. The depth of rooting is confined mainly to the top 20 inches early in spring and to the 20 to 40 inches of sandy material as the season progresses. The available moisture capacity is low to moderate. This soil is low to high in content of lime. Its capacity to supply nitrogen is medium. Its capacity to furnish phosphorus and potassium is low. Wetness delays planting for short periods in spring. Unless the soil is protected, the hazard of erosion is slight to moderate in cultivated areas.

This soil is fairly well suited to most crops grown in the county. It can be worked throughout a wide range of moisture content. Because the soil is excessively leached, response is generally better to smaller but more frequent applications of fertilizer than to one large application. Lime needs vary. Spot drainage of wetter areas improves the utility of fields made up of this soil. Unless contour measures are used to control erosion and runoff, row crops should not be grown more than 2 years in succession before seeding to close-growing crops for 3 or 4 years. If the soil is farmed intensively, these erosion control practices should be supplemented with minimum tillage, the return of crop residue, and the use of green manure crops.

CAPABILITY UNIT IIw-3

This unit consists of deep, gently sloping, moderately well drained, medium-textured soils of the Amenia and Herkimer series. The Amenia soil formed in till on uplands. It is high in content of lime and has moderate to high available moisture capacity. The Herkimer soil formed in gravelly outwash on terraces. It is low to medium in content of lime and has low to moderate available moisture capacity. Both soils have medium capacity to supply nitrogen, phosphorus, and potassium. The depth of rooting is mainly in the top 18 to 24 inches in spring and is influenced by the seasonal water table. Few roots extend below this depth as the water table recedes. Wetness sometimes delays planting for a short time in spring. Unless these soils are protected, the hazard of erosion is slight to moderate in cultivated areas.

Soils of this unit are well suited or fairly well suited to most crops grown in the county. They can be worked throughout a fairly wide range of moisture content. Crops respond well to fertilizer. The need for lime varies. It is generally greater on Herkimer soils. Spot drainage of wetter areas improves the utility of fields made up of these soils.

Unless runoff and erosion can be controlled by contour farming and contour stripcropping, the cropping intensity should not exceed more than 2 years of row crops before seeding to close-growing crops for 3 or 4 years. Diversions are needed to break up long slopes. If the soils are farmed intensively, these erosion control practices should be supplemented with minimum tillage, the return of crop residue, and the use of cover crops.

CAPABILITY UNIT IIw-4

Teel silt loam, the only soil in this unit, is a deep, nearly level, moderately well drained to somewhat poorly drained, medium-textured soil on flood plains. The depth of rooting is mainly in the top 18 to 24 inches in spring and is affected by the seasonal high water table. Roots extend to a depth of 30 inches or more as the water table recedes. The available moisture capacity is high. This soil is medium in content of lime. Its capacity to supply nitrogen, phosphorus, and potassium is medium. It is subject to flooding, but generally is not flooded during the growing season. Wetness sometimes delays planting for short periods in spring.

This soil is very well suited to most crops grown in the county. Early spring flooding and the seasonal high water table restrict the choice of some crops. Crops respond very well to fertilizer and lime. This soil is easily worked throughout a fairly wide range of moisture content. The best economic return is generally obtained by growing row crops, which can be grown year after year without damage to the soil if minimum tillage and crop residue are used. Winter cover is desirable. Problems caused by flooding (fig. 14) can be reduced in places by improving and maintaining existing stream channels and using levees.

CAPABILITY UNIT IIs-1

This unit consists of deep, nearly level and gently sloping, somewhat excessively drained, moderately coarse textured, gravelly soils of the Hoosic series. These soils formed in very gravelly glacial outwash deposits on outwash plains and terraces. The depth of rooting is mainly in the top 30 inches. Few roots extend below this depth. The available moisture capacity is low or very low. These soils are low or very low in content of lime. Their capacity to supply nitrogen is medium. Their capacity to furnish phosphorus and potassium is low. They tend to be droughty, and plants show moisture stress after short dry periods. Unless the soils are protected, the hazard of erosion is slight to moderate where they are gently sloping.

Unless irrigated, these soils are generally better suited to deep-rooted crops than to shallow-rooted crops, which are damaged by drought. They are easy to work and can be planted early. Applied lime and fertilizer are leached rapidly from the soils; therefore, the response is generally better to smaller but more frequent or more timely applications than to one large application. In places surface gravel interferes with the operation of precision machinery used for the cultivation and harvesting of vegetable crops. Row crops can be grown year after year if organic-matter content is maintained by good management. Organic matter can be restored annually by the return of crop residue, use of cover crops, and an occasional year or two of sod.

Erosion is a slight limitation on the gently sloping soils. The longer, uniform slopes can be contoured. Sod crops, minimum tillage, and plant residue on the surface are needed on undulating soils or in large fields where contouring is not feasible.

These are excellent soils for irrigated crops because they have a rapid infiltration rate and little or no

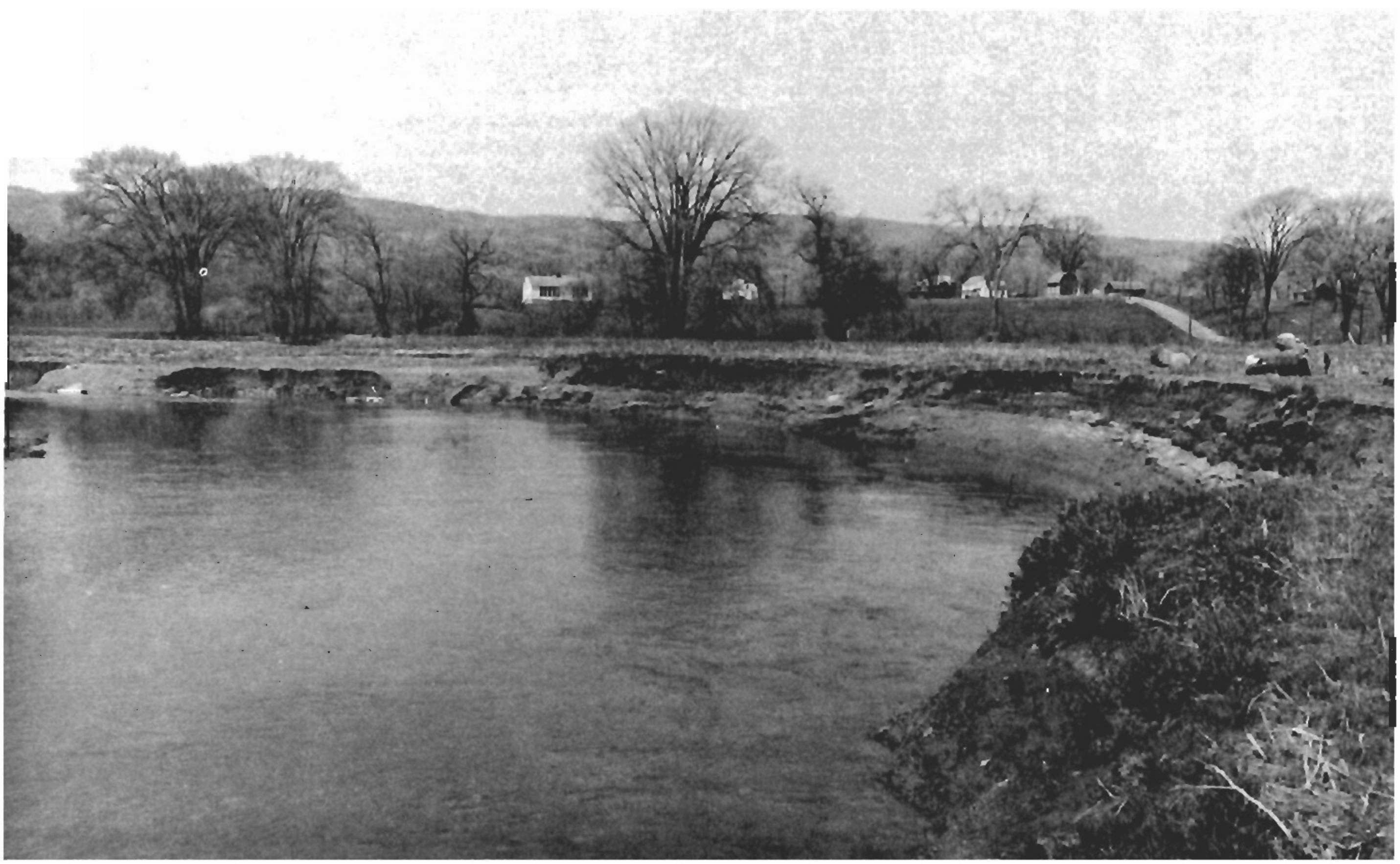

***Figure 14.*—Streambank erosion in Teel soil.**

crusting or sealing. They also can be cultivated soon after irrigation with little or no compaction.

CAPABILITY UNIT IIIe-1

This unit consists of deep, sloping, medium-textured soils of the Hudson series and moderately fine textured soils of the Vergennes series. These soils are dominantly moderately well drained, but Hudson soils in places are well drained. All formed in silty and clayey deposits on lake plains or estuarine plains. Roots are concentrated in the upper 18 to 24 inches, but a few penetrate below this depth through cracks in the dense clay subsoil. Runoff is rapid, and the hazard of erosion is severe. The available moisture capacity is high. The soils are medium to high in content of lime. Their capacity to supply nitrogen and phosphorus is medium. Their capacity to furnish potassium is high.

These soils are fairly well suited to most field crops grown in the county, but they can be worked within only a narrow range of moisture content. If tilled when moist, they become cloddy and puddle easily. The slow and very slow permeability causes wetness in spring, which sometimes delays planting or grazing for a short time. Generally this limitation can be overcome by using surface drainage and growing deep-rooted crops. Crops respond well to nitrogen and phosphorus. Lime needs vary.

These soils are subject to severe erosion in frequently cultivated areas. Complex slopes are common. In such places, contouring to control runoff and erosion is not feasible. Cropping intensity should not exceed 1 year of row crops before seeding to hay for at least 2 years. Where feasible, contouring and stripcropping along with diversions or terraces and grassed waterways permit more intensive use of these soils. Minimum tillage, the return of crop residue, and the use of green manure crops help in maintaining the organic-matter content and favorable soil structure and also help in controlling erosion.

CAPABILITY UNIT IIIe-2

Hoosic gravelly sandy loam, 8 to 15 percent slopes, the only soil in this unit, is a deep, somewhat excessively drained, moderately coarse textured, gravelly soil. This soil formed in very gravelly outwash on kames and terraces. The depth of rooting is mainly in the top 30 inches, but a few roots extend below this depth. The available moisture capacity is low or very low. This soil is low or very low in content of lime. Its capacity to supply nitrogen is medium. Its capacity to furnish phosphorus and potassium is low. It is droughty. Unless the soil is protected, the hazard of erosion is moderate to severe.

Deep-rooted crops should be favored in cropping systems on this droughty soil. Shallow-rooted crops are damaged by lack of moisture, and irrigation is generally not feasible because erosion is a hazard. This soil warms up early in spring, and it can be worked throughout a wide range of moisture content. Surface gravel in places interferes slightly with tillage. Applied lime and fertilizer are leached rapidly from this soil; therefore, response is generally better to smaller but more frequent or more timely applications than to one large application.

Unless runoff and erosion can be controlled by contour farming and contour stripcropping, the cropping intensity should not exceed 1 year of row crops before seeding to hay for 2 or more years. Additional measures that help control erosion are the use of minimum tillage and green manure crops and the return of crop residue.

CAPABILITY UNIT IIIe-3

Hartland very fine sandy loam, 6 to 12 percent slopes, the only soil in this unit, is a deep, well-drained, medium-textured soil. This soil formed in silt and very fine sand on old stream terraces, lake plains, and deltas. The depth of rooting is 40 inches or more. The available moisture capacity is high. This soil is low to medium in content of lime. Its capacity to supply nitrogen is medium. Its capacity to furnish phosphorus and potassium is low. Unless protected, it is highly erodible.

This soil is fairly well suited to the field crops commonly grown in the county. It can be easily worked throughout a fairly wide range of moisture content. Crops respond very well to lime and fertilizer. Unless runoff and erosion can be controlled by contour measures, tillage should be confined largely to renovation of hay and pasture sods. If contour measures are used, the cropping system should not exceed more than 2 years of successive row crops before seeding to hay for at least 2 or 3 years. Additional measures that help control erosion are the use of minimum tillage and cover crops and the return of crop residue.

CAPABILITY UNIT IIIe-4

This unit consists of deep and moderately deep, sloping soils of the Pittsfield and Palatine series. These soils are on uplands. They formed in glacial till that contained lime. The Pittsfield soil is well drained and moderately coarse textured. It is medium in content of lime. Its capacity to supply phosphorus and potassium is low. The Palatine soil is a well-drained to somewhat excessively drained, medium-textured soil that is 20 to 40 inches deep over dark, calcareous shale bedrock. It is high in content of lime. Its capacity to furnish phosphorus is medium, and its capacity to supply potassium is high. Both soils have a moderate to high available moisture capacity. Their capacity to supply nitrogen is medium. Unless they are protected, the hazard of erosion is moderate to severe in cultivated areas.

These soils are fairly well suited to the field crops commonly grown in the county. They are easily worked throughout a fairly wide range of moisture content. Crops respond well to fertilizer. Lime needs vary.

Unless erosion can be reduced by contour measures, tillage should be confined largely to renovation of hay and pasture sods. If contour tillage and contour stripcropping are used, the cropping system should not exceed 2 years of row crops before seeding to hay for at least 2 years. Diversions are needed to break up long slopes. Additional measures that help control erosion are the use of minimum tillage and cover crops and the return of crop residue.

CAPABILITY UNIT IIIe-5

Bernardston gravelly silt loam, 8 to 15 percent slopes, the only soil in this unit, is a deep, dominantly well drained, medium-textured soil on uplands. This soil has a very firm, slowly permeable fragipan at a depth of 18 to 30 inches that restricts growth of roots and movement of water. The available moisture capacity is moderate to high. This soil is low or very low in content of lime. Its capacity to supply nitrogen and phosphorus is medium. Its capacity to furnish potassium is low. Unless the soil is protected, the hazard of erosion is moderate to severe in cultivated areas.

This soil is fairly well suited to the field crops commonly grown in the county. It is easily worked throughout a fairly wide range of moisture content. Crops respond well to lime and fertilizer.

Unless erosion can be controlled by contour measures, the cropping system should not exceed 1 year of row crops before seeding to hay for 3 or 4 years. If contour measures and diversions are used to break up long slopes, the cropping system should not exceed 2 years of row crops before seeding to hay for at least 2 years. Additional measures that help reduce erosion are the use of minimum tillage and cover crops and the return of crop residue.

CAPABILITY UNIT IIIe-6

Only Bernardston-Nassau shaly silt loams, 8 to 15 percent slopes, is in this unit. It is on uplands. The Bernardston soil is deep, dominantly well drained, and medium textured. It has a dense, slowly permeable fragipan at a depth of 18 to 30 inches that restricts growth of roots and movement of water. The Nassau soil is a somewhat excessively drained, very shaly, medium-textured soil that is only 10 to 20 inches deep over folded shale bedrock. The available moisture capacity ranges from high in the Bernardston soil to very low in the Nassau soil; consequently, the moisture pattern in this soil complex varies extremely from place to place. Both soils are low or very low in content of lime. Their capacity to supply nitrogen and phosphorus is medium. Potassium reserves are low. Unless the soils are protected, the hazard of erosion is moderate to severe in cultivated areas.

These soils are only fairly well suited to the field crops commonly grown in the county. They are easily tilled throughout a fairly wide range of moisture content. Response of crops to lime and fertilizer is spotty because moisture is lacking in areas of the shallow Nassau soil. Shale bedrock crops out in places, but not extensively enough to interfere greatly with the use of farm equipment.

Complex slopes are common. In such places, contouring for control of erosion is not feasible. Sod-forming crops should be favored in the cropping system. Where contour measures can be applied, the cropping system should seldom exceed 1 year of row crops before seeding to 1 year of grain and 2 years of hay. Additional measures that help reduce erosion are the return of crop residue and the use of green manure crops and minimum tillage.

CAPABILITY UNIT IIIw-1

This unit consists of deep, nearly level and gently sloping, somewhat poorly drained, fine-textured soils of the Kingsbury series and medium-textured soils of the Rhinebeck series. These soils formed in clayey and silty deposits on lake plains or estuarine plains. The depth of rooting is affected by the seasonal high water table and the slowly permeable or very slowly permeable clayey subsoil and is confined mainly to the upper 15 to 20 inches. The available moisture capacity is low to moderate in the Kingsbury soil and moderate to high in the Rhinebeck soil. Normally, moisture is more than sufficient for plant growth. These soils are medium to high in content of lime. Their capacity to supply phosphorus is medium. Their capacity to furnish potassium is high. The total content of nitrogen is generally high, but nitrogen is released so slowly in spring, when the soils are cold and wet, that crops respond to additional applications. Excessive wetness is the main limitation. Also, unless protected, the gently sloping soils are subject to erosion in cultivated areas.

In undrained areas, planting is delayed and the choice of crops is limited mainly to sod crops that tolerate wetness. These soils can be worked within only a very narrow range of moisture content. If tilled when wet, they become cloddy and puddle easily. Crop response to fertilizer is fair. Lime needs vary.

If row crops are grown, it is essential that the drainage system be effective. Surface drainage by means of land shaping on nearly level soils and diversions ditches along with graded rows on gently sloping soils are generally more effective than using tile drains because the subsoil is slowly permeable or very slowly permeable. Additional measures that help in maintaining good soil structure and controlling erosion on the sloping soils are minimum tillage and the return of crop residue. Also, the cropping intensity should not exceed 1 year of row crops before seeding to hay for at least 2 years.

CAPABILITY UNIT IIIw-2

This unit consists of deep, nearly level, medium-textured soils of the Fredon and Wallington series and a moderately coarse textured soil of the Cosad series. These soils are dominantly somewhat poorly drained, but the Fredon soil in places is poorly drained. All formed in water-sorted material on outwash plains, stream terraces, lake plains, or delta fringes. The depth of rooting is affected by the seasonally high water table, and in spring most roots are near the surface. As the season progresses, roots extend to a depth of about 24 inches in the Cosad and Fredon soils and to a depth of 15 to 24 inches above the fragipan in the Wallington soil. The available moisture capacity is low to moderate in the Cosad soil, moderate in the Fredon soil, and moderate to high in the Wallington soil. The Cosad soil is low to high in content of lime, the Fredon soil is medium to high, and the Wallington soil is low. All have a medium to high capacity to supply nitrogen, but nitrogen is released so slowly in spring, when the soils are cold and wet, that crops respond to additional applications. The Fredon soil has a medium capacity to supply phosphorus and potassium. Reserves of these elements are low in the Cosad and Wallington soils. Seasonal wetness is the main limitation.

Unless these soils are drained, planting is delayed and the choice of crops limited mainly to sod crops that tolerate some wetness. Tile drains, surface drains, or both are generally effective. Also, land shaping is a desirable supplemental measure in places.

If effectively drained, these soils can be worked throughout a fairly wide range of moisture content. Crops respond well to lime and fertilizer. The need for lime varies. If the soils are used intensively for row crops, the cropping system should include green manure crops and occasional sod crops. Minimum tillage and the return of crop residue also are essential.

CAPABILITY UNIT IIIw-3

This unit consists of deep, nearly level and gently sloping, somewhat poorly drained, medium-textured soils of the Scriba series. These soils formed in glacial till on uplands. They have a dense, slowly permeable or very slowly permeable fragipan at a depth of 12 to 18 inches that restricts growth of roots and movement of water. The available moisture capacity above the fragipan is low to moderate. Normally, moisture is more than sufficient for plant growth, but drought can be a limiting factor during extended dry periods in midsummer. These soils are low in content of lime. Their capacity to supply phosphorus is medium. Their capacity to furnish potassium is low. The total content of nitrogen is high, but nitrogen is released so slowly in spring, when the soils are cold and wet, that crops respond to additional applications. Seasonal wetness is the main limitation. Unless protected, the gently sloping Scriba soil has a slight to moderate hazard of erosion in cultivated areas.

Unless these soils are drained, wetness delays planting and limits the choice of crops mainly to sod crops that tolerate wetness. Seasonal wetness also affects workability. Crop response to lime and fertilizer is fair.

Growing row crops on these soils is generally not economically feasible unless drainage and water disposal measures are adequate. Surface drainage is generally more effective than tile drains, other than for spot drainage, because the slowly permeable or very slowly permeable fragipan is near the surface. Land shaping is also a desirable drainage measure in places. On gently sloping soils, diversion ditches, graded rows, stripcropping, and grassed waterways are effective in controlling erosion and disposing of water. If these soils are row cropped, the cropping system should include sod crops. Minimum tillage and the return of crop residue also are essential.

CAPABILITY UNIT IIIw-4

Limerick silt loam, the only soil in this unit, is a deep, nearly level, poorly drained, medium-textured soil on flood plains. The depth of rooting is affected by a high water table and is confined mainly to the upper 12 inches in spring. Few roots extend below this depth as the water table recedes. The available moisture capacity is moderate to high. This soil is low to medium in content of lime. Its capacity to supply phosphorus and potassium is generally low to medium. The content of nitrogen is high, but nitrogen is released slowly in spring when the soil is wet and cold. The hazards of flooding and wetness are the main limitations.

Unless this soil is drained and protected from flooding during the growing season, the choice of crops is limited mainly to forage crops that tolerate wetness.

If adequately drained and protected from flooding, this soil is fairly well suited to intensive row cropping. Minimum tillage, the return of crop residue, and occasional sod crops are needed to maintain soil structure. Crops respond well to lime and fertilizer.

CAPBILITY UNIT IIIw-5

Carlisle muck, the only soil in this unit, consists of well-decomposed organic deposits 51 inches or more deep over mineral material. It is in wet depressions in valleys and on lake plains and uplands. Unless it is drained, the water table is at or near the surface much of the time. The depth of rooting is affected by the water table. This soil ranges from low to high in content of lime. Its capacity to supply phosphorus and potassium is low. The content of nitrogen is high, but nitrogen is released so slowly when the water table is close to the surface that crops respond to additional applications. Excessive wetness is the main limitation. Also, many areas occur in frost pockets.

Most of the acreage is forested with water-tolerant trees. If drained, many areas can be used for cash crops of high value. After drainage, however, the organic material shrinks and settles. For this reason, controlled drainage is generally desirable to accommodate the moisture needs of the crops to be grown and reduce the amount of shrinkage and decomposition. If the soil is used intensively for crops, structure of the surface layer breaks down, and the soil is highly susceptible to blowing. Windbreaks are needed to reduce crop damage and keep drainage ditches from becoming plugged and ineffective.

CAPABILITY UNIT IIIs-1

Oakville loamy fine sand, 0 to 5 percent slopes, the only soil in this unit, is a deep, excessively drained, sandy soil that formed in water-sorted or wind-sorted sandy deposits on deltas and terraces. Plant roots can easily penetrate the loose sandy top 30 inches. The available moisture capacity is very low to moderate. The soil is medium in content of lime. Its capacity to supply nitrogen, phosphorus, and potassium is low. Droughtiness and low fertility are among the main limitations. Also, unless protected, the soil is subject to soil blowing.

This soil is better suited to deep-rooted crops than to others. Its use for shallow-rooted crops is limited unless it is irrigated. It is easy to cultivate, but frequent cultivation often results in damage from soil blowing. Lime and fertilizer are easily leached from this soil; therefore, response is generally better to smaller but more frequent or more timely applications than to one large application. In order to minimize damage from soil blowing and maintain organic-matter content, the cropping system should include cover crops. Minimum tillage and the return of crop residue also are essential.

CAPABILITY UNIT IIIs-2

Farmington loam, 0 to 8 percent slopes, the only soil in this unit, is a shallow, well-drained, medium-textured soil on uplands. The depth of rooting is limited mainly to the 10 to 20 inches of soil above limestone bedrock. Few roots penetrate below this depth along joints and through solution cracks in the limestone. The available moisture capacity is very low to moderate. This soil is medium in content of lime. Its capacity to supply nitrogen, phosphorus, and potassium is medium. It is subject to erosion unless protected. Also, lack of moisture is a limiting factor. Rock crops out in places, but not extensively enough to interfere greatly with the use of farm equipment.

Crops that mature early or can withstand dry periods are generally better suited than others because this soil is droughty. The soil can be worked throughout a fairly wide range of moisture content. Crop response to lime and fertilizer is affected by the available water capacity.

All rotations should include sod-farming crops. Except under soil-conserving management, the maximum intensity should not exceed 1 year of cultivated crops before seeding to sod for 3 or 4 years. Soil and water can be conserved by contour cultivation or stripcropping, minimum tillage, the return of crop residue, and a cropping system that includes cover crops.

CAPABILITY UNIT IVe-1

This unit consists of soils of the Bernardston and Nassau series. These soils are on uplands. Bernardston soils are mainly deep, moderately steep, dominantly well drained, and medium textured. They are intermingled in a rolling and hilly complex with the shallow, very shaly, somewhat excessively drained, medium-textured Nassau soils. Bernardston soils have a dense, slowly permeable fragipan at a depth of 18 to 30 inches that restricts growth of roots and movement of water. Nassau soils are only 10 to 20 inches deep over folded shale bedrock. The available moisture capacity is moderate to high in the Bernardston soils and low or very low in the Nassau soils. It varies widely from place to place. The soils are low or very low in content of lime. Their capacity to supply nitrogen and phosphorus is medium. Potassium reserves are low. Runoff is rapid on these moderately steep, rolling, and hilly soils. The hazard of erosion is severe.

These soils are not suited to cultivated crops because they are moderately steep or rolling and hilly and are subject to erosion. The slope makes tillage and harvesting difficult and hazardous. These soils should be used mainly for hay or pasture. The pastures or meadows need renovation and applications of lime and fertilizer. Response is spotty in areas of the Bernardston-Nassau complex because little moisture is available in the shallow Nassau soil. Shale bedrock crops out in this complex, but not extensively enough to interfere greatly with the use of farm equipment.

CAPABILITY UNIT IVe-2

This unit consists of deep, moderately steep, medium-textured soils of the Hudson series and moderately fine textured soils of the Vergennes series. These soils are dominantly moderately well drained, but the Hudson soil in places is well drained. Both soils formed in silty and clayey deposits on lake plains or estuarine plains. Roots are concentrated in the upper 18 to 24 inches, but a few penetrate below this depth through cracks in the dense clay subsoil. The available moisture capacity is high. The soils are medium to high in content of lime. Their capacity to supply nitrogen and phosphorus is medium. Their capacity to furnish potassium is high. Runoff is rapid, and the hazard of erosion is very severe.

These soils are poorly suited to cultivated crops because they are moderately steep and are subject to very severe erosion. The slope makes tillage difficult and hazardous. Also, they can be tilled within only a fairly narrow range of moisture content. If tilled when moist, they become cloddy. Tillage should be confined largely to renovation for hay and pasture, to which the soils are well suited. Using the soils for hay and pasture helps in controlling erosion and runoff. Applications of nitrogen and phosphorus are needed for best crop response. Lime needs vary.

CAPABILITY UNIT IVe-3

Nassau shaly silt loam, undulating through hilly, the only soil in this unit, is a shallow, somewhat excessively drained, medium-textured soil on uplands. It has folded slaty bedrock at a depth of 10 to 20 inches that limits growth of roots. The available moisture capacity is very low or low. The soil is very low in content of lime. Its capacity to supply nitrogen and phosphorus is medium. Its capacity to furnish potassium is low. Unless protected, it is subject to severe erosion. Also, it is droughty.

This soil is poorly suited to general cultivated crops because it has complex undulating, rolling, and hilly slopes and is shallow over bedrock, droughty, and subject to erosion. Crops that mature early or can withstand dry periods are better suited than others. Bedrock crops out extensively enough to interfere slightly with tillage. Also, the hilly areas are difficult and hazardous to work. Because erosion is a hazard, tillage should be confined largely to renovation for hay and pasture. Applications of lime and fertilizer are needed for best crop response. An application of nitrogen on grass sods early in spring makes more efficient use of the moisture available for early pasture or hay.

CAPABILITY UNIT IVe-4

Hartland very fine sandy loam, 12 to 20 percent slopes, the only soil in this unit, is a deep, well-drained, medium-textured soil. It formed in silt and very fine sand on old stream terraces, lake plains, and deltas. The depth of rooting is 40 inches or more. The available moisture capacity is high. This soil is low to medium in content of lime. Its capacity to supply nitrogen is medium. Its capacity to furnish phosphorus and potassium is low. Slope and the severe hazard of erosion are the main limitations.

Slope and the hazard of erosion make this soil poorly suited to cultivated crops. The soil is better suited to close-growing grain and sod-forming crops than to others. It is especially well suited to high-yielding varieties of alfalfa. It can be tilled throughout a fairly wide range of moisture content, but the steeper soils are difficult and hazardous to work. Where possible, contour tillage or cross-slope tillage should be used as a supplemental measure to control erosion even where renovating for hay and pasture. Applications of lime and fertilizer are needed for best crop response. Old pasture can be improved by adding lime and fertilizer, but periodic renovation of pasture sod provides higher quality feed and is better for control of erosion.

CAPABILITY UNIT IVe-5

Hoosic gravelly sandy loam, rolling and hilly, the only soil in this unit, is a deep, somewhat excessively drained, moderately coarse textured, gravelly soil that formed in very gravelly outwash on kames or kame terraces. The depth of rooting is mainly in the top 30 inches. The available moisture capacity is low or very low. The soil is low or very low in content of lime. Its capacity to supply nitrogen is medium. Its capacity to furnish phosphorus and potassium is low. Unless protected, it is subject to severe erosion. Also, it is droughty.

This soil is poorly suited to cultivated crops because it has complex slopes and is subject to erosion. Contour measures to control erosion are generally not feasible. Tillage should be confined largely to renovation of hay and pasture. Deep-rooted grasses and legumes should be favored because they tolerate droughtiness. Applied lime and fertilizer are needed for best crop response. Applied nutrients are readily leached from this soil; therefore, response is generally better to smaller but more frequent or more timely applications than to one large application.

CAPABILITY UNIT IVw-1

This unit consists of deep, nearly level, moderately fine textured soils of the Covington and Madalin series. These soils formed in clayey lacustrine or estuarine deposits. They are dominantly poorly drained, but in places the Madalin soil is very poorly drained. The depth of rooting is restricted mainly to the upper 15 inches. It is affected by the water table, which is at or near the surface for extended periods, and by the slowly permeable or very slowly permeable clayey subsoil. The available moisture capacity is low in the Covington soil and low to moderate in the Madalin soil, but moisture is normally more than sufficient for plant growth. These soils are high to medium in content of lime. The total content of nitrogen is high, but nitrogen is released slowly in spring when the soils are wet and cold. Both soils have a medium capacity to supply phosphorus. Their capacity to furnish potassium is high. Excess water, the slow or very slow permeability, and the difficulty of maintaining good tilth are limitations.

Unless drained, these soils are too wet for cultivation and are better suited to native pasture or woodland than to other uses. Completely effective drainage is difficult to accomplish. In cultivated areas hay and pasture mixtures that tolerate wetness are generally better suited than other plants. Where outlets are available, surface drainage by open ditches, or land shaping, or both is more effective than tile drainage because the subsoil and substratum are slowly permeable or very slowly permeable. The range of moisture content within which these soils can be worked is very narrow. If tilled when wet, they become cloddy and puddle easily and become hard when dry. Favorable moisture conditions for plowing, preparation of the seedbed, and seeding generally occur during dry periods in summer. Livestock and machinery traffic should be avoided on these soils when they are wet because such traffic causes the surface layer to compact and puddle. Response to lime and fertilizer is fair. Native pasture can be improved by annual applications of complete fertilizer. These soils provide fair summer forage when drier soils lack moisture.

CAPABILITY UNIT IVw-2

This unit consists of deep, level or nearly level, medium-textured, very poorly drained soils of the Halsey series and poorly drained and very poorly drained soils of the Sun series. These soils are in depressions where runoff water accumulates and remains for long periods. The Halsey soil formed in gravelly glacial outwash on terraces, and the Sun soil formed in till on uplands. Unless the soil is drained, the depth of rooting is mainly in the upper 10 to 15 inches and is influenced by the water table. The available moisture capacity is low to moderate, but water is generally more than sufficient for plant growth. The Halsey soil is medium in content of lime, and the Sun soil is medium to high. Both soils are high in total content of nitrogen, but nitrogen is released slowly in spring, when the soil is wet and cold. The capacity to supply phosphorus and potassium is medium in the Halsey soil and low in the Sun soil. Excessive wetness is the main limitation.

Unless drained, these soils are too wet for cultivation and are better suited to native pasture or woodland. Where outlets are available, they can generally be effectively drained by surface drains, or subsurface drains, or both. If adequately drained, they are suited to most field crops commonly grown in the county. If they are used for continuous row cropping, the organic-matter content and favorable soil structure should be maintained by the use of minimum tillage and cover crops and the return of crop residue. Response of crops to lime and fertilizer is fair to good, depending upon the effectiveness of drainage. Native pasture can be improved by annual applications of complete fertilizer. These soils provide fair summer forage when drier soils lack moisture.

CAPABILITY UNIT IVw-3

Palms muck, the only soil in this unit, is a very poorly drained organic soil that is underlain by loamy mineral material at a depth of 16 to 50 inches. This soil is in waterlogged depressions on uplands, lake plains, and outwash plains. Unless the soil is drained, the water table is at or near the surface much of the time. The depth of rooting is affected by the water table. This soil is medium to high in content of lime. The content of nitrogen is high, but nitrogen is released slowly when the water table is near the surface. This soil has a low capacity to supply phosphorus and potassium. Excessive wetness and, in places, shallow organic deposits are limitations. Also, in many areas this soil is in frost pockets.

If adequately drained, some areas of this soil can be used for cash crops of high value. After drainage, however, the organic material shrinks and settles so much that in areas where the muck is less than 3 feet thick, cultivation is generally not economically feasible. Such areas are better suited to wildlife habitat. In the deeper areas, controlled drainage is desirable to accommodate the moisture needs of the crops to be grown and reduce the amount of shrinkage and decomposition. If the soil is used intensively for crops, structure of the surface layer breaks down, and the soil is highly susceptible to blowing. Windbreaks are needed to reduce crop damage and keep drainage ditches from becoming plugged and ineffective.

CAPABILITY UNIT IVs-1

This unit consists of deep, excessively drained, sandy soils of the Oakville series and very gravelly and sandy soils of the Otisville series. These soils formed mainly in water-sorted deposits on glacial outwash terraces, kames, and deltas. The Oakville soil is gently sloping and sloping, and the Otisville soils range from nearly level through hilly. Roots can easily penetrate these soils, but most are confined to the top 20 to 30 inches, especially in the Otisville soils. The available moisture capacity is very low to moderate in the Oakville soil and very low in the Otisville soils. The Oakville soil is medium in content of lime, and the Otisville soils are low or very low. All have a low capacity to supply nitrogen, phosphorus, and potassium. Droughtiness and low fertility are among the main limitations. Also, unless protected, these soils are subject to erosion and soil blowing.

Unless they can be irrigated, the droughty soils in this unit are better suited to deep-rooted crops or early maturing crops than to others. Some of the soils, especially the rolling and hilly Otisville soils, are too steep and too erodible for irrigation. All are early soils that can be worked throughout a wide range of moisture content. The content of gravel in Otisville soils interferes with tillage. Also, frequent cultivation of the Oakville soil in many places results in damage from soil blowing. Lime and fertilizer are needed for the best crop response. Applied nutrients are easily leached from these soils; therefore, response is generally better to smaller but more frequent or more timely applications than to one large application.

Complex slopes are common. In such places, contouring to control erosion and runoff is not feasible. Unless contour measures can be applied, tillage should be confined largely to renovation of hay and pasture. An occasional row crop can be grown on the less sloping soils. In such areas, the cropping system should include the use of minimum tillage and cover crops and the return of crop residue in order to maintain the organic-matter content and provide protective cover.

CAPABILITY UNIT VIw-1

Saco silt loam, the only soil in this unit, is a deep, very poorly drained, medium-textured soil that formed in silty alluvial sediment. It is nearly level and is in low areas on flood plains that are frequently flooded or is in depressions on lake plains and stream terraces that are frequently ponded. The water table is at or near the surface much of the time. The depth of rooting is mainly in the top 10 to 15 inches and is affected by the water table. The available moisture capacity is moderate, but water is generally more than sufficient for plant growth. This soil is low to medium in content of lime. Generally, its capacity to supply phosphorus is medium. Its capacity to furnish potassium is low. The total content of nitrogen is high, but nitrogen is released slowly during the long periods of wetness. Prolonged wetness and the frequency of flooding or ponding are limitations.

Unless drained, this soil is not suitable for cropping because wetness is prolonged and flooding or ponding frequent. Drainage in most places is not feasible because outlets are not available. Where cleared of brush and trees, the soil provides some limited grazing during dry periods and, in places, is suited to some forms of wildlife habitat.

CAPABILITY UNIT VIs-1

This unit consists of deep, very stony, well drained, moderately well drained, and somewhat poorly drained soils of the Amenia, Bernardston, Pittsfield, Charlton, and Scriba series on uplands. Amenia, Bernardston, and Pittsfield soils are gently sloping through moderately steep; Charlton soils are gently sloping and sloping; and Scriba soils are nearly level through sloping. Surface stoniness is the main feature that affects the use of these soils for crops. Large stones and boulders more than 10 inches in diameter are 5 to 30 feet apart on the surface.

These soils are too stony for cultivation. They provide some native pasture and are suited to woodland and to development for some types of wildlife habitat. In places, cleared areas that are used for pasture can be improved by topdressing with lime and fertilizer and hand seeding with such legumes as birdsfoot trefoil. These soils are generally well drained or moderately well drained and can be grazed fairly early in the season. Scriba soils are somewhat poorly drained. Grazing should be controlled in improved areas to maintain productivity and quality of the stand.

CAPABILITY UNIT VIs-2

This unit consists of nearly level to moderately steep, very rocky soils of the Farmington, Hollis, Nassau, and Vergennes series. The well-drained Farmington soils and the somewhat excessively drained Hollis and Nassau soils are shallow soils on uplands. The moderately well drained Vergennes soil is a deep, clayey soil on lake plains or estuarine plains. Bedrock exposures are the main limiting feature. Approximately 10 to 25 percent of the surface area is exposed rock and soil too thin over rock for useful plant growth. In places, these soils are also very stony.

These soils are too rocky and, in places, too stony for cultivation. Much of the acreage is covered with woody vegetation. In places, cleared areas that are used for pasture can be improved by topdressing with lime and fertilizer and hand seeding such legumes as birdsfoot trefoil. Most of the soils, except the Vergennes soil, can be grazed early in the season. Grazing should be controlled in improved areas to maintain productivity and quality of the stand.

CAPABILITY UNIT VIIe-1

This unit consists of deep, steep and very steep soils of the Bernardston, Hudson, and Vergennes series. Bernardston soils are dominantly well drained and are on uplands. Hudson and Vergennes soils are well drained and moderately well drained and commonly are on the walls of deep dissections in the lake plain. The steep and very steep slopes are the main limiting factor. Unless the soils are protected, runoff is rapid and the hazard of erosion is very severe. Also, mass slippage and landslides are common on the Hudson and Vergennes soils.

These soils are too steep for cropping or the use of farm equipment, but they are suited to woodland. In places they provide some limited grazing. Generally, grazing animals should be restricted from these soils in order to preserve natural cover for control of runoff and erosion.

CAPABILITY UNIT VIIs-1

This unit is made up of deep soils of the Charlton, Hoosic, Otisville, and Oakville series. Charlton soils are very stony, well-drained, moderately steep and steep soils on uplands. The very gravelly and sandy, somewhat excessively drained Hoosic soil and excessively drained Otisville soil are steep and very steep and are on glacial outwash terrace escarpments, kames, and eskers. The sandy, excessively drained, moderately steep and steep Oakville soil is on escarpments of deltas and terraces. The moderately steep through very steep slopes along with the very stony nature of the Charlton soil; the very droughty nature of the Hoosic, Otisville, and Oakville soils; and the low natural fertility of all these soils are the main limiting factors. Also, unless the soils are protected, erosion is a severe hazard.

Most of these soils are too steep or too stony for cropping. They are fairly well suited to woodland. In places, the moderately steep Charlton and Oakville soils provide some early grazing. In such places, the establishment and maintenance of adequate cover for erosion control is very difficult. Grazing animals should generally be restricted from these soils in order to preserve the natural cover.

CAPABILITY UNIT VIIs-2

This unit consists of very rocky, moderately steep to very steep soils of the Farmington, Hollis, Nassau, and Vergennes series. The well-drained Farmington soil and the somewhat excessively drained Hollis and Nassau soils are shallow soils on uplands. The deep, clayey, moderately well drained Vergennes soil is on lake plains or estuarine plains. Bedrock exposures and the moderately steep through very steep slopes are the main limiting factors. Approximately 10 to 25 percent of the surface area is exposed rock and soil too thin over rock for useful plant growth. In places, these soils are very stony. Also, unless they are protected, they are subject to erosion.

These soils are too rocky and, in most places, too steep and too stony for cultivation and improvement for pasture. Much of the acreage is covered with woody vegetation. Grazing animals should be restricted from areas of these soils in order to preserve adequate cover for control of erosion and runoff.

CAPABILITY UNIT VIIs-3

Sun very stony soils, the only mapping unit in this capability unit, consists of deep, nearly level, poorly drained and very poorly drained soils in depressions in the uplands where water accumulates and remains for long periods. Stoniness and wetness are the main limiting factors. Stones and boulders more than 10 inches in diameter are spaced 5 to 30 feet apart on the surface. The water table is at or near the surface much of the time.

These soils are too stony and too wet for cropping. Cleared areas provide some limited grazing of native vegetation during dry periods. Such areas are generally too wet to benefit from such improvement measures as topdressing with lime and fertilizer and hand seeding.

CAPABILITY UNIT VIIIw-1

The land type Saprists, Aquepts, and Aquents makes up this unit. It is popularly termed Fresh water marsh and consists mainly of low-lying, level, organic and mineral soil material along the edges of lakes and ponds that are ponded with shallow water much of the year. Also included are areas flooded by beaver dams.

This land is too wet for the commercial production of plants, and drainage is generally not feasible. The marsh is well suited to wetland wildlife habitat for aquatic animals and waterfowl.

CAPABILITY UNIT VIIIs-1

This unit consists only of the land type Rock outcrop, which is exposures of bare bedrock over 90 percent of the surface area. In Washington County, Rock outcrop has been mapped as parts of associations with very rocky soils of the Farmington, Hollis, Nassau, and Vergennes series. Where mapped in association with Farmington soils, it is mainly limestone or dolomite; with Hollis soils, it is mainly syenite or granite gneiss; with Nassau soils it is mainly slate or shale; and with Vergennes soils, any of the abovenamed kinds of rock. Slopes range from nearly level through very steep.

These bedrock exposures are not suitable for the commercial production of plants. In places they provide areas for recreational development.

Estimated Yields [4]

Table 2 shows the estimated yields per acre of the principal crops grown on soils of Washington County under two levels of management.

[4] STANLEY M. ANDERSON and EARL F. GATES, Soil Conservation Service, and LESLIE G. NEUFFER, county cooperative extension agent, helped prepare this section.

The figures in columns A represent yields to be expected under average management. Average management is defined as the less than highly skilled use of crop rotations, lime, fertilizer, cultivation, artificial drainage, and other soil-conserving practices. The estimates shown in columns A are a little above the average yields obtained by farmers in the county in the mid-1960's.

TABLE 2.—*Estimated average yields per acre of specified crops under two levels of management*

[Figures in columns A indicate yields obtained under ordinary management; those in columns B are yields to be expected under improved management. Absence of figure indicates that crop is not commonly grown on the specified soil. Only arable soils are listed]

Soil	Corn for silage		Corn for grain		Forage mixture (hay): Alfalfa-grass		Forage mixture (hay): Alfalfa-birdsfoot trefoil-grass		Forage mixture (hay): Birdsfoot trefoil-grass	
	A	B	A	B	A	B	A	B	A	B
	Tons	*Tons*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*
Amenia silt loam, 3 to 8 percent slopes	16	20	80	100	3.0	5.0	3.0	4.0	2.5	3.5
Belgrade silt loam, 0 to 2 percent slopes	16	24	80	100	3.0	5.0	3.0	4.0	2.5	3.5
Belgrade silt loam, 2 to 6 percent slopes	16	24	80	100	3.0	5.0	3.0	4.0	2.5	3.5
Bernardston gravelly silt loam, 3 to 8 percent slopes	16	20	80	100	3.0	5.0	3.0	4.0	2.5	3.5
Bernardston gravelly silt loam, 8 to 15 percent slopes	14	18	70	90	3.0	5.0	3.0	4.0	2.5	3.5
Bernardston gravelly silt loam, 15 to 25 percent slopes	12	16			2.5	4.5	2.5	3.5	2.5	3.5
Bernardston-Nassau shaly silt loams, 3 to 8 percent slopes	10	12	50	70	2.5	4.0	2.5	3.5	2.0	3.0
Bernardston-Nassau shaly silt loams, 8 to 15 percent slopes	10	12	50	70	2.5	4.0	2.5	3.5	2.0	3.0
Bernardston-Nassau shaly silt loams, rolling and hilly					2.5	4.0	2.5	3.5	2.0	3.0
Claverack loamy fine sand, 0 to 2 percent slopes	16	20	80	100	3.0	5.0	3.0	4.0	2.5	3.5
Claverack loamy fine sand, 2 to 6 percent slopes	16	20	80	100	3.0	5.0	3.0	4.0	2.5	3.5
Cosad fine sandy loam	14	18	70	90	2.5	4.0	2.0	3.0	2.5	3.5
Covington silty clay loam							2.0	3.0	2.5	3.5
Farmington loam, 0 to 8 percent slopes	10	14	50	70	2.0	3.5	2.0	3.5	2.0	3.0
Fredon silt loam	14	18	70	90	2.5	4.0	2.0	3.0	2.5	3.5
Halsey mucky silt loam	14	18	70	90	2.5	4.0	2.0	3.0	2.5	3.5
Hamlin silt loam	18	30	100	140	3.0	5.0	3.0	5.0	2.5	3.5
Hartland very fine sandy loam, 0 to 2 percent slopes	16	26	90	110	3.0	5.0	3.0	4.0	2.5	3.5
Hartland very fine sandy loam, 2 to 6 percent slopes	16	26	90	110	3.0	5.0	3.0	4.0	2.5	3.5
Hartland very fine sandy loam, 6 to 12 percent slopes	14	22	70	90	3.0	5.0	3.0	4.0	2.5	3.5
Hartland very fine sandy loam, 12 to 20 percent slopes					3.0	5.0	3.0	4.0	2.5	3.5
Herkimer gravelly silt loam, 0 to 3 percent slopes	16	20	80	100	3.0	5.0	3.0	4.0	2.5	3.5
Herkimer gravelly silt loam, 3 to 8 percent slopes	16	20	80	100	3.0	5.0	3.0	4.0	2.5	3.5
Hoosic gravelly sandy loam, 0 to 3 percent slopes	14	20	80	100	3.0	5.0	3.0	4.0	2.5	3.5
Hoosic gravelly sandy loam, 3 to 8 percent slopes	14	20	80	100	3.0	5.0	3.0	4.0	2.5	3.5
Hoosic gravelly sandy loam, 8 to 15 percent slopes	12	18	70	90	3.0	5.0	3.0	4.0	2.5	3.5
Hoosic gravelly sandy loam, rolling and hilly	12	16	60	80	3.0	5.0	2.5	3.5	2.0	3.0
Hudson silt loam, 2 to 6 percent slopes	14	20	80	100	3.0	5.0	3.0	4.0	2.5	3.5
Hudson silt loam, 6 to 12 percent slopes	14	20	80	100	3.0	5.0	3.0	4.0	2.5	3.5
Hudson silt loam, 12 to 20 percent slopes					3.0	5.0	3.0	4.0	2.5	3.5
Kingsbury silty clay, 0 to 2 percent slopes	12	16			2.5	4.0	2.5	3.5	2.5	3.5
Kingsbury silty clay, 2 to 6 percent slopes	12	16			2.5	4.0	2.5	3.5	2.5	3.5
Limerick silt loam		26		110				4.0	2.5	3.5
Madalin silty clay loam									2.5	3.5
Nassau shaly silt loam, undulating through hilly					2.0	3.0	2.0	3.0	2.0	3.0
Oakville loamy fine sand, 0 to 5 percent slopes	10	14			2.0	4.0	2.0	3.0	1.5	2.5
Oakville loamy fine sand, 5 to 15 percent slopes	8	12			2.0	4.0	2.0	3.0	1.5	2.5
Otisville gravelly sandy loam, 0 to 3 percent slopes	10	14			2.0	3.0	2.0	3.0	1.5	2.5
Otisville gravelly sandy loam, 3 to 8 percent slopes	10	14			2.0	3.0	2.0	3.0	1.5	2.5
Otisville gravelly sandy loam, rolling and hilly					2.0	3.0	2.0	3.0	1.5	2.5
Palatine shaly silt loam, 3 to 8 percent slopes	12	18	60	90	3.0	5.0	3.0	4.0	2.5	3.5
Palatine shaly silt loam, 8 to 15 percent slopes	12	18	60	90	3.0	5.0	3.0	4.0	2.5	3.5
Pittsfield stony fine sandy loam, 3 to 8 percent slopes	14	22	70	100	3.0	5.0	3.0	4.0	2.5	3.5
Pittsfield stony fine sandy loam, 8 to 15 percent slopes	14	22	70	100	3.0	5.0	3.0	4.0	2.5	3.5
Rhinebeck silt loam, 0 to 2 percent slopes	14	18	70	100	3.0	4.0	3.0	4.0	2.5	3.5
Rhinebeck silt loam, 2 to 6 percent slopes	14	18	70	100	3.0	4.0	3.0	4.0	2.5	3.5
Scriba gravelly silt loam, 0 to 3 percent slopes	10	16	50	85	2.0	3.5	2.0	3.0	2.5	3.5
Scriba gravelly silt loam, 3 to 8 percent slopes	10	16	50	85	2.0	3.5	2.0	3.0	2.5	3.5
Sun loam	10	14							2.5	3.5
Teel silt loam	16	28	90	120	3.0	5.0	3.0	4.0	2.5	3.5
Vergennes silty clay loam, 2 to 6 percent slopes	12	18	50	80	3.0	5.0	3.0	4.0	2.5	3.5
Vergennes silty clay loam, 6 to 12 percent slopes	12	18	50	80	3.0	5.0	3.0	4.0	2.5	3.5
Vergennes silty clay loam, 12 to 20 percent slopes					2.5	4.0	2.5	3.5	2.5	3.5
Wallington silt loam, sandy substratum	10	16	50	80	2.5	4.0	2.0	3.0	2.5	3.5

The figures in columns B represent yields that can be expected under improved management. This management consists of using suitable crop rotations; applying lime and fertilizer in kinds and amounts indicated by soil tests; providing adequate drainage and irrigation where needed; using contour farming, stripcropping, sodded waterways, or other measures to conserve soil and water; controlling weeds and insects; and tilling at the right time and in the right way.

The annually revised editions of "Cornell Recommends for Field Crops" and "Cornell Recommends for Vegetable Crops" can be used as a guide for the management needed to obtain the yields shown in columns B.

Use of the Soils as Woodland [5]

Washington County has a total of 238,100 acres (*6*) of commercial forest. About 47,100 acres is white or red pine, 11,500 acres other soft woods, 8,700 acres oak-pine, 36,700 acres oak, 59,000 acres elm-ash-red maple, 64,600 acres maple-beech-birch, and 10,500 acres aspen-birch.

Little timber grows on the Hudson and Vergennes soils along the Hudson-Champlain Lowland. Eastern redcedar is volunteering in the northern part of this lowland, mainly on the Vergennes soils.

The Adirondack Mountains are in the northwestern part of Washington County. Concentrated stands of white pine are on the lower slopes and valley edges. The northern hardwood type, the oak-pine type, and the aspen-birch type also are fairly prevalent. On the better soils, natural woodlands are dominantly northern hardwood; sugar maple is well represented.

The Taconic Uplands are in the eastern part of Washington County. Forests cover about 60 percent of this area. Stands of northern hardwoods and white birch are on the sheltered hillsides. Oaks grow on the exposed slopes. A higher than average proportion of gross farm income in the Taconic Uplands is derived from the sale of forest products (*11*).

Woodland Groups

The soils of Washington County have been assigned to 27 woodland groups. Each group is made up of soils that are similar in potential productivity, are suited to similar kinds of wood crops, and require similar management. Information on the suitability of the soils in these groups for crops is given in table 3. All mapping units but those generally not suitable for commercial production of timber are represented in the groups. The names of the soils in each group can be readily learned by referring to the "Guide to Mapping Units."

The slope ranges generally used in determining woodland groupings were 0 to 8 percent, 8 to 15 percent, 15 to 35 percent, and 35 percent or more. In this survey the range in percent of slopes of some of the mapping units differs from these. Appropriate interpolations were made in such instances.

In addition to a brief description of the soils in the group, table 3 gives an indicator species for each group and the estimated range in site index for that species. Site index is the height the tree will attain at 50 years of age. Estimated site indexes are based on field measurements of indicator species on various plots in the State of New York. Site curves used are for eastern white pine (USDA Bulletin No. 13 by E. H. Frothingham) and sugar maple (University of Vermont Bulletin 629 by R. O. Curtis and B. W. Post). Under "Hazards and limitations," ratings are shown for erosion hazard, equipment restriction, seedling mortality, plant competition, and windthrow hazard. The ratings are *slight, moderate,* or *severe* according to the degree of the limitation. Also shown in the table are the trees suitable for planting and the trees to be favored in natural stands.

Each woodland group is identified by a three-part symbol, for example, 2o1, 3w3, or 4s2.

The first element of the group symbol indicates the class, which is the potential productivity based on the site index of the indicator tree species. In this county, it is expressed by Arabic numerals 2 through 5. Soils in class 2 have the highest potential productivity in Washington County.

The second element in the symbol indicates the subclass, which expresses the dominant soil feature that causes management problems. Some soils within groups have more than one kind of subclass characteristic. Priority in placing each kind of soil in a subclass is in the order listed below:

Subclass x (stoniness or rockiness).—Soils are restricted or limited for woodland use or management by stones or rocks.

Subclass w (excessive wetness).—Soils in which excessive water, either seasonally or year round, significantly limits their use for woodland use or management.

Subclass d (restricted rooting depth).—Soils are restricted or limited for woodland use or management by restricted rooting depths, for example, soils that are shallow over hard bedrock.

Subclass c (clayey soils).—Soils are restricted or limited for woodland use or management by the kind and amount of clay.

Subclass s (sandy soils).—Soils are restricted or limited for woodland use by the amount of coarse-textured material in the profile.

Subclass r (relief or slope).—Soils are restricted or limited for woodland use or management as a result of slope.

Subclass o (slight or no limitations).—Soils are not significantly restricted or limited for woodland use or management.

The third element in the symbol differentiates between woodland groups that have identical first and second parts in their identifying symbol. Soils in woodland group 3o1, for example, require somewhat different management than those in group 3o2. The

[5] By MEREDITH PETERS, woodland conservationist, Soil Conservation Service, in consultation with personnel of the New York State College of Environmental Science and Forestry, Syracuse, New York; Department of Forest Soils, Cornell University; and the New York State Department of Environmental Conservation.

TABLE 3.—*Management of the*

Woodland groups	Potential productivity		Hazards and limitations	
	Species	Estimated site index range	Erosion hazard	Equipment restrictions
Group 2o1. Deep, nearly level, well drained and moderately well drained to somewhat poorly drained, medium-textured soils on flood plains. Soils are medium in content of lime. The root zone is more than 20 inches deep. Hamlin: Hb. Teel: Te.	Sugar maple	65–70	Slight	Slight
Group 3o1. Deep, nearly level to sloping, somewhat excessively drained, well drained, and moderately well drained, medium-textured and moderately coarse textured soils that are very low to medium in content of lime. The root zone is mainly more than 20 inches deep. Belgrade: BeA, BeB. Bernardston: BnB, BnC, BrB, BrC. For Nassau part of BrB and BrC, see group 5d1. Hartland: HcA, HcB. Herkimer: HeA, HeB. Hoosic: HoA, HoB, HoC.	Sugar maple	60–65	Slight	Slight
Group 3o2. Gently sloping and sloping, well drained, somewhat excessively drained, and moderately well drained, medium-textured and moderately coarse textured soils. All but Palatine soils are deep. Palatine soils are 20 to 40 inches deep over shale bedrock. All are high to medium in content of lime. The root zone is mainly more than 20 inches deep. Amenia: AmB. Hudson: HvB. Palatine: PaB, PaC. Pittsfield: PtB, PtC.	Sugar maple	60–65	Slight	Slight
Group 3r1. Deep, sloping, well drained and moderately well drained, medium-textured soils that are highly erodible. Soils are low to high in content of lime. The root zone is mainly more than 20 inches deep. Hartland: HcC. Hudson: HvC.	Sugar maple	60–65	Moderate	Slight
Group 3r2. Deep, dominantly moderately steep, well drained and moderately well drained, medium-textured and moderately coarse textured soils that are very low to medium in content of lime. The root zone is mainly more than 20 inches deep. Bernardston: BnD, BSCK, BTC. For Nassau part of BSCK, see group 5d1. Hoosic: HSDK. Pittsfield: PVC.	Sugar maple	60–65	Slight	Moderate
Group 3r3. Deep, moderately steep through very steep, well drained and moderately well drained, medium-textured soils that are highly erodible. Soils are low to high in content of lime. The root zone is mainly more than 20 inches deep. Hartland: HcD. Hudson: HvD, HWE. For Vergennes part of HWE, see group 3c3.	Sugar maple	60–65	Severe	Moderate
Group 3r4. Deep, steep and very steep, dominantly well drained and somewhat excessively drained, medium-textured and moderately coarse textured soils that are low or very low in content of lime. The root zone is mainly more than 20 inches deep. Bernardston: BUF. Hoosic: HTF. For Otisville part of HTF, see group 4s3.	Sugar maple	60–65	Moderate	Severe
Group 3s1. Deep, nearly level and gently sloping, moderately well drained, coarse textured soils that have a clayey substratum at a depth of 20 to 40 inches. Soils are low to high in content of lime. The root zone is more than 20 inches deep. Claverack: ClA, ClB.	Sugar maple	60–65	Slight	Slight
Group 3c1. Deep, gently sloping, moderately well drained, moderately fine textured soils that have a subsoil of clay. Soils are high to medium in content of lime. The root zone is more than 20 inches deep. Vergennes: VeB.	Sugar maple	60–65	Slight	Moderate

soils as woodland

Hazards and limitations—Continued				Species—	
Seedling mortality	Plant competition		Windthrow hazard	To be favored in stand	Suitable for planting
	Hardwoods	Conifers			
Slight	Moderate	Severe	Slight	Beech, birch, maple, white pine, black locust, red oak, white ash.	Red pine, white pine, Norway spruce, white spruce, European larch, Japanese larch, black locust, hybrid poplar, red oak.
Slight	Slight	Moderate	Slight	Sugar maple, birch, beech, black locust, red oak.	Scotch pine, red pine, white pine, European larch, Japanese larch, black locust.
Slight	Slight	Moderate	Slight	Beech, birch, maple, white oak, red oak, black locust.	White pine, Austrian pine, Norway spruce, white spruce, European larch, Japanese larch, black locust.
Slight	Slight	Moderate	Slight	Beech, birch, maple, red oak, black locust.	White pine, Austrian pine, Norway spruce, white spruce, European larch, Japanese larch, black locust.
Slight	Slight	Moderate	Slight	Beech, birch, maple, black locust, red oak.	Red pine, white pine, Norway spruce, white spruce, European larch, Japanese larch, black locust.
Slight	Slight	Moderate	Slight	Beech, birch, maple, white oak, red oak, black locust.	White pine, Norway spruce, white spruce, European larch, Japanese larch, black locust.
Slight	Slight	Moderate	Slight	Beech, birch, maple, red oak, black locust.	Red pine, white pine, Norway spruce, white spruce, European larch, Japanese larch, black locust.
Slight	Slight	Moderate	Slight	Beech, birch, maple, black locust.	Scotch pine, red pine, white pine, European larch, Japanese larch, black locust.
Slight	Slight	Moderate	Slight	Beech, birch, maple, black locust.	White pine, Austrian pine, Norway spruce, white spruce, European larch, Japanese larch, black locust.

TABLE 3.—*Management of the*

Woodland groups	Potential productivity		Hazards and limitations	
	Species	Estimated site index range	Erosion hazard	Equipment restrictions
Group 3c2. Deep, sloping, moderately well drained, moderately fine textured soils that have a clay subsoil and are erodible. Soils are high to medium in content of lime. The root zone is more than 20 inches deep. Vergennes: VeC.	Sugar maple	60–65	Moderate	Moderate
Group 3c3. Deep, moderately steep through very steep, moderately well drained, moderately fine textured soils that have a clay subsoil and are highly erodible. Soils are high to medium in content of lime. The root zone is more than 20 inches deep. Vergennes: VeD.	Sugar maple	60–65	Severe	Severe
Group 3w1. Deep, nearly level and gently sloping, somewhat poorly drained, medium-textured and fine-textured soils that are high to low in content of lime. The root zone is mainly less than 20 inches deep. Kingsbury: KbA, KbB. Rhinebeck: RhA, RhB. Wallington: Wa.	Sugar maple	60–65	Slight	Moderate
Group 3w2. Deep, nearly level through sloping, somewhat poorly drained, medium-textured soils that have a fragipan. Soils are low in content of lime. The root zone is less than 20 inches deep. Scriba: ScA, ScB, SDC.	Sugar maple	60–65	Slight	Moderate
Group 3w3. Deep, nearly level, somewhat poorly drained to poorly drained, medium-textured soils that are medium in content of lime. The root zone is mainly more than 20 inches deep. Fredon: Fr.	Sugar maple	60–65	Slight	Moderate
Group 3x1. Gently sloping through moderately steep, moderately well drained, moderately fine textured soils that are very rocky. Soils are high to medium in content of lime. Depth of the root zone varies. Vergennes soil mapped with Rock outcrop RPC.	Sugar maple	60–65	Moderate to severe.	Moderate to severe.
Group 3x2. Steep and very steep, moderately well drained, moderately fine textured soils that are very rocky. Soils are medium in content of lime. Depth of root zone varies. Vergennes soil mapped with Rock outcrop RPF.	Sugar maple	60–65	Severe	Severe
Group 4o1. Deep, gently sloping and sloping, well-drained, moderately coarse textured soils that are very stony. Soils are low or very low in content of lime. The root zone is mainly more than 20 inches deep. Charlton: CHC.	Sugar maple	50–60	Slight	Slight
Group 4r1. Deep, moderately steep and steep, well-drained, moderately coarse textured soils that are very stony. Soils are low or very low in content of lime. The root zone is mainly more than 20 inches deep. Charlton: CHE.	Sugar maple	50–60	Slight	Moderate
Group 4s1. Deep, nearly level through sloping, excessively drained, coarse textured and moderately coarse textured soils that are medium to very low in content of lime. The root zone is mainly more than 20 inches deep. Oakville: OaB, OaC. Otisville: OtA, OtB.	White pine	60–70	Slight	Slight
Group 4s2. Deep, dominantly moderately steep and steep, excessively drained, coarse textured and moderately coarse textured soils that are medium to very low in content of lime. The root zone is mainly more than 20 inches deep. Oakville: OKE. Otisville: OVDK.	White pine	60–70	Slight	Moderate
Group 4s3. Deep, steep and very steep, excessively drained, moderately coarse textured soils that are low or very low in content of lime. The root zone is mainly more than 20 inches deep. Otisville soil mapped with Hoosic soil HTF.	White pine	60–70	Slight to moderate.	Moderate to severe.
Group 4w1. Deep, nearly level, very poorly drained and poorly drained, medium-textured soils that are low to high in content of lime. The root zone is mainly less than 20 inches deep. Limerick: Lm. Sun: Su, SV.	Red maple	60–70	Slight	Severe

soils as woodland—Continued

Hazards and limitations—Continued				Species—	
Seedling mortality	Plant competition		Windthrow hazard	To be favored in stand	Suitable for planting
	Hardwoods	Conifers			
Slight	Slight	Moderate	Slight	Beech, birch, maple, black locust.	White pine, Austrian pine, Norway spruce, white spruce, European larch, Japanese larch, black locust.
Slight	Slight	Moderate	Slight	Beech, birch, maple, black locust.	White pine, Austrian pine, Norway spruce, white spruce, European larch, Japanese larch, black locust.
Moderate	Moderate	Severe	Moderate	Beech, birch, maple, white pine.	White spruce, white cedar.
Moderate	Moderate	Severe	Moderate	Beech, birch, maple, white pine.	Norway spruce, white spruce.
Moderate	Moderate	Severe	Slight	Beech, birch, maple, white pine.	Norway spruce, white spruce, white cedar.
Slight to moderate.	Slight	Moderate	Slight to severe	Beech, birch, maple, black locust, white ash, red oak.	White pine, Austrian pine, Norway spruce, white spruce, European larch, Japanese larch, black locust.
Slight to moderate.	Slight	Moderate	Slight to severe	Beech, birch, maple, black locust, white ash, red oak.	White pine, Austrian pine, Norway spruce, white spruce, European larch, Japanese larch, black locust.
Slight	Slight	Moderate	Slight	Beech, birch, maple, white pine, white ash.	Red pine, white pine, Norway spruce, white spruce, European larch, Japanese larch, black locust.
Slight	Slight	Moderate	Slight	Beech, birch, maple, black locust, white pine, white ash.	Red pine, white pine, Norway spruce, white spruce, European larch, Japanese larch, black locust.
Severe	Slight	Slight	Slight	Beech, birch, maple, white pine, black locust.	Scotch pine, red pine, white pine, European larch, Japanese larch, black locust.
Severe	Slight	Slight	Slight	Beech, birch, maple, white pine, black locust.	Scotch pine, red pine, white pine, European larch, Japanese larch, black locust.
Severe	Slight	Slight	Slight	Beech, birch, maple, white pine, black locust.	Scotch pine, red pine, white pine, European larch, Japanese larch, black locust.
Moderate to severe.	Severe	Severe	Moderate	Beech, birch, maple	Competition, drainage, and frost hazard restrict planting.

TABLE 3.—*Management of the*

Woodland groups	Potential productivity		Hazards and limitations	
	Species	Estimated site index range	Erosion hazard	Equipment restrictions
Group 4w2. Deep, nearly level, somewhat poorly drained, moderately coarse textured soils that are low to high in content of lime. The root zone is mainly less than 20 inches deep. Cosad: Cs.	Sugar maple	50–60	Slight	Moderate
Group 5d1. Shallow, dominantly gently sloping and sloping, but moderately steep in places, well-drained and somewhat excessively drained, medium-textured soils that are very low to medium in content of lime. The root zone is mainly less than 20 inches deep. Farmington: FaB. Nassau: NAC.	Sugar maple	45–50	Slight	Slight
Group 5w1. Deep, nearly level, poorly drained and very poorly drained, medium-textured and moderately fine textured mineral soils and organic soils that are high to medium in content of lime. The root zone is mainly less than 20 inches deep. Carlisle: Ca. Covington: Cv. Halsey: Ha. Madalin: Ma. Palms: Pm.	Red maple	50–60	Slight	Severe
Group 5x1. Shallow, nearly level through steep, well-drained and somewhat excessively drained, medium-textured soils that are very rocky. Soils are very low to medium in content of lime. The root zone is less than 20 inches deep. Farmington: FCC. Hollis: HLE, HNC. For Charlton part of HLE, see group 4r1. Nassau: NBC.	Sugar maple	45–50	Slight	Moderate
Group 5x2. Shallow, dominantly steep and very steep, well-drained and somewhat excessively drained, medium-textured soils that are very rocky. Soils are very low to medium in content of lime. The root zone is less than 20 inches deep. Farmington: FCF. Hollis soil mapped with Rock outcrop. Nassau: NBF.	Sugar maple	45–50	Moderate	Severe

management limitations considered are erosion hazard, equipment restricitions, seedling mortality, plant competition, and windthrow hazard. The ratings are *slight, moderate,* or *severe* according to the degree of the limitation.

Erosion hazard is rated according to the potential soil erosion that occurs following cutting where the soil is exposed along roads, skid trails, fire lanes, and log-docking areas.

Equipment restrictions refers to the trafficability of the soils. Ratings indicate the degree to which the use of equipment commonly used in harvesting of trees is restricted or prohibited.

Seedling mortality refers to the expected degree of failure for natural seedlings or planting stock as influenced by kinds of soil, degree of erosion, or other site factors. The rating is *slight* if the expected mortality is less than 25 percent, *moderate* if expected mortality is between 25 and 50 percent, and *severe* if it is more than 50 percent.

Plant competition refers to the invasion or growth of undesirable species if openings are made in the tree canopy. The rating is *slight* where competition does not delay natural or artificial regeneration of desirable species; *moderate* where competition delays but does not prevent natural or artificial regeneration; and *severe* where competition prevents adequate natural or artificial regeneration without intensive site preparation and maintenance, such as weeding.

Windthrow hazard is an evaluation of the soil characteristics that control development of roots and affect firmness of the tree during wind (fig. 15). The rating is *slight* if windthrow is not a problem. It is *moderate* if root development is adequate for stability except during periods of soil wetness or during periods of strong wind velocity. It is *severe* if many trees are expected to be blown over because their roots do not provide enough stability.

Species to the favored in existing stands is a listing of the commonly found trees that can be managed as wood crops. The listing is not intended to be in order of preference.

Species suitable for planting is a listing of species suitable for open field and woodland interplanting (*7*) (fig. 16). High local incidence of weevil or blister rust infestation sometimes dictates use of another species. Information can be obtained from the New York State Department of Environmental Conservation.

soils as woodland—Continued

Hazards and limitations—Continued				Species—	
Seedling mortality	Plant competition		Windthrow hazard	To be favored in stand	Suitable for planting
	Hardwoods	Conifers			
Moderate	Moderate	Severe	Moderate	Beech, birch, maple	Norway spruce, white spruce, white cedar.
Moderate to severe.	Slight	Slight	Moderate	Beech, birch, maple	Scotch pine (limited).
Severe	Severe	Severe	Moderate	Beech, birch, maple	Competition, drainage, and frost hazard restrict planting.
Severe	Slight	Slight	Moderate	Beech, birch, maple	Scotch pine (limited).
Severe	Slight	Slight	Moderate	Beech, birch, maple	Scotch pine (limited).

Wildlife

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 kinds of soil.

In table 4 the soils are rated for seven elements of wildlife habitat: grain and seed crops, grasses and legumes, wild herbaceous plants, hardwood plants, coniferous plants, wetland plants, and shallow-water developments. The soils are also rated for three classes of wildlife: openland, woodland, and wetland (*1*).

A rating of *good* in table 4 indicates that the soil has few limitations to be considered in developing or managing the habitat element. A rating of *fair* indicates moderate limitations, *poor* indicates severe limitations, and *very poor* indicates very severe limitations that make development or management impractical or impossible.

[6] By ROBERT E. MYERS, wildlife biologist, Soil Conservation Service, Syracuse, New York.

Habitat Elements

Each soil is rated in table 4 according to its suitability for various kinds of plants and water developments that make up wildlife habitat. These ratings can be used as an aid in selecting the best soils for creating, improving, or maintaining specific elements of wildlife habitat; in determining the relative intensity of management required for individual habitat elements; and in recognizing soils that would be difficult or not feasible to manage.

Grain and seed crops.—Among these crops are seed-producing annuals, such as corn, sorghum, wheat, barley, oats, millet, buckwheat, and sunflower. Soils that are well suited to these plants and have a rating of *good* are deep, nearly level or very gently sloping, medium textured, well drained or moderately well drained, and free of stones or nearly so. They also have high moisture-holding 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.

Figure 15.—**Windthrow on shallow Hollis soil.**

Grasses and legumes.—In this group are domestic grasses and legumes that are established by planting. Examples 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 moisture-holding capacity. An adequate stand of many kinds of plants can be easily maintained on these soils. Occasional flooding and surface stones are not of serious concern because the soils are seldom tilled.

Wild herbaceous plants.—In this group are perennial grasses and weeds that are generally established naturally, such as bluestem, quackgrass, panicgrass, goldenrod, wild carrot, nightshade, and dandelion. Soils that are well suited to these plants and that have a rating of *good* vary widely in texture, drainage, and slope. Drainage ranges between well drained and somewhat poorly drained. Slope is not a limiting factor. Stoniness and occasional flooding are not of serious concern.

Hardwood plants.—These 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. They are generally established naturally, but can be planted. Among the native kinds are oak, beech, cherry, maple, birch, poplar, apple, hawthorn, dogwood, viburnum, grape, and briers. Soils that are good sites for these plants are deep or moderately deep, medium textured or moderately fine textured, and well drained to somewhat poorly drained. Slope 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. 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 transplated successfully.

Coniferous plants.—This element consists of 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 be maintained close to the ground so that food and cover are readily available to rabbits, pheasants, and other small animals. The lower branches die if trees form a dense canopy that shuts out the light.

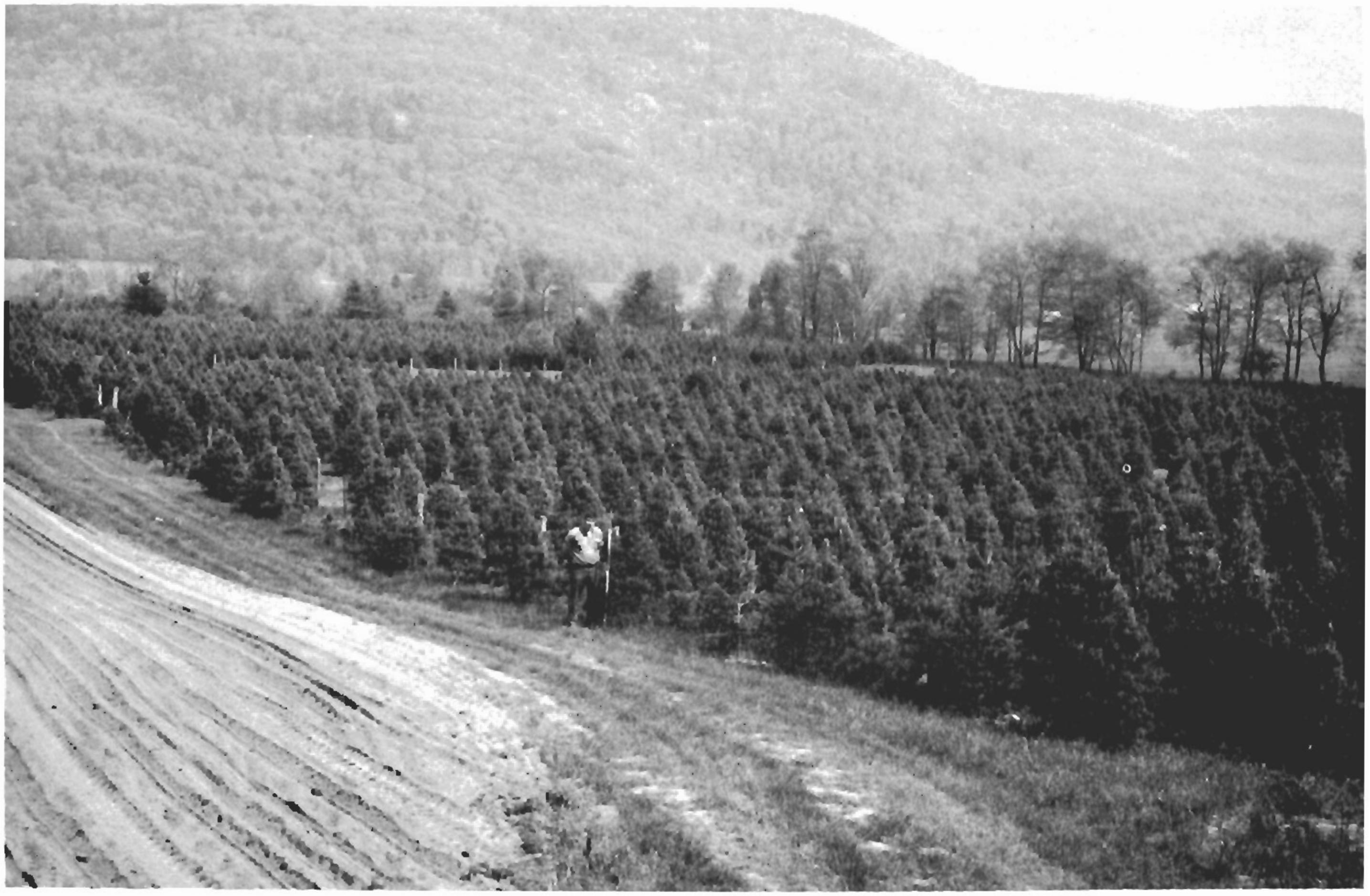

Figure 16.—Well-managed Christmas tree plantation of Scotch pine on Claverack soil.

Soils that are rated *good* are those on which conifers grow at a moderate to rapid rate. These are the deeper soils that are either well drained, moderately well drained, or somewhat poorly drained and have high available moisture capacity. Cover is easier and quicker to establish than on the less well suited soils. However, more management is required to eliminate invading hardwoods. In addition, 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 by slow growth. Seedling mortality is high, and it will take considerable time before conifers are of adequate size to provide effective cover.

Wetland plants.—These are wild herbaceous annual and perennial plants that grow on moist to wet sites. Among them are smartweed, wild millet, rushes, sedges, rice cutgrass, mannagrass, and cattails. These plants are used by wetland wildlife for food and cover.

Soils that have a rating of *good* are nearly level and 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 developments.—Open water is essential for waterfowl courtship, mating, and brood rearing. It is also essential for other forms of wildlife associated with wetlands. Deer and many other forms of upland wildlife use these areas as a source of drinking water.

This habitat element is rated on the basis of suitability of the soils for the construction of a low dike to impound a shallow body of water, commonly called a marsh, or the excavation or blasting of potholes and level ditches. Water supply for these developments is either surface runoff, a high water table, or both.

Deep-water farm ponds are not considered in this habitat element. A detailed field investigation is needed to determine feasibility of shallow-water developments. Table 7 in the section "Engineering Uses of the Soils" shows some of the limitations of the soil for use in reservoir areas and embankments for ponds.

Classes of Wildlife

Table 4 rates the soils according to their suitability for the three classes of wildlife in the county—openland, woodland, and wetland. These ratings can be used as an aid in planning the broad use of land for wildlife refuge, nature-study areas, or other developments for wildlife and in determining areas that are suitable for acquisition for wildlife development.

Each rating under "Classes of wildlife" in table 4 is based on the ratings listed for selected essential habitat elements in the first part of the table. The ratings for openland wildlife are based on the ratings shown

TABLE 4.—*Elements of wildlife habitat*

[A rating of good means that limitations are slight, fair means that limitations are moderate, poor means that

Soil series and map symbols	Wildlife habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood plants
Amenia: AmB	Fair	Good	Good	Good
Belgrade:				
BeA	Good	Good	Good	Good
BeB	Good	Good	Good	Good
Bernardston:				
BnB	Fair	Good	Good	Good
BnC	Fair	Good	Good	Good
BnD	Poor	Fair	Good	Good
BrB	Fair	Good	Good	Good
BrC	Fair	Good	Good	Good
BSCK	Poor	Fair	Good	Good
BUF, BTC	Very poor	Poor	Good	Good
For Nassau parts of BrB, BrC, and BSCK, see Nassau series.				
Carlisle: Ca	Very poor	Poor	Poor	Poor
Charlton: CHC, CHE	Very poor	Poor	Fair	Fair
Claverack:				
ClA	Fair	Good	Good	Fair
ClB	Fair	Good	Good	Fair
Cosad: Cs	Fair	Good	Good	Fair
Covington: Cv	Poor	Poor	Fair	Fair
Farmington:				
FaB	Poor	Poor	Fair	Poor
FCC, FCF	Very poor	Poor	Fair	Poor
Fredon: Fr	Poor	Fair	Good	Fair
Halsey: Ha	Very poor	Poor	Poor	Poor
Hamlin: Hb	Good	Good	Good	Good
Hartland:				
HcA, HcB	Good	Good	Good	Good
HcC	Fair	Good	Good	Good
HcD	Poor	Fair	Good	Good
Herkimer: HeA, HeB	Fair	Good	Good	Fair
Hollis: HLE, HNC	Very poor	Poor	Fair	Poor
For Charlton part of HLE, see Charlton series.				
For Rock outcrop part of HNC, see Rock outcrop.				
Hoosic:				
HoA, HoB, HoC, HSDK	Poor	Fair	Fair	Poor
HTF	Very poor	Poor	Fair	Poor
For Otisville part of HTF, see Otisville series.				
Hudson:				
HvB	Fair	Good	Good	Good
HvC	Fair	Good	Good	Good
HvD	Poor	Fair	Good	Good
HWE	Very poor	Fair	Good	Good
Kingsbury:				
KbA	Poor	Fair	Fair	Fair
KbB	Poor	Fair	Fair	Fair
Limerick: Lm	Poor	Fair	Fair	Fair
Madalin: Ma	Poor	Poor	Poor	Poor
Nassau:				
NAC, NBC	Very poor	Poor	Poor	Very poor
NBF	Very poor	Very poor	Poor	Very poor
For Rock outcrop part of NBC and NBF, see Rock outcrop.				
Oakville:				
OaB, OaC	Poor	Poor	Fair	Poor
OKE	Very poor	Poor	Fair	Poor
Otisville: OtA, OtB, OVDK	Very poor	Poor	Poor	Very poor
Palatine: PaB, PaC	Fair	Good	Good	Fair
Palms: Pm	Very poor	Poor	Poor	Poor

See footnote at end of table.

and classes of wildlife

limitations are severe, and very poor means that it is impractical to attempt to improve, maintain, or create habitat].

Wildlife habitat elements—Continued			Classes of wildlife		
Coniferous plants	Wetland plants	Shallow-water developments [1]	Openland	Woodland	Wetland
Good	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	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	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.
Poor	Good	Good	Poor	Poor	Good.
Fair	Very poor	Very poor	Poor	Fair	Very poor.
Fair	Poor	Poor	Good	Fair	Poor.
Fair	Poor	Very poor	Good	Fair	Very poor.
Fair	Fair	Fair	Good	Fair	Fair.
Fair	Good	Good	Poor	Fair	Good.
Poor	Poor	Very poor	Poor	Poor	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Fair	Fair	Very poor	Fair	Fair	Poor.
Poor	Good	Good	Poor	Poor	Good.
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.
Fair	Poor	Very poor	Good	Fair	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Poor	Very poor	Very poor	Fair	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	Fair	Good	Very poor.
Fair	Good	Fair	Fair	Fair	Fair.
Fair	Fair	Very poor	Fair	Fair	Poor.
Fair	Good	Fair	Fair	Fair	Fair.
Poor	Good	Good	Poor	Poor	Good.
Very poor	Very poor	Very poor	Poor	Very poor	Very poor.
Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Very poor	Very poor	Very poor	Poor	Very poor	Very poor.
Fair	Very poor	Very poor	Good	Fair	Very poor.
Poor	Good	Good	Poor	Poor	Good.

See footnote at end of table.

TABLE 4.—*Elements of wildlife habitat*

Soil series and map symbols	Wildlife habitat elements			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood plants
Pittsfield:				
PtB	Fair	Fair	Good	Good
PtC	Fair	Fair	Good	Good
PVC	Very poor	Poor	Good	Good
Rhinebeck:				
RhA	Poor	Fair	Good	Fair
RhB	Poor	Fair	Good	Fair
Saco: Sa	Very poor	Poor	Poor	Poor
Saprists, Aquepts and, Aquents: SB	Very poor	Very poor	Very poor	Very poor
Scriba:				
ScA	Poor	Poor	Fair	Fair
ScB	Poor	Poor	Fair	Fair
SDC	Very poor	Poor	Fair	Fair
Sun:				
Su	Very poor	Poor	Poor	Poor
SV	Very poor	Poor	Poor	Poor
Teel: Te	Good	Good	Good	Good
Vergennes:				
VeB	Fair	Good	Good	Good
VeC	Fair	Good	Good	Good
VeD	Poor	Good	Good	Good
Wallington: Wa	Fair	Good	Good	Good

[1] Detailed investigation is needed at the site of a proposed shallow-water development. Table 7 in the section "Engineering Uses of the Soils" lists the soil features that affect the construction of reservoirs and embankment of farm ponds.

for grain and seed crops, grasses and legumes, wild herbaceous plants, hardwood plants, and coniferous plants. The ratings for woodland wildlife are based on the ratings listed for all the above elements except grain and seed crops. Those for wetland wildlife are based on the ratings shown for wetland plants and shallow-water developments.

Openland wildlife.—Examples of openland wildlife are pheasants, meadowlarks, field sparrows, doves, woodcock, cottontail rabbits, red foxes, and woodchucks. These birds and mammals normally make their home in areas of cropland, pasture, meadow, and lawns and in areas overgrown with grasses, herbs, and shrubs.

Woodland wildlife.—Among the birds and mammals that prefer woodland are ruffed grouse, thrushes, vireos, scarlet tanagers, grey and red squirrels, gray foxes, white-tailed deer, and raccoons.

Wetland wildlife.—Ducks, geese, rails, herons, shore birds, redwing blackbirds, mink, muskrats, and beavers are familiar examples of birds and mammals that normally make their home in and around ponds, marshes, swamps, and other wet areas (fig. 17).

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 commissions, 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, 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 the 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 of the soil survey 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, show the problems associated with these areas.
3. Locate 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] By JOHN B. FLECKENSTEIN, senior agronomist, New York State Department of Transportation, Soil Mechanics Bureau; DONALD W. SHANKLIN, assistant State conservation engineer; BERNARD S. ELLIS, senior staff geologist; and DONALD F. FLORA, soil scientist, Soil Conservation Service.

and classes of wildlife—Continued

Wildlife habitat elements—Continued			Classes of wildlife		
Coniferous plants	Wetland plants	Shallow-water developments [1]	Openland	Woodland	Wetland
Good	Poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Fair	Good	Fair	Fair	Fair	Fair.
Fair	Poor	Very poor	Fair	Fair	Very poor.
Poor	Good	Fair	Poor	Poor	Fair.
Very poor	Good	Good	Very poor	Very poor	Good.
Fair	Fair	Poor	Poor	Fair	Poor.
Fair	Poor	Very poor	Poor	Fair	Very poor.
Fair	Poor	Very poor	Poor	Fair	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Poor	Good	Fair	Poor	Poor	Fair.
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.
Good	Fair	Fair	Good	Good	Fair.

7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 5, 6, and 7, which show, respectively, the results of engineering laboratory tests on soil samples, estimates of soil properties significant in engineering, and interpretations for various engineering uses.

This information, along with the soil map and other

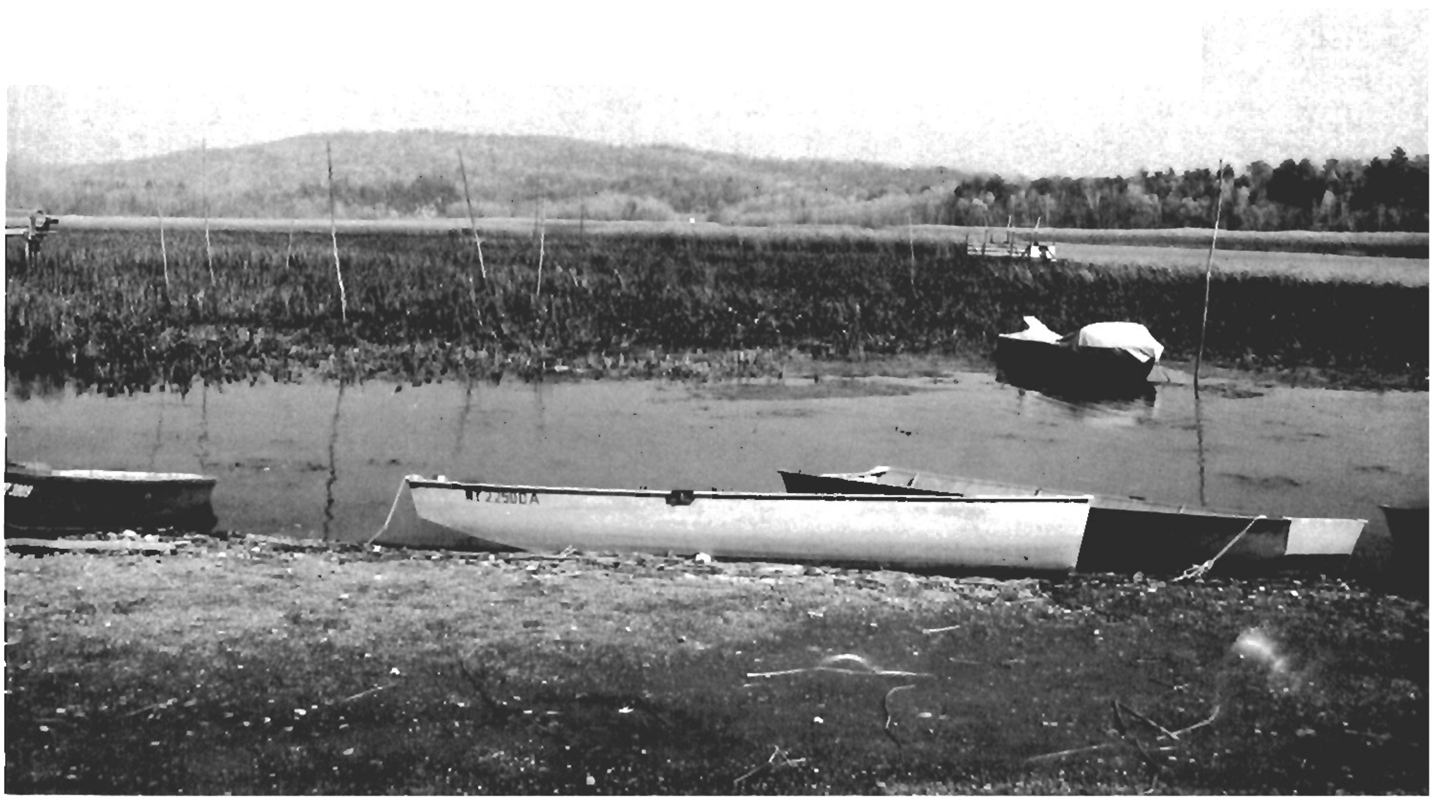

Figure 17.—Freshwater marsh along the edge of Lake Champlain provides habitat for waterfowl. The marsh is mapped as Saprists, Aquepts, and Aquents.

TABLE 5.—*Engineering*

[Tests performed by the New York State Department of Transportation, Soil Mechanics Bureau, in accordance with standard procedures of ... apply. The symbol >

Soil name and location	Parent material	SCS report number S68NY58	Depth from surface	Moisture-density[1] Maximum dry density	Moisture-density[1] Optimum moisture	In-place moisture content[3]	In-place dry density[4]	Percolation rate[5]	Lineal shrinkage
			In.	*Lb./cu. ft.*	*Pct.*	*Pct.*	*Lb./cu. ft.*	*Min./in.*	*Pct.*
Belgrade silt loam:									
Town of White Creek, 50 feet east of Old N.Y. Route 22, one-fourth mile north of County Route 69 at Old N.Y. Route 22. (Modal)	Lacustrine silt.	11–1	0–8	94	25	25	--------	--------	4.2
		11–2	8–14	106	13	22	87	--------	3.6
		11–3	14–18	108	18	19	--------	--------	4.8
		11–4	18–24	109	18	18	104	--------	3.6
		11–5	24–65	101	23	19	103	--------	3.8
Bernardston gravelly silt loam:									
Town of Easton, one-third mile east of South Cambridge Road on Meeting House Road, 50 feet south of Meeting House Road. (Modal) Estimated 5 to 10 percent coarse fragments more than 3 inches in diameter in all layers of profile.	Glacial till derived mainly from shale, slate, and sandstone.	4–1	0–9	106	16	9	88	--------	3.8
		4–2	9–27	114	14	12	--------	4.8	3.0
		[8]4–3	27–28	--------	--------	--------	--------	--------	--------
		4–4	28–72	125	11	12	116	--------	3.0
		4–5	72–92	129	10	12	114	--------	1.6
Town of Easton, one-third mile east of junction of South Cambridge and Meeting House Roads, 100 yards south of Meeting House Road. (Coarser textured substratum than modal) Estimated 5 to 10 percent coarser fragments more than 3 inches in diameter and a few boulders throughout the profile.	Sloughed till material derived mainly from shale, slate, and sandstone over water-laid silt, over slaty shale bedrock at a depth of 90 inches.	5–1	0–10	108	16	15	79	--------	3.2
		5–2	10–16	116	14	11	--------	--------	3.4
		5–3	16–21	125	10	8	--------	5.3	2.4
		5–4	21–39	123	11	10	112	--------	3.6
		5–5	39–62	126	10	12	120	--------	3.0
		5–6	62–84	129	9	10	122	--------	.4
		[8]5–7	84–90						
			90						
Town of Cambridge, one-third mile east of junction of South Cambridge and Meeting House Roads, 100 feet north of South Cambridge Road. (Deeper over fragipan and shallower over bedrock than modal) Estimated 5 to 10 percent coarse fragments more than 3 inches in diameter and a few 2- to 3-foot boulders in all layers of profile.	Glacial till derived mainly from shale, slate, and sandstone over folded slaty shale bedrock at a depth of 72 inches.	6–1	0–10	107	15	10	82	--------	4.2
		6–2	10–29	120	10	7	93	7.0	2.4
		[8]6–3	29–33	--------	--------	--------	--------	--------	--------
		6–4	33–56	124	11	9	106	--------	2.0
		6–5	56–72	125	11	9	111	--------	2.0
			72						
Town of Hampton, 1,000 feet north of County Route 18, three-fourths mile west of County Road at N.Y. Route 22A. (Shallower over fragipan than modal) The 6- to 9-inch and 9- to 15-inch layers were sampled as a composite. Estimated 10 to 15 percent coarse fragments more than 3 inches in all layers of the profile.	Glacial till derived mainly from slate, shale, and sandstone and some phyllite.	19–1	0–6	106	16	5	--------	--------	3.4
		19–2	6–9	--------	--------	--------	--------	--------	--------
		19–3	9–15	118	13	5	--------	16.4	3.4
		19–4	15–20	125	10	5	--------	--------	2.2
		19–5	20–47	122	13	10	--------	--------	5.6
		19–6	47–55	129	10	7	--------	--------	4.4

See footnotes at end of table.

test data

the American Association of State Highway Officials (AASHO). Dashes mean that no determination was made or that information does not means more than]

Reaction	Organic matter[6]	Mechanical analysis[2]: Percentage passing sieve— 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.)	Percentage smaller than— 0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.	Liquid limit	Plasticity index	Classification: AASHO[7]	Unified
pH	*Pct.*												*Pct.*			
6.3	4.3	------	------	100	99	96	90	85	76	56	18	6	45	11	A-7-5(9)	ML
5.7	1.0	------	100	99	96	92	84	78	73	60	28	12	33	7	A-4(8)	ML
5.0	.6	------	------	100	99	95	88	83	77	65	33	16	28	9	A-4(8)	CL
5.1	.5	------	------	------	100	98	94	90	83	65	31	16	25	8	A-4(8)	CL
5.7	------	------	------	------	------	------	------	100	93	76	33	17	29	6	A-4(8)	ML-CL
6.4	4.5	100	98	92	78	69	58	47	40	24	8	3	30	4	A-4(2)	SM
5.7	2.1	100	81	73	61	55	46	38	33	20	7	3	22	3	A-4(0)	GM
5.4	.4	------	100	92	76	67	52	39	36	22	10	6	19	4	A-4(0)	SM-SC
6.4	------	100	96	89	73	64	49	32	28	18	8	4	18	3	A-2-4(0)	SM
6.0	3.4	100	98	90	79	71	61	51	43	22	7	4	------	[9]NP	A-4(3)	ML
5.6	1.7	100	89	80	64	57	48	39	34	21	9	4	26	5	A-4(1)	GM-GC
5.5	.4	100	95	85	68	59	47	33	28	16	7	4	18	3	A-2-4(0)	SM
5.6	.3	------	100	92	71	61	48	36	31	19	10	7	19	5	A-4(0)	SM-SC
5.9	------	100	99	93	75	66	52	36	31	16	8	4	17	4	A-4(0)	SM-SC
7.1	------	100	97	89	72	60	41	23	20	14	4	2	------	NP	A-1-b(0)	SM
6.1	4.7	100	98	89	74	67	57	48	40	20	9	3	37	8	A-4(3)	SM
5.2	.9	100	97	87	72	65	54	45	38	23	10	6	24	5	A-4(2)	GM-GC
4.9	.4	100	93	85	72	66	54	43	36	21	9	5	20	3	A-4(2)	SM
5.3	------	100	95	84	68	60	48	36	30	17	8	5	19	3	A-4(0)	SM
6.2	6.6	------	100	94	79	69	61	46	45	21	8	4	23	3	A-4(2)	SM
5.4	1.4	------	100	93	81	72	63	44	38	23	9	3	21	3	A-4(2)	SM
5.3	.7	100	88	82	70	63	54	38	32	20	11	6	19	4	A-4(1)	SM-SC
6.0	.3	100	99	96	85	77	68	55	44	41	26	17	25	9	A-4(4)	CL
8.4	------	100	87	78	61	55	47	37	34	26	17	11	22	7	A-4(0)	GC-GM

TABLE 5.—*Engineering*

Soil name and location	Parent material	SCS report number S68NY58	Depth from surface	Moisture-density[1]: Maximum dry density	Moisture-density[1]: Optimum moisture	Moisture-density[1]: In-place moisture content[3]	Moisture-density[1]: In-place dry density[4]	Percolation rate[5]	Lineal shrinkage
			In.	*Lb./cu. ft.*	*Pct.*	*Pct.*	*Lb./cu. ft.*	*Min./in.*	*Pct.*
Claverack loamy fine sand:									
Town of Kingsbury, 50 feet south of Hopkins road, one-fourth mile northwest of Pattens Mills. (Modal)	Deltaic sand over varved clay, silt, and sand.	13-1	0-8	107	16	12	87	--------	3.4
		13-2	8-18	114	12	9	87	--------	--------
		13-3	18-29	107	13	6	88	9.9	--------
		13-4	29-33	112	14	13	--------	--------	--------
		13-5	33-63	108	18	23	97	--------	5.2
		13-6	63-96	111	17	39	--------	--------	2.0
Covington silty clay loam:									
Town of Kingsbury, 25 feet north of County Route 36, one-half mile northwest of U.S. Route 4 at County Route 36. (Modal)	Lacustrine clay.	21-1	0-6	75	36	32	--------	--------	12.0
		21-2	6-13	81	38	38	--------	--------	14.0
		21-3	13-27	86	34	30	80	>120	14.0
		21-4	27-55	89	33	42	78	--------	14.0
		21-5	55-93	90	31	44	77	>120	13.8
Fredon silt loam:									
Town of Cambridge, 150 feet south of Perry Lane, one-half mile west of Perry Lane at N.Y. Route 372. (Modal) The 50- to 80-inch layer is less than 2 percent coarse fragments more than 3 inches in diameter.	Glacial outwash derived mainly from slate, sandstone, and quartzite.	8-1	0-7	85	31	30	67	--------	3.4
		8-2	7-13	100	21	19	79	--------	3.4
		8-3	13-22	113	15	12	97	1.6	4.0
		8-4	22-50	123	10	10	100	--------	--------
		8-5	50-80	129	9	--------	--------	--------	--------
Hamlin silt loam:									
Town of Whitehall, one-half mile south of Grays Corners, 30 feet west of road. (Thicker solum than modal)	Recent alluvium of silt, very fine sand, and fine sand.	18-1	0-10	101	20	17	78	--------	5.0
		18-2	10-18	104	18	19	83	--------	4.0
		18-3	18-41	110	16	20	94	3.7	3.2
		18-4	41-54	113	15	25	84	--------	3.0
		19-5	54-78	120	11	26	89	--------	--------
		18-6	78-88	120	13	19	--------	--------	--------
		18-7	88-93	122	12	15	--------	--------	--------
Hartland very fine sandy loam:									
Town of Easton, 200 feet north of Old Schuylerville Road, three-fourths mile east of Hudson River. (Finer textured solum than modal)	Lacustrine very fine sand and silt.	1-1	0-6	105	15	11	76	--------	.6
		1-2	6-20	110	13	11	85	2.5	--------
		1-3	20-48	106	14	4	83	1.9	--------
Hoosic gravelly sandy loam:									
Town of Cambridge, 500 feet east of Cambridge Creek at Greenwich Road, 1,000 feet north of N.Y. Route 372 at Greenwich Road. (Modal) Estimated 5 to 10 percent coarse fragments more than 3 inches in all layers of the profile below depth of 13 inches.	Glacial outwash derived mainly from slate, shale, sandstone, and quartz.	9-1	0-8	108	15	16	--------	--------	6.0
		9-2	8-13	122	12	8	--------	--------	4.0
		9-3	13-35	125	10	6	--------	.8	2.0
		9-4	35-83	125	10	12	--------	--------	2.0
Kingsbury silty clay:									
Town of Kingsbury, 25 feet north of County Road 36, five-eighths mile northwest of U.S. Route 4 at County Road 36. (Coarser textured surface layer than modal)	Lacustrine clay.	16-1	0-5	88	30	20	--------	--------	8.0
		[8]16-2	5-8	--------	--------	--------	--------	--------	--------
		16-3	8-19	91	29	29	84	62.4	11.4
		16-4	19-27	89	31	32	78	--------	11.6
		16-5	27-65	89	32	35	83	--------	13.6

See footnotes at end of table.

test data—Continued

Reaction	Organic matter[6]	Mechanical analysis[2]: Percentage passing sieve— 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.)	Percentage smaller than— 0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.	Liquid limit	Plasticity index	Classification: AASHO[7]	Unified
pH	*Pct.*												*Pct.*			
6.4	3.1	------	------	------	100	98	93	41	32	13	5	1	------	NP	A-4(1)	SM
6.8	.7	------	------	------	100	99	94	29	22	7	4	1	------	NP	A-2-4(0)	SM
6.9	.2	------	------	------	100	99	98	23	18	5	3	1	------	NP	A-2-4(0)	SM
6.8	.3	------	------	------	100	99	97	43	32	8	5	2	------	NP	A-4(2)	SM
6.6	------	------	------	------	------	100	98	77	60	20	15	10	24	8	A-4(8)	CL
6.4	------	------	------	------	------	------	100	88	68	18	8	4	19	3	A-4(8)	ML
6.2	9.6	------	------	------	------	100	98	96	80	45	30	16	57	26	A-7-5(18)	OH
6.9	2.8	------	------	------	------	100	99	98	90	71	59	41	60	25	A-7-5(18)	MH
7.3	.7	------	------	------	------	------	------	100	99	95	86	72	61	22	A-7-5(17)	MH
7.6	1.0	------	------	------	------	100	99	99	98	95	85	71	59	29	A-7-6(19)	MH-CH
8.4	------	------	------	------	------	------	------	100	99	97	91	71	66	28	A-7-5(19	MH
6.7	7.4	------	------	100	98	96	92	71	59	29	9	3	------	NP	A-4(7)	OL
6.9	3.3	------	100	99	96	94	90	68	57	31	12	6	34	9	A-4(7)	ML-CL
6.9	1.1	------	100	98	85	79	69	45	39	18	9	5	25	5	A-4(2)	SM-SC
7.0	------	100	99	95	80	71	52	14	12	5	1	0	------	NP	A-2-4(0)	SM
8.4	------	100	99	89	61	47	23	7	([10])	------	------	------	------	NP	A-1-a(0)	SM-SP
5.8	3.7	------	------	------	------	100	99	91	78	47	16	2	34	9	A-4(8)	ML-CL
6.3	1.9	------	------	------	------	------	100	95	82	48	21	10	30	7	A-4(8)	ML-CL
7.0	.6	------	------	------	------	------	100	87	71	28	16	10	24	6	A-4(8)	ML-CL
7.1	------	------	------	------	------	------	100	75	60	28	15	9	20	5	A-4(8)	ML-CL
7.1	------	------	------	------	------	100	99	31	27	17	9	6	------	NP	A-2-4(0)	SM
7.2	------	------	------	------	------	100	99	38	30	12	6	3	------	NP	A-4(1)	SM
7.2	------	------	------	------	------	100	98	30	24	9	6	4	------	NP	A-2-4(0)	SM
5.7	2.4	------	------	------	100	99	96	70	54	11	5	2	------	NP	A-4(7)	ML
5.6	.3	------	------	100	99	98	97	72	57	18	8	4	------	NP	A-4(7)	ML
6.0	------	------	------	------	------	------	100	60	44	20	8	5	------	NP	A-4(5)	ML
6.1	6.7	100	87	76	57	48	35	28	22	10	2	0	42	5	A-2-5(0)	GM
5.6	2.5	100	90	77	51	40	24	16	13	6	2	0	29	5	A-1-b(0)	GM-GC
5.5	1.6	100	80	62	39	27	12	7	([10])	------	------	------	21	2	A-1-a(0)	GW-GM
7.6	------	100	90	80	63	50	20	7	([10])	------	------	------	------	NP	A-1-a(0)	SP-SM
5.8	6.6	------	------	------	------	100	98	89	83	68	48	31	45	16	A-7-6(11)	ML
7.3	1.0	------	------	------	------	------	100	98	97	94	85	77	54	24	A-7-5(16)	MH-CH
7.9	1.0	------	------	------	------	100	99	98	98	95	92	80	60	28	A-7-5(19)	MH-CH
8.4	------	------	------	------	------	------	------	------	100	99	97	82	64	29	A-7-5(20)	MH

TABLE 5.—*Engineering*

Soil name and location	Parent material	SCS report number S68NY58	Depth from surface	Moisture-density[1] Maximum dry density	Optimum moisture	In-place moisture content[3]	In-place dry density[4]	Percolation rate[5]	Lineal shrinkage
			In.	*Lb./cu. ft.*	*Pct.*	*Pct.*	*Lb./cu. ft.*	*Min./in.*	*Pct.*
Oakville loamy fine sand: Town of Easton, one-fourth mile north of N.Y. Route 29 on Windy Hill Road, 50 feet west of Windy Hill Road. (Thinner sand and gravel deposit than modal)	Deltaic sand over stratified sand and gravel at a depth of 49 inches.	2-1	0-9	112	14	14	92	--------	--------
		2-2	9-16	117	12	11	90	--------	--------
		2-3	16-22	116	11	8	93	.9	1.4
		2-4	22-43	110	10	5	92	--------	--------
		2-5	43-49	122	9	--------	--------	--------	--------
		2-6	49-70	123	12	4	--------	.1	--------
Palatine shaly silt loam: Town of Kingsbury, one-fourth mile north of N.Y. Route 4 at State Route 149, 25 feet east of Route 4. (Modal)	Thin till derived mainly from dark calcareous shale.	15-1	0-8	99	20	--------	--------	5.8	8.0
		15-2	8-38	113	16	--------	--------	--------	7.4
		15-3	>38	Shale bedrock.					
Pittsfield stony fine sandy loam: Town of Kingsbury, 150 feet north of County Road 35, three-eighths mile east of Warren-Washington County line. (Modal) Estimated more than 10 percent coarse fragments more than 3 inches in diameter plus boulders in all layers of profile.	Glacial till derived mainly from syenite gneiss, granite gneiss, sandstone, and limestone.	14-1	0-7	109	16	8	--------	--------	2.4
		14-2	7-14	122	11	7	95	--------	1.2
		14-3	14-20	126	9	10	96	--------	1.2
		14-4	20-43	125	9	6	117	3.3	0
		14-5	43-77	128	9	10	126	15.2	0
Town of Kingsbury, 100 yards south of Kingsbury Road, 50 feet west of Hendee Road. (Lower coarse fragment content in the surface layer and subsoil than modal) Estimated 10 percent coarser fragments more than 3 inches in diameter in all layers below a depth of 26 inches in the profile.	Glacial till derived mainly from limestone and sandstone.	17-1	0-8	101	18	12	--------	--------	3.6
		17-2	8-15	116	12	10	85	--------	2.0
		17-3	15-21	110	13	7	--------	8.5	.4
		17-4	21-26	114	14	15	--------	--------	1.8
		17-5	26-48	123	10	12	106	--------	1.6
		17-6	48-84	132	8	8	--------	--------	.8
Rhinebeck silt loam: Town of Easton, 25 feet south of Wright Road, one and one-eighths mile west of N.Y. Route 40. (Modal)	Lacustrine silt and clay.	3-1	0-7	91	27	20	--------	--------	5.2
		3-2	7-10	101	21	--------	--------	--------	4.8
		3-3	10-21	102	23	20	101	15.5	8.2
		3-4	21-26	101	23	22	--------	--------	8.8
		3-5	26-61	98	24	25	96	--------	10.4
Scriba gravelly silt loam: Town of White Creek, 50 feet west of McCart Road, three-fourths mile south of Post Corners. (Modal) Estimated 10 to 15 percent coarse fragments more than 3 inches in diameter in all layers below a depth of 12 inches in the profile.	Glacial till derived mainly from shale, slate, and sandstone.	12-1	0-8	112	15	12	--------	--------	6.0
		12-2	8-12	119	12	11	--------	--------	3.2
		12-3	12-26	125	11	9	111	10.6	2.4
		12-4	26-54	125	10	11	113	--------	2.4
		12-5	54-64	129	9	13	122	--------	3.4

See footnotes at end of table.

test data—Continued

Reaction	Organic matter[6]	Mechanical analysis[2]: Percentage passing sieve— 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.)	Percentage smaller than— 0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.	Liquid limit	Plasticity index	Classification: AASHO[7]	Unified
pH	*Pct.*												*Pct.*			
6.2	1.7	------	------	------	------	100	90	36	28	12	5	3	20	2	A-4(0)	SM
6.5	.5	------	------	------	------	100	88	35	29	12	5	2	------	NP	A-2-4(0)	SM
5.4	.4	------	------	------	100	99	85	31	24	8	5	2	------	NP	A-2-4(0)	SM
5.8	------	------	------	------	------	100	83	14	11	2	1	1	------	NP	A-2-4(0)	SM
5.5	------	100	89	85	80	76	63	30	24	9	2	1	------	NP	A-2-4(0)	SM
5.6	------	100	94	81	58	44	7	2	([10])	------	------	------	------	NP	A-1-a(0)	SP
7.4	5.1	------	100	99	94	86	81	79	72	55	28	16	43	12	A-7-5(9)	ML
7.7	1.9	100	92	72	32	26	22	21	19	14	8	5	38	14	A-2-6(0)	GC-GM
5.6	3.7	100	99	96	90	86	75	51	39	12	3	1	------	NP	A-4(3)	ML
5.6	1.0	100	86	80	73	69	58	27	22	7	3	0	------	NP	A-2-4(0)	SM
6.1	.2	------	100	95	90	85	71	33	26	10	3	1	------	NP	A-2-4(0)	SM
6.6	------	100	99	93	87	77	64	37	29	7	3	0	------	NP	A-4(0)	SM
6.7	------	100	97	91	83	77	65	39	31	9	3	2	------	NP	A-4(1)	SM
6.5	7.7	------	100	97	87	82	74	52	41	17	6	3	36	4	A-4(3)	ML or OL
6.2	1.4	------	100	98	95	92	86	65	51	18	7	4	19	2	A-4(6)	ML
5.5	.6	------	------	100	98	96	93	63	47	11	4	2	------	NP	A-4(6)	ML
5.5	.6	------	------	------	100	99	97	72	56	21	7	3	18	1	A-4(7)	ML
5.6	------	100	95	92	73	58	41	21	17	10	5	4	19	2	A-1-b(0)	SM
8.4	------	100	95	89	78	70	59	34	28	13	6	2	12	1	A-2-4(0)	SM
6.1	4.6	------	------	------	100	99	96	92	82	64	28	11	42	14	A-7-6(10)	ML-CL
5.6	1.8	------	------	------	100	98	95	91	84	70	35	17	31	9	A-4(8)	ML-CL
6.3	.8	------	------	------	------	100	99	98	92	80	51	32	36	15	A-6(10)	CL
7.1	.6	------	------	------	------	100	99	99	93	83	52	32	38	18	A-6(11)	CL
8.4	------	------	------	------	------	100	99	99	95	89	62	34	42	19	A-7-6(12)	CL
5.8	4.0	100	93	83	73	65	53	44	38	25	10	5	42	11	A-7-5(2)	SM
6.2	1.2	100	95	87	75	67	54	41	36	23	12	6	27	6	A-4(1)	SM-SC
6.7	.6	100	98	92	80	72	58	44	39	26	13	8	20	5	A-4(2)	SM-SC
7.0	.5	100	96	92	80	73	61	48	42	30	15	9	19	5	A-4(3)	SM-SC
7.2	------	100	97	90	76	68	53	37	33	23	11	6	17	4	A-4(0)	SM-SC

TABLE 5.—*Engineering*

Soil name and location	Parent material	SCS report number S68NY58	Depth from surface	Moisture-density[1] Maximum dry density	Optimum moisture	In-place moisture content[3]	In-place dry density[4]	Percolation rate[5]	Lineal shrinkage
			In.	*Lb./cu. ft.*	*Pct.*	*Pct.*	*Lb./cu. ft.*	*Min./in.*	*Pct.*
Wallington silt loam, sandy substratum:									
Town of Hampton, 300 feet northwest of N.Y. Route 22A, 600 feet south of Poultney River Bridge on N.Y. Route 22A. (Modal) The 66- to 80-inch and 80- to 90-inch layers were sampled as a composite.	Lacustrine silt and very fine sand over sand and gravel at a depth of 48 inches.	20-1	0-9	90	30	34			4.0
		20-2	9-12	92	28	33			3.0
		20-3	12-17	98	24	28		5.9	2.8
		20-4	17-32	107	18	23			1.8
		20-5	32-48	110	16	21			.4
		20-6	48-66	110	14	11			
		20-7	66-80						
		20-8	80-90	135	8	8			

[1] AASHO Designation: T-99, Method C.

[2] 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, 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.

[3] Laboratory determination of moisture content of soil in accordance with A.S.T.M. Designation: D2216-63T.

parts of this publication, can be used to make interpretations in addition to those in tables 6 and 7, and it also can be used to make other useful maps.

This information, however, does not eliminate the need for further investigations at sites selected for engineering works, especially works that involve heavy loads or require excavations to depths greater than those shown in the tables, generally depths of more than 6 feet. Inspection of sites, especially the small ones, is essential because many delineated areas of a given soil mapping unit 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 meanings in soil science that may be unfamiliar to engineers. The Glossary defines many of these terms.

Engineering Soil Classification Systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*15*) used by the Soil Conservation Service, Department of Defense, and other agencies and the AASHO system adopted by the American Association of State Highway Officials (*2*).

In the Unified system, soils are classified according to particle-size distribution of the material less than 3 inches in diameter, 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 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, ML-CL.

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 that range from A-1 through A-7 on the basis of grain-size distribution of the material less than 3 inches in diameter, liquid limit, and plasticity index. In group A-1 are soils that have the highest bearing strength and are the best soils for subgrade (foundation). At the other extreme, in group A-7, are soils that have the lowest strength when wet and 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; and A-7-5 and A-7-6. As additional refinement, the engineering value of a 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 5; the estimated classification, without group index numbers, is given in table 6 for all soils mapped in the county.

According to the system used by the U.S. Department of Agriculture, the texture of the fine earth is determined by the relative proportions of sand, silt, and clay in soil material that is less than 2.0 millimeters in diameter. Examples of these textural classes are loam, silt loam, and fine sandy loam. For soils in which 15 percent or more of the soil mass consists of particles more than 2.0 millimeters in diameter, the

test data—Continued

Reaction	Organic matter[6]	Mechanical analysis[2]: Percentage passing sieve—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.)	Percentage smaller than—0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.	Liquid limit	Plasticity index	Classification: AASHO[7]	Unified
pH	*Pct.*												*Pct.*			
5.0	4.6	------	------	------	100	99	96	90	79	54	15	6	39	6	A-4(8)	ML
4.9	1.9	------	------	------	100	99	93	88	78	57	19	7	37	7	A-4(8)	ML
5.1	1.0	------	------	------	100	94	86	81	72	50	18	8	30	2	A-4(8)	ML
5.4	.4	------	------	------	100	97	93	89	72	31	10	5	------	NP	A-4(8)	ML
5.3	.6	------	------	------	------	100	99	79	61	16	6	3	------	NP	A-4(8)	ML
5.5	------	------	------	------	------	100	98	28	22	7	4	2	------	NP	A-2-4(0)	SM
6.6	------	------	100	98	68	52	19	4		------	------	------	------	NP	A-1-b(0)	SW

[4] Based on standard method of test for density of soil in place by the sand cone method—A.S.T.M. Designation: D1556-64.
[5] New York State Department of Health, Bulletin No. 1—Standard Percolation Test.
[6] Wet combustion method—based on Cornell University agronomy test procedure modified by the Soil Mechanics Bureau.
[7] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 8). The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHO Designation: M 145-49.
[8] Not sampled.
[9] NP—Nonplastic.
[10] No hydrometer analysis on sands if less than 10 percent passes No. 200 sieve.

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.

Soil Test Data

Table 5 contains engineering test data for some of the major soil series in Washington 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. Determinations of in-place moisture content and in-place dry density are based on methods developed by the American Society for Testing and Materials (ASTM).

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 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.

Shrinkage limit is the percentage of moisture at which shrinkage of the soil material stops.

Linear shrinkage is the decrease 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.

Soil Properties Significant in Engineering

Estimates of soil properties significant in engineering are shown in table 6. These estimates are made for representative soil profiles, by layers that differ sufficiently in soil properties to differ significantly in suitability for use in engineering projects. 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 6.

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.

TABLE 6.—*Estimates of soil properties*

[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 referring to other series that appear in the first column of

Soil series and map symbols	Depth to— Bedrock	Depth to— Seasonal high water table	Depth from surface of typical profile	USDA texture	Classification Unified	Classification AASHO
	Feet	*Feet*	*Inches*			
Amenia: AmB	>3½	1½–2	0–9	Silt loam	ML or CL	A–4
			9–21	Silt loam, loam, fine sandy loam, and gravelly analogs.	ML, CL, SM, or SC	A–4 or A–2
			21–50	Gravelly silt loam, loam, or fine sandy loam.	ML, CL, SM, SC, GM, or GC	A–4, A–2, or A–1
Belgrade: BeA, BeB	>5	1½–2	0–8	Silt loam	ML	A–4, A–7, or A–6
			8–24	Silt loam, very fine sandy loam.	ML, CL, SM, or SC	A–4
			24–65	Silt loam, very fine sandy loam.	ML, CL, SM, or SC	A–4
*Bernardston: BnB, BnC, BnD, BrB, BrC, BSCK, BTC, BUF. For Nassau part of BrB, BrC, and BSCK, see Nassau series.	>3½–5	1½–2½	0–9	Gravelly or shaly silt loam.	SM, ML, or GM	A–4
			9–28	Gravelly silt loam, gravelly loam.	GM, GC, SM, or SC	A–4 or A–2
			28–92	Gravelly loam, gravelly fine sandy loam, gravelly silt loam (fragipan).	SM, SC, CL, GM, or GC	A–4, A–2, or A–1
Carlisle: Ca. No estimates on material below a depth of 80 inches.	>4½	[2] 0	0–80	Organic material	Pt	----------
			80–110	Marl, silt loam, or silt.		
Charlton: CHC, CHE	>3½	>3½	0–28	Sandy loam, loam, fine sandy loam, and gravelly analogs.	SM, SC, ML	A–1, A–4, or A–2
			28–50	Sandy loam, fine sandy loam, and gravelly analogs.	SM, SC, GM, or GC	A–1, A–4, or A–2
Claverack: ClA, ClB	>6	1½–2	0–8	Loamy fine sand	SM	A–4 or A–2
			8–33	Loamy fine sand, fine sand.	SM or SP	A–4 or A–2
			33–63	Silty clay loam, silty clay, clay.	CH, MH, CL, or ML	A–7, A–4, or A–6
			63–96	Varved clay, sand, and silt.	ML, CL, CH, or MH	A–7, A–4, or A–6
Cosad: Cs	>5	½–1½	0–9	Fine sandy loam	SM, SC, ML	A–4
			9–30	Loamy fine sand, loamy sand.	SM	A–2, A–4
			30–52	Clay, silty clay, silty clay loam.	CH, MH, CL, or ML	A–7 or A–6
Covington: Cv	>3½	0–½	0–6	Silty clay loam	MH–CH or OH	A–7
			6–13	Silty clay or clay	MH	A–7
			13–55	Clay	MH or CH	A–7
			55–93	Varved clay or estuarine clay.	MH	A–7
Farmington: FaB, FCC, FCF. For Rock outcrop part of FCC and FCF, see Rock outcrop.	1–1½	1½	0–6	Loam	ML, CL, SM, SC, GM, or GC	A–4 or A–2
			6–18	Loam, fine sandy loam, silt loam, or gravelly analogs.	SM, SC, ML, CL, GM, or GC	A–4, A–2, or A–1
			18	Limestone bedrock.		
Fluvaquents: FL. Subject to flooding or ponding. Not rated.						

See footnotes at end of table.

significant in engineering

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for this table. The symbol > means more than; < means less than]

Coarse fraction greater than 3 inches	Percentage passing sieve— No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Permeability	Available moisture capacity [1]	Reaction	Shrink-swell potential
Percent					*Inches per hour*	*Inches per inch of soil*	*pH*	
<5	80–95	75–90	70–90	55–80	0.63–2.0	0.12–0.19	6.1–7.3	Low.
<5	65–95	60–90	40–90	25–80	0.63–2.0	0.09–0.18	6.1–7.3	Low.
5–10	55–70	50–65	35–65	20–60	<0.2	------------	>7.6	Low.
0	95–100	90–100	80–100	65–90	0.63–2.0	0.18–0.21	5.1–6.5	Low.
0	95–100	90–100	75–100	45–90	0.63–2.0	0.15–0.20	5.1–6.0	Low.
0	95–100	90–100	75–100	45–100	0.06–2.0	0.15–0.20	5.1–7.3	Low.
5–10	70–85	65–75	55–65	40–55	0.63–2.0	0.13–0.16	4.5–6.5	Low.
5–10	60–85	50–75	45–65	30–55	0.63–2.0	0.09–0.15	4.5–6.0	Low.
5–10	60–85	50–80	40–70	20–55	<0.2	------------	4.5 8.4	Low.
0	100	100	100	100	2.0–6.3	0.25–0.35	5.6–7.8	
10–15	60–90	55–90	30–85	15–65	0.63–2.0	0.07–0.16	4.5–5.5	Low.
10–15	55–90	50–90	30–70	15–45	0.63–2.0	0.07–0.13	4.5–5.5	Low.
0	95–100	95–100	80–95	15–45	>6.3	0.07–0.09	5.1–7.3	Low.
0	95–100	95–100	65–100	10–45	>6.3	0.07–0.08	5.1–7.3	Low.
0	------------	100	90–100	75–100	<0.2	------------	6.1–8.4	Moderate.
0	------------	100	90–100	70–90	<0.2	------------	6.1–8.4	
0	95–100	95–100	65–85	40–55	>6.3	0.15–0.16	5.1–7.3	Low.
0	95–100	95–100	65–100	15–45	>6.3	0.07–0.09	5.1–7.3	Low.
0	------------	100	90–100	75–100	<0.2	------------	6.6–8.4	Moderate.
0	------------	100	95–100	85–100	0.20–2.0	0.18	5.6–7.3	Moderate.
0	------------	100	95–100	90–100	<0.2	0.13–0.14	5.6–7.3	Moderate.
0	------------	100	95–100	95–100	<0.2	0.13	5.6–7.8	Moderate.
0	------------	100	95–100	95–100	<0.2	------------	>7.6	Moderate.
<5	60–90	55–85	45–80	30–60	0.63–2.0	0.10–0.15	5.6–7.3	Low.
<5	60–90	55–85	35–85	20–75	0.63–2.0	0.08–0.17	5.6–7.3	Low.

TABLE 6.—*Estimates of soil properties*

Soil series and map symbols	Depth to— Bedrock	Depth to— Seasonal high water table	Depth from surface of typical profile	USDA texture	Classification Unified	Classification AASHO
	Feet	*Feet*	*Inches*			
Fredon: Fr	>6	½–1	0–13	Silt loam	ML, OL, or CL	A-4
			13–22	Sandy loam, fine sandy loam, loam, silt loam, or gravelly analogs.	SM, SC, ML, or CL	A-4 or A-2
			22–50	Gravelly loamy sand, very gravelly loamy sand.	SM, SP, SC, SW, GM, GW, or GC	A-2, A-1, or A-3
			50–80	Very gravelly sand	SW, SP, SM, GM, GP, or GW	A-1 or A-2
Halsey: Ha	>5	0	0–10	Mucky silt loam	ML, CL, or OL	A-4
			10–23	Gravelly loam, fine sandy loam, gravelly fine sandy loam, loam.	ML, CL, SM, or SC	A-4, A-2, or A-1
			23–50	Very gravelly sand	GW, GP, GM, SW, SP, or SM	A-1 or A-2
Hamlin: Hb	6	[2] >2	0–46	Silt loam, very fine sandy loam.	ML or CL	A-4
			46–50	Silt loam, very fine sandy loam, fine sandy loam, loamy fine sand.	ML, CL, SM, or SC	A-4 or A-2
Hartland: HcA, HcB, HcC, HcD.	>6	>4	0–10	Very fine sandy loam	ML	A-4
			10–75	Silt loam, very fine sandy loam, loamy fine sand.	ML or SM	A-4
Herkimer: HeA, HeB	>5	1½–2	0–8	Gravelly silt loam	ML, CL, SM, SC, GM, or GC	A-4
			8–21	Very gravelly silt loam, very gravelly loam, very gravelly sandy loam.	GW, GM, or GC	A-1, A-2, or A-4
			21–45	Very gravelly loamy sand, very gravelly sandy loam, very gravelly loam.	GW, GM, or GC	A-1 or A-2
			45–50	Very gravelly sand	GW, GP, or GM	A-1 or A-2
*Hollis: HLE, HNC. For Rock outcrop part of HNC, see Rock outcrop. For Charlton part of HLE, see Charlton series.	1–1½	>1½	0–19	Loam, fine sandy loam, sandy loam, and gravelly analogs.	SM or ML	A-2, A-4, or A-1
			19	Synenite and granite gneiss bedrock.		
*Hoosic: HoA, HoB, HoC, HSDK, HTF. For Otisville part of HTF, see the Otisville series.	>6	>3	0–8	Gravelly sandy loam	GM or SM	A-1 or A-2
			8–13	Sandy loam, fine sandy loam, loam, and gravelly or very gravelly analogs.	GM, GC, ML, or CL	A-1, A-3, A-2, or A-4
			13–83	Very gravelly loamy sand or sand.	GW, GM, SM, or SP	A-1
*Hudson: HvB, HvC, HvD, HWE. For Vergennes part of HWE, see Vergennes series.	>3½	1½–2	0–9	Silt loam	ML or CL	A-4
			9–26	Heavy silty clay loam, silty clay, clay.	CL or MH	A-6 or A-7
			26–50	Silty clay	CL	A-6 or A-7
Kingsbury: KbA, KbB	>3½	½–1½	0–8	Silty clay	ML or MH	A-7
			8–28	Clay	MH or CH	A-7
			28–50	Clay	MH or CH	A-7
Limerick: Lm	>5	[2] 0–½	0–50	Silt loam, very fine sandy loam.	ML, CL, SM, or SC	A-4

See footnotes at end of table.

significant in engineering—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve—				Permeability	Available moisture capacity [1]	Reaction	Shrink-swell potential
	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*	
0	80–100	75–100	70–95	65–75	0.63–2.0	0.16–0.21	5.6–7.3	Low.
<5	70–90	65–90	60–80	30–55	2.0–6.3	0.09–0.18	5.6–7.3	Low.
<5	20–80	15–75	5–55	0–20	>6.3	0.01–0.06	6.6–8.4	Low.
<5	20–65	15–50	5–45	0–15	>6.3	------------	6.6–8.4	Low.
0	80–90	75–90	65–90	55–80	0.63–2.0	0.16–0.19	5.6–7.3	Low.
<5	65–90	60–90	40–85	25–65	0.63–6.3	0.09–0.15	5.6–7.3	Low.
<5	20–70	15–50	5–45	0–15	>6.3	0.01–0.02	6.1–8.4	Low.
0	95–100	90–100	90–100	60–95	0.63–2.0	0.15–0.21	5.6–7.3	Low.
0	90–100	90–100	90–100	25–95	0.63–>6.3	------------	5.6–7.3	Low.
0	90–100	90–100	90–100	65–75	0.63–2.0	0.15–0.20	5.1–7.3	Low.
0	90–100	90–100	90–100	45–75	0.20–2.0	0.13–0.20	5.1–7.3	Low.
<5	65–80	60–75	55–75	40–65	0.63–2.0	0.12–0.15	5.1–7.3	Low.
<5	45–55	40–50	25–50	15–45	0.63–2.0	0.06–0.10	5.1–7.3	Low.
1–10	35–55	30–50	15–45	5–35	>6.3	0.02–0.08	5.6–7.8	Low.
1–10	35–55	30–50	15–35	0–15	>6.3	------------	5.6–7.8	Low.
0–10	65–90	60–90	25–85	20–65	2.0–6.3	0.09–0.15	4.5–5.5	Low.
<5	50–75	45–75	25–50	15–30	>6.3	0.07–0.13	5.1–6.5	Low.
<5	45–80	40–80	20–75	15–60	>6.3	0.06–0.13	5.1–6.0	Low.
5–10	35–65	25–50	10–30	0–15	>6.3	0.01–0.04	5.1–7.8	Low.
0	------------	100	90–100	70–90	0.20–2.0	0.21	5.6–7.3	Low.
0	------------	100	90–100	75–95	<0.2	0.13–0.17	5.6–7.3	Moderate.
0	------------	100	95–100	90–95	<0.2	0.14	7.4–8.4	Moderate.
0	------------	100	95–100	85–95	0.20–2.0	0.14–0.17	5.1–7.3	Moderate.
0	------------	100	95–100	95–100	<0.2	0.13	5.1–7.8	Moderate.
0	------------	100	95–100	95–100	<0.2	------------	6.1–8.4	Moderate.
0	95–100	90–100	80–100	45–90	0.63–2.0	0.14–0.20	5.1–7.3	Low.

TABLE 6.—*Estimates of soil properties*

Soil series and map symbols	Depth to—		Depth from surface of typical profile	USDA texture	Classification	
	Bedrock	Seasonal high water table			Unified	AASHO
	Feet	*Feet*	*Inches*			
Madalin: Ma	>3½	0–½	0–6	Silty clay loam	OL, OH, ML, MH, or CL	A-7
			6–52	Silty clay, silty clay loam, clay.	CL, MH	A-6 or A-7
*Nassau: NAC, NBC, NBF. For Rock outcrop part of NBC and NBF, see Rock outcrop.	1–1½	>1½	0–9	Shaly silt loam	ML, SM, or GM	A-4
			9–19	Very shaly loam or silt loam.	GM	A-1, A-2, or A-4
			19	Shale, slate, or phyllite bedrock.		
Oakville: OaB, OaC, OKE	>6	>2	0–24	Loamy fine sand, fine sand.	SM	A-4, A-2
			24–50	Loamy fine sand, fine sand, loamy sand, sand.	SM, SW, or SP	A-2, A-1
Otisville: OtA, OtB, OVDK	>6	>3	0–9	Gravelly sandy loam	SM or SC	A-1
			9–23	Very gravelly loamy sand.	SW, SM, GW, or GM	A-1
			23–50	Stratified very gravelly loamy coarse sand, very gravelly sand.	GW, GP, GM, SW, SP, or SM	A-1
Orthents and Psamments: OP. Not rated.						
Palatine: PaB, PaC	1½–3½	1½–3½	0–8	Shaly silt loam	ML, GM, or GC	A-7, A-6, A-2, or A-4
			8–38	Very shaly silt loam or very shaly loam.	GC, GM	A-2 or A-1
			38	Calcareous shale bedrock.		
Palms muck: Pm	>2	[2] 0	0–25	Organic material (Sapric).	Pt	---
			25–50	Fine sandy loam, loam, sandy clay loam, clay loam.	---	---
*Pittsfield: PtB, PtC, PVC. For Amenia part of PVC, see Amenia series.	>3½	>3	0–20	Fine sandy loam, loam, sandy loam, and gravelly analogs.	SM, ML, or OL	A-2, A-4
			20–77	Gravelly fine sandy loam, gravelly sandy loam.	SM	A-4, A-1, or A-2
Rhinebeck: RhA, RhB	>3½	½–1½	0–10	Silt loam	ML or CL	A-4, A-6, or A-7
			10–26	Silty clay loam, silty clay, clay.	CL	A-6 or A-7
			26–61	Varved clay with thin lenses of silt and very fine sand.	CL	A-6 or A-7
*Rock outcrop: ROF, RPC, RPF. For Hollis part of ROF, see Hollis series. For Vergennes part of RPC and RPF, see Vergennes series.	0	---	---	Exposed slate, shale, phyllite, sandstone, gneiss, limestone, dolomite, or quartzite bedrock.		
Saco: Sa	>5	[2] 0	0–12	Silt loam	ML, OH, OL	A-4
			12–50	Silt loam, very fine sandy loam.	ML or CL	A-4

See footnotes at end of table.

significant in engineering—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve—				Permeability	Available moisture capacity [1]	Reaction	Shrink-swell-potential
	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*	
0	------------	100	95–100	85–95	0.20–2.0	0.17	5.6–7.3	Moderate.
0	------------	100	95–100	90–100	<0.2	0.13–0.17	5.6–8.4	Moderate.
0	70–80	65–75	60–75	45–65	0.63–2.0	0.13–0.15	4.5–5.5	Low.
0	35–55	30–50	25–50	20–45	0.63–2.0	0.06–0.10	4.5–5.5	Low.
0	100	95–100	80–90	10–40	>6.3	0.04–0.10	5.6–7.3	Low.
0	55–100	40–100	5–90	0–35	>6.3	0.03–0.04	5.6–7.8	Low.
0–10	55–65	50–60	30–40	15–25	>6.3	0.08–0.10	5.1–5.5	Low.
5–10	40–60	35–50	20–40	5–15	>6.3	0.03–0.04	5.1–5.5	Low.
5–10	30–60	20–50	5–35	0–15	>6.3	0.01–0.04	5.1–6.0	Low.
0	55–95	50–90	45–85	35–80	0.63–2.0	0.10–0.16	5.6–7.8	Low.
0	30–50	25–45	20–40	15–35	0.63–2.0	0.08–0.13	5.6–7.8	Low.
0	100	100	100	100	2.0–6.3	0.25–0.35	5.6–7.8	
0	100	100	70–100	40–80	0.63–2.0	------------	6.1–8.4	Low.
0–15	70–100	65–100	55–100	25–75	2.0–6.3	0.09–0.15	5.6–7.3	Low.
5–15	70–90	55–80	40–70	20–45	0.63–2.0	0.09–0.13	5.6–8.4	Low.
0	100	95–100	95–100	90–95	0.20–2.0	0.20–0.21	5.6–7.3	Low.
0	------------	100	95–100	95–100	<0.2	0.13–0.17	5.6–7.3	Moderate.
0	------------	100	95–100	95–100	<0.2	------------	7.4–8.4	
0	100	95–100	85–100	65–95	0.63–2.0	0.20–0.21	5.1–7.3	Low.
0	------------	100	85–100	55–90	0.63–2.0	0.16–0.20	5.1–7.3	Low.

TABLE 6.—*Estimates of soil properties*

Soil series and map symbols	Depth to—		Depth from surface of typical profile	USDA texture	Classification	
	Bedrock	Seasonal high water table			Unified	AASHO
	Feet	*Feet*	*Inches*			
Saprists, Aquepts, and Aquents: SB. Subject to flooding or ponding. Not rated.						
Scriba: ScA, ScB, SDC	>3½	½–1½	0–12	Gravelly silt loam, gravelly loam.	SM, SC, or ML	A–7, A–6, or A–4
			12–54	Gravelly loam, gravelly silt loam (fragipan).	SM, SC, ML, GM, or GC	A–4
			54–64	Gravelly loam, gravelly silt loam (fragipan).	SM, SC, GM, GC, or ML	A–4
Sun: Su, SV	>3½	0	0–9	Loam	SM, SC, ML, OL, or CL	A–4
			9–21	Loam, sandy loam, fine sandy loam, and gravelly analogs.	SM, SC, ML, CL, GM, or GC	A–2 or A–4
			21–50	Gravelly fine sandy loam, gravelly sandy loam, and gravelly loam.	SM, SC, GW, GM, GC, or ML	A–1, A–2, or A–4
Teel: Te	>4	[2]1½–2	0–50	Silt loam, very fine sandy loam.	ML or CL	A–4
Vergennes: VeB, VeC, VeD	>3½	1½–2	0–6	Silty clay loam	ML, CL	A–7 or A–6
			6–25	Silty clay, clay	MH or CH	A–7
			25–50	Clay	MH or CH	A–7
Wallington: Wa	>6	½–1½	0–17	Silt loam, very fine sandy loam.	ML	A–4
			17–48	Silt loam, very fine sandy loam (fragipan).	ML	A–4
			48–66	Loamy fine sand	SM or SC	A–2
			66–90	Stratified fine gravel and coarse sand.	SP or SW	A–1

[1] Estimates of available moisture capacity are to a depth of 30 inches or to a root-restricting feature, such as bedrock, a fragipan, a dense substratum, or a high water table.

Soil texture is described in table 6 in the standard terms used by the Department of Agriculture. These terms take into account the 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 is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil is 15 percent or more gravel or other particles coarser than sand, an appropriate modifier is added, for example, gravelly silt loam.

Permeability is that quality that enables a soil to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 6 do not take into account such transient soil features as plowpans and surface crusts.

Available moisture 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 generally to a depth of 30 inches or to the depth of root-restricting soil features, such as bedrock, fragipan, dense substratum, or high water table.

Reaction is the degree of acidity or alkalinity of a soil, expressed as a pH value. The pH value and terms used to describe soil reaction are explained in the Glossary.

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 or swells when it is 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 moderate shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material that has this rating.

Engineering Interpretations

The interpretations in table 7 are based on the engineering properties of soils shown in table 6, on test

significant in engineering—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve—				Permeability	Available moisture capacity [1]	Reaction	Shrink-swell-potential
	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*	
0–15	70–75	60–85	50–85	40–75	0.63–2.0	0.12–0.17	5.6–7.3	Low.
10–15	50–80	45–75	40–75	40–65	<0.2	0.08–0.14	5.6–7.3	Low.
10–15	50–80	45–70	40–70	36–60	<0.2	------------	6.1–7.8	Low.
0–10	75–90	70–90	60–85	40–65	0.63–2.0	0.12–0.15	5.1–7.3	Low.
0–15	55–90	50–90	30–85	15–65	0.63–2.0	0.07–0.15	5.6–7.3	Low.
5–15	45–75	40–70	25–65	10–55	<0.2	------------	6.6–7.8	Low.
0	95–100	90–100	90–100	65–95	0.63–2.0	0.14–0.20	5.6–7.3	Low.
0	------------	100	95–100	85–95	<0.20–0.63	0.18	5.1–7.3	Moderate.
0	------------	100	90–100	80–100	<0.06	0.13	5.1–7.8	Moderate.
0	------------	100	100	95–100	<0.06	0.13	7.9–8.4	Moderate.
0	100	90–100	85–100	80–90	0.63–2.0	0.15–0.20	4.5–6.5	Low.
0	100	95–100	90–100	75–90	<0.2	0.10–0.14	4.5–6.5	Low.
0	------------	100	95–100	25–35	>6.3	------------	5.1–7.3	Low.
0	65–75	45–55	15–25	0–5	>6.3	------------	5.1–7.3	Low.

[2] Subject to flooding and ponding.

data for soils in this county and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Washington County. In table 7, 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, installation, and maintenance of highways; light buildings; drainage of cropland and pasture; irrigation; ponds and reservoirs; and terraces, diversions, and waterways.

Suitability of the soil as a source of topsoil, sand and gravel, and road fill is rated by the terms *good, fair, poor,* and *unsuitable.*

Topsoil is material used in 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 in preparing a seedbed; natural fertility of the material, or the response of plants to fertilizer; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are other characteristics that affect suitability. Also considered in rating the soils as a source of topsoil are features that determine the ease or difficulty of excavation, particularly soil slope, wetness, and the thickness of suitable material.

Sand and gravel are used in great quantitites in many kinds of construction. The ratings in table 7 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. Neither do they indicate quality of the deposit.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and 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

TABLE 7.—*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 such to other series that appear in

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Embankment foundation	Foundations for low buildings
Amenia: AmB	Fair: coarse fragments; low volume.	Unsuitable: none present.	Good: some large stones.	Seasonal high water table at depth of 18 to 24 inches; seepage and sloughing in cuts; frost heaving of boulders in places; bedrock in some cuts; trafficability generally good, but soil is seasonally wet.	Adequate strength for high embankments.	Adequate strength; seasonal high water table at depth of 18 to 24 inches; bedrock in places.
Belgrade: BeA, BeB.	Good	Generally poor: excess fines; possible source below depth of 42 inches in places.	Fair to poor: silty material; highly erodible; fair source of gravelly and sandy material below depth of 42 inches in places; possible need for excavation under water.	Seasonal hign water table at depth of 18 to 24 inches; clay lenses below depth of 42 inches cut slopes highly erodible; wet subgrade in cuts; trafficability generally good, but soil is seasonally wet.	Generally adequate strength for low embankments; variable compressibility.	Generally adequate strength; seasonal high water table at depth of 18 to 24 inches; variable compressibility.
*Bernardston: BnB, BnC, BnD, BrB, BrC, BSCK, BTC, BUF. For Nassau part of BrB, BrC, and BSCK, see Nassau series.	Poor: coarse fragments.	Unsuitable: none present.	Good for all but BnD and BUF: some large stones. Fair for BnD: moderately steep. Poor for BUF: steep and very steep.	Seasonal high water table at depth of 18 to 30 inches; severe seepage and sloughing in cuts above fragipan; bedrock in some cuts; frost heaving of boulders in places and possible loss of embankments in cuts; BnD and BUF are moderately steep or steep and very steep; trafficability generally good except on steeper slopes.	Generally adequate stength for high embankments; BnD is moderately steep and in places requires benching to improve bonding; BUF is steep and very steep and in places requires benching to improve bonding.	Adequate strength; seasonal high water table at depth of 18 to 30 inches; BnD and BUF are moderately steep or steep and very steep.
Carlisle: Ca	Unsuitable: possibly can be used as amendment for mineral soils.	Unsuitable: none present.	Unsuitable: 51 inches or more of organic material over variable mineral soils.	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 surface; compressible organic material 51 inches or more thick over variable mineral soils.

See footnotes at end of table.

interpretations

mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring the first column of this table]

Soil features affecting—Continued					
Ponds		Agricultural drainage	Irrigation	Diversions	Waterways
Reservoir areas	Embankments [2]				
Slow permeability in substratum; seasonal high water table at depth of 18 to 24 inches; bedrock in places.	Low permeability; medium to low compressibility; poor to good compaction characteristics; some large stones.	Seasonal high water table at depth of 18 to 24 inches; slow permeability in substratum.	Moderate to high available water capacity; rooting zone mainly in top 24 inches; moderate intake rate; seasonal high water table at depth of 18 to 24 inches; slight to moderate erosion hazard.	Stony in places: slow permeability in substratum.	Slow permeability in substratum; stony in places; erodible; moderately well drained.
Pervious layers subject to excess seepage during dry periods; seasonal high water table at depth of 18 to 24 inches.	Low to medium permeability; poor to fair stability; fair to good compaction characteristics; susceptible to piping; erodible.	Seasonal high water table at depth of 18 to 24 inches; cut slopes highly erodible; siltation hazard.	Moderate to slow intake rate; high available water capacity; seasonal high water table at depth of 18 to 24 inches; erodible.	Pervious layers subject to seepage; erodible.	Cut slopes highly erodible; siltation hazard; moderately well drained.
Slow permeability in fragipan; seasonal high water table at depth of 18 to 30 inches; BnC, BnD, BrC, BSCK, BTC, and BUF are sloping through very steep.	Low permeability; low to medium compressibility; good to fair compaction characteristics; stony.	Slow permeability in fragipan; seasonal high water table at depth of 18 to 30 inches; subject to seepage and sloughing above fragipan; BnC, BnD, BrC, BSCK, BTC, and BUF are sloping through very steep.	Moderate to slow intake rate; rooting zone restricted mainly to depth of 18 to 30 inches above fragipan; moderate to high available water capacity; BnC, BnD, BrC, BSCK, BTC, and BUF are sloping through very steep and erodible.	BnB, BnC generally have no adverse features; other units are too steep or too stony or have irregular slopes or erratic depths to bedrock from place to place.	Slow permeability in fragipan at depth of 18 to 30 inches; seepage above pan; well drained and moderately well drained; BnD, BSCK, and BUF are moderately steep through very steep, or are rolling and hilly; BTC is very stony.
Prolonged high water table at or near surface; 51 inches or more of organic material that has moderately rapid permeability over mineral soils of variable permeability.	Unsuitable: 51 inches or more of organic material over variable mineral soils.	Prolonged high water table at or near surface; hazards of subsidence and soil blowing; outlets difficult to locate.	Drainage needed; water level control for subirrigation.	Not applicable; flat or depressional relief; 51 inches or more of organic material over variable mineral soils.	Not applicable; flat or depressional relief; 51 inches or more of organic material over variable mineral soils; very poorly drained.

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Embankment foundation	Foundations for low buildings [1]
Charlton: CHC, CHE.	Poor: coarse fragments.	Poor: excessive fines.	Good for CHC: many large stones and boulders. Fair to poor for CHE: moderately steep and steep.	Cut slopes are erodible; bedrock in some cuts; boulders in cuts can be dislodged by frost action; boulders are subject to frost heave in subgrades; trafficability generally good on CHC; CHE is moderately steep and steep.	Generally adequate strength for high embankments; CHE is moderately steep and steep and in places requires benching to improve bonding.	Adequate strength; CHE is moderately steep and steep.
Claverack: ClA, ClB.	Poor: sandy	Unsuitable: less than 36 inches thick.	Poor to fair: 20 to 40 inches of sand over clay and silt that is generally wet.	Seasonal high water table at depth of 18 to 24 inches; 20 to 40 inches of sand over clay and silt that is generally wet; cut slopes subject to seepage and sloughing; in places underlying clay requires a slope protection blanket; when wet, underlying clay in subgrade hinders hauling operations; seasonally poor trafficability caused by sandy surface layer and wetness.	Generally adequate strength for low embankments; underlain by compressible clay and silt that is generally wet.	Generally adequate strength; seasonal high water table at depth of 18 to 24 inches; moderate shrink-swell potential in clayey substratum.
Cosad: Cs	Poor: sandy	Unsuitable: less than 36 inches thick.	Poor: 20 to 34 inches of sandy material over clay and silt; generally wet.	Seasonal high water table at depth of 6 to 18 inches; 20 to 34 inches of sandy material over clay and silt; generally wet; nearly level; cut slopes subject to seepage and sloughing; when wet, clayey substratum hinders hauling operations; seasonally poor trafficability caused by sandy surface layer and wetness.	Generally adequate strength for low embankments; underlain by compressible clay and silt; generally wet.	Generally adequate strength; seasonal high water table at depth of 6 to 18 inches; moderate shrink-swell potential in clayey substratum.
Covington: Cv.	Poor: low volume; high clay content; poorly drained.	Unsuitable: none present.	Poor: generally wet and sticky clay.	Prolonged high water table at or near surface; nearly level or depressional; subgrade of wet, plastic, compressible clay; trafficability very poor for long periods.	Soft, wet, weak, compressible clay; onsite investigation needed.	Prolonged high water table at or near surface; soft, wet, sticky, compressible clay; moderate shrink-swell potential.

See footnotes at end of table.

interpretations—Continued

Soil features affecting—Continued					
Ponds		Agricultural drainage	Irrigation	Diversions	Waterways
Reservoir areas	Embankments [2]				
Moderate permeability; very stony; deep water table; CHE is moderately steep and steep.	Medium to low permeability; low to medium compressibility; good to fair compaction characteristics; susceptible to piping in places; very stony.	Not applicable; well drained.	Very stony; low to high available water capacity; moderate to rapid intake rate; CHE is moderately steep and steep.	Moderate permeability; very stony; CHE is moderately steep and steep.	Moderate permeability; very stony; well drained; CHE is moderately steep and steep.
20 to 40 inches of pervious sandy material over clay and silt that has slow permeability; seasonal high water table at depth of 18 to 24 inches.	Sandy surface layer has medium to low permeability; low to medium compressibility; susceptible to piping; fair to good compaction characteristics. Clayey substratum has low permeability; high to medium compressibility; poor to good compaction characteristics; low to medium strength.	Seasonal high water table at depth of 18 to 24 inches; ditchbanks unstable; 20 to 40 inches of sandy material over clay and silt.	Low to moderate available water capacity; high intake rate; seasonal high water table at depth of 18 to 24 inches.	20 to 40 inches of sandy material over clay and silt; subject to soil blowing and water erosion.	20 to 40 inches of sandy material over clay and silt; subject to soil blowing and water erosion; moderately well drained.
20 to 34 inches of pervious sandy material over clay and silt that has slow or very slow permeability; seasonal high water table at depth of 6 to 18 inches.	Sandy surface layer has medium to low permeability; low to medium compressibility; susceptible to piping; fair to good compaction characteristics. Clayey substratum has low permeability; high to medium compressibility; generally wet; low to medium strength.	Seasonal high water table at depth of 6 to 18 inches; ditchbanks unstable; 20 to 34 inches of sandy material over clay and silt; subject to piping.	Low to moderate available water capacity; moderate to high intake rate; seasonal high water table at depth of 6 to 18 inches; drainage needed.	Not applicable; nearly level.	Not applicable; nearly level.
Very slow permeability; prolonged high water table at or near surface.	Generally wet and sticky clay; low to medium permeability; high compressibility; poor compaction characteristics; low strength; moderate shrink-swell potential.	Prolonged high water table at or near surface; very low permeability in subsoil and substratum; outlets difficult to locate.	Generally not applicable; poorly drained.	Not applicable; nearly level or depressional.	Not applicable; nearly level or depressional;

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Embankment foundation	Foundations for low buildings [1]
*Farmington: FaB, FCC, FCF. For Rock outcrop part of FCC and FCF, see Rock outcrop.	Poor: low yield; coarse fragments.	No sand or gravel.	Poor: low yield.	10 to 20 inches deep over bedrock, generally limestone; rock in most cuts; seepage above rock; FCC and FCF are very rocky and sloping through moderately steep, steep, and very steep.	Adequate strength for high embankments; FCC and FCF are sloping through moderately steep, steep, and very steep, and in places require benching to improve bonding.	10 to 20 inches deep over bedrock, generally limestone; adequate strength; FCC and FCF are sloping through moderately steep, steep, and very steep.
Fluvaquents: FL.	Variable	Generally unsuitable: variable.	Variable: generally wet in natural state.	Subject to frequent flooding; seasonal high water table at or near surface in most places; nearly level.	Variable strength	Subject to frequent flooding; seasonal high water table at or near surface in most places; variable strength.
Fredon: Fr	Poor to fair: coarse fragments; low volume; poorly drained in places.	Fair to poor in substratum: some excess fines; possible need for excavation under water.	Good to poor in substratum: possible need for excavation under water; poorly drained in places.	Seasonal high water table at depth of 6 to 12 inches; cuts not indicated unless drainage outlets are available; hazards of seepage and sloughing in cuts; subgrade in cuts subject to differential frost heave; seasonally poor trafficability caused by wetness.	Generally adequate strength for low embankments.	Generally adequate strength; seasonal high water table at depth of 6 to 12 inches.
Halsey: Ha	Poor: low volume; coarse fragments; very poorly drained.	Generally good in substratum: excess fines in places; generally under water.	Unsuitable in surface layer: mucky. Good in substratum, but generally under water.	Prolonged water table at or near surface; cuts not indicated unless areas are drainable; cut slopes unstable; subgrade subject to differential frost heave; generally poor trafficability caused by mucky surface layer and prolonged wetness.	Generally adequate strength for low embankments; in places is underlain by wet compressible material.	Generally not applicable: prolonged high water table at or near surface; possible large settlement under heavy or vibratory loads.
Hamlin: Hb	Good	Unsuitable: excess fines.	Poor: highly erodible silts; may be wet with depth.	Subject to flooding; water table may be encountered below depth of 24 inches; subgrade unstable; seasonally poor trafficability.	Generally adequate strength, but onsite investigation needed.	Not applicable: subject to flooding.

See footnotes at end of table.

interpretations—Continued

Soil features affecting—Continued						
Ponds		Agricultural drainage	Irrigation	Diversions	Waterways
Reservoir areas	Embankments [2]				
10 to 20 inches deep over bedrock, generally limestone; FCC and FCF are very rocky and are sloping through moderately steep, steep, and very steep.	10 to 20 inches deep over bedrock; low yield.	Not applicable: well drained.	Low to moderate available water capacity in 10- to 20-inch zone above bedrock; moderate intake rate; FCC and FCF are very rocky and are sloping through moderately steep, steep, and very steep.	10 to 20 inches deep over bedrock; FCC and FCF are very rocky and in places have slopes of more than 20 percent.	10 to 20 inches deep over bedrock; FCC and FCF are very rocky and have slopes of more than 15 percent.
Variable permeability; subject to frequent flooding.	Variable material; wet in most places.	Subject to frequent flooding; seasonal high water table at or near surface in most places; variable permeability; outlets inadequate in places.	Not applicable: subject to frequent flooding.	Not applicable: nearly level; subject to frequent flooding.	Not applicable: nearly level; subject to frequent flooding; seasonal high water table at or near surface in most places.
Seasonal high water table at depth of 6 to 12 inches; pervious substratum.	Variable permeability; pervious material good for outside shell; wetness.	Seasonal high water table at depth of 6 to 12 inches; ditch banks unstable; rapid permeability in substratum; outlets difficult to locate in places.	Generally not applicable: seasonal high water table at depth of 6 to 12 inches; water generally available.	Generally not applicable: nearly level.	Generally not applicable: nearly level; somewhat poorly drained to poorly drained.
Pervious substratum; prolonged high water table at or near surface.	Variable permeability; pervious material good for outside shell; generally wet.	Prolonged high water table at or near surface; rapid permeability in substratum; ditchbanks unstable; outlets difficult to establish in places.	Generally not applicable: prolonged high water table at or near surface.	Not applicable: nearly level or depressional.	Not applicable: nearly level or depressional; very poorly drained.
Subject to flooding; moderate permeability; water table may be encountered below depth of 24 inches.	Medium to low permeability; low to medium compressibility; good to poor compaction characteristics; wetness; susceptible to piping; erodible.	Subject to flooding, but drainage not generally needed; may encounter water table below depth of 24 inches for brief periods.	High available water capacity; unrestricted rooting depth; moderate to slow intake rate; subject to flooding, but rarely during growing season.	Not applicable: nearly level.	Not applicable: nearly level.

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Embankment foundation	Foundations for low buildings [1]
Hartland: HcA, HcB, HcC, HcD.	Good	Unsuitable: excess fines.	Poor to fair: highly erodible; subject to soil blowing.	Grade location not critical above water table, which is generally at a depth of more than 48 inches; cut slopes highly erodible and subject to soil blowing; subgrade in cuts subject to differential frost heave where stratified; lenses of wet clay encountered in places; trafficability generally good except on HcD, which is moderately steep.	Generally adequate strength for low embankments; HcD is moderately steep.	Generally adequate strength; compressible under vibratory loads; HcD is moderately steep.
Herkimer: HeA, HeB.	Poor: coarse fragments; low volume.	Good to fair: high content of flat fragments in places; wetness in places.	Good: wetness in places.	Seasonal high water table at depth of 18 to 24 inches; highway grade location not critical above water table; in places cut slopes subject to seepage and sloughing; subgrade in cuts subject to differential frost heave; trafficability generally good, but soil is seasonally wet.	Generally adequate strength for moderately high embankments; subject to densification by vibratory or very heavy loads.	Generally adequate strength; seasonal water table at depth of 18 to 24 inches.
*Hollis: HLE, HNC. For Rock outcrop part of HNC, see Rock outcrop; for Charlton part of HLE, see Charlton series.	Poor: coarse fragments; low volume.	Unsuitable: none present.	Poor: low volume.	Shallow; gneiss bedrock at depth of 10 to 20 inches; rock in most cuts; seepage above rocks; trafficability hindered by many rock outcrops; HLE is steep.	Adequate strength for high embankments; HLE is moderately steep and steep and in places requires benching to improve bonding.	Shallow; gneiss bedrock at depth of 10 to 20 inches; HLE is moderately steep and steep.

See footnotes at end of table.

interpretations—Continued

Soil features affecting—Continued						
Ponds		Agricultural drainage	Irrigation	Diversions	Waterways
Reservoir areas	Embankments [2]				
Moderate to moderately slow permeability in substratum; pervious layers in places; HcC and HcD are sloping and moderately steep.	Medium to low permeability; medium compressibility; fair to poor compaction characteristics; highly susceptible to piping; erodible.	Not applicable: well drained.	High available water capacity; rooting depth is unrestricted; slow intake rate; HcB, HcC, and HcD are gently sloping to moderately steep and highly erodible.	Highly erodible; hazards of soil blowing and siltation; subject to piping.	Highly erodible; hazards of soil blowing and siltation; subject to piping; well drained.
Pervious substratum; seasonal high water table at depth of 18 to 24 inches.	Medium to high permeability; generally low compressibility; good to fair compaction characteristics; suitable for outside shell.	Seasonal high water table at depth of 18 to 24 inches; ditchbanks subject to seepage and sloughing; rapid permeability in substratum.	Low to moderate available water capacity; moderate to rapid intake rate; rooting depth mainly in top 18 to 24 inches, few below; seasonal high water table at depth of 18 to 24 inches.	Rapid permeability in substratum; subject to seepage.	Rapid permeability in substratum; subject to seepage; moderately well drained.
Shallow; gneiss bedrock at depth of 10 to 20 inches.	Shallow; gneiss bedrock at depth of 10 to 20 inches.	Not applicable: shallow; gneiss bedrock at depth of 10 to 20 inches; somewhat excessively drained.	Shallow; gneiss bedrock at depth of 10 to 20 inches; low to moderate available water capacity; moderate to rapid intake rate; HLE is moderately steep and steep.	Shallow; gneiss bedrock at depth of 10 to 20 inches; HLE has slopes of more than 20 percent.	Shallow; gneiss bedrock at depth of 10 to 20 inches; somewhat excessively drained.

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Embankment foundation	Foundations for low buildings [1]
*Hoosic: HoA, HoB, HoC, HSDK, HTF. For Otisville part of HTF, other than slope, see Otisville series.	Poor: coarse fragments.	Good in substratum.	Good for all but HTF; possible need for water for proper compaction. Poor for HTF: steep and very steep slopes.	Highway grade location not critical above water table, which is generally several feet below surface, but in places may be encountered at depth of 36 inches; local seepage and some sloughing in cuts; embedded cobblestones can be dislodged by frost action; subgrade in cuts subject to differential frost heave; trafficability generally good except on HSDK and HTF, which are sloping through very steep.	Generally adequate strength for moderately high embankments; can be underlain by wet compressible material; HTF is steep and very steep; in places requires benching to improve bonding.	Adequate strength; seasonal water table at depth of 36 inches in places; HSDK includes some hilly topography; HTF is steep and very steep.
*Hudson: HvB, HvC, HvD, HWE. For Vergennes part of HWE, other than slope, see Vergennes series.	Fair to poor: low volume; can be clayey.	Unsuitable: none present.	Poor: clayey material; sticky and plastic when wet.	Seasonal high water table at depth of 18 to 24 inches; highway grade location is critical on all units; cut slopes subject to seepage and slumping; flat slopes generally required for stability and possible need for slope protection blanket; subgrade highly compressible, clayey material; trafficability blanket generally required; seasonally poor trafficability on all units when wet.	Generally adequate strength for low embankments; low strength and high compressibility; HWE, which is steep and very steep, should be avoided.	Generally adequate strength; seasonal water table at depth of 18 to 24 inches; moderate shrink-swell potential; HvD and HWE are moderately steep and very steep.
Kingsbury: KbA, KbB.	Poor: low volume; clayey.	Unsuitable: none present.	Poor to unsuitable: sticky and plastic clay that is generally wet.	Seasonal high water table at a depth of 6 to 18 inches; highway grade location is critical on all units; cut slopes subject to seepage and slumping; flat slopes required for stability; slope blanket protection needed; subgrade in cuts is highly compressible clay; trafficability blanket required; very poor trafficability for long periods caused by wetness and clayey texture.	Onsite investigation needed; low strength; high compressibility.	Seasonal high water table at a depth of 6 to 18 inches; high compressibility; moderate shrink-swell potential.

[1] See footnotes at end of table.

interpretations—Continued

Soil features affecting—Continued					
Ponds		Agricultural drainage	Irrigation	Diversions	Waterways
Reservoir areas	Embankments				
Rapid or very rapid permeability throughout; seasonal high water table at depth of 36 inches in places; HoC, HSDK, and HTF are sloping and very steep.	High permeability; low compressibility; good to fair compaction characteristics; good for outside shell.	Not applicable: somewhat excessively drained.	Very low to low available water capacity; rapid intake rate; HoC, HSDK, and HTF are sloping through very steep.	Rapid or very rapid permeability throughout; HSDK and HTF include slopes of more than 20 percent; difficult to vegetate.	Rapid or very rapid permeability throughout; HSDK and HTF include slopes of more than 15 percent; somewhat excessively drained; difficult to vegetate.
Slow or very slow permeability in subsoil and substratum; seasonal high water table at depth of 18 to 24 inches; HvD and HWE are moderately steep and steep.	Low permeability; medium compressibility; fair to good compaction characteristics; sticky and plastic when wet; moderate shrink-swell potential; low strength.	Seasonal high water table at depth of 18 to 24 inches; slow or very slow permeability in subsoil and substratum; ditchbanks unstable; HvD and HWE are moderately steep and steep.	High available water capacity; slow intake rate; seasonal high water table at depth of 18 to 24 inches; slow or very slow permeability in subsoil and substratum; most rooting is in top 18 inches; erodible.	Slow or very slow permeability in subsoil and substratum; poor workability when wet; erodibility; HWE is steep and very steep.	Erodibility; clayey subsoil and substratum; moderately well and well drained; HvD and HWE are moderately steep and very steep.
Very slow permeability in subsoil and substratum; seasonal high water table at a depth of 6 to 18 inches.	Low permeability; high compressibility; fair to poor compaction characteristics; low strength; moderate shrink-swell potential; sticky and plastic clay that is generally wet.	Seasonal high water table at a depth of 6 to 18 inches; very slow permeability in subsoil and substratum; ditchbanks unstable.	Generally not applicable; seasonal high water table at a depth of 6 to 18 inches; adequate water available.	Very slow permeability in clay subsoil and substratum; poor workability when wet; erodible.	Erodible; clay subsoil and substratum; somewhat poorly drained.

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Embankment foundation	Foundations for low buildings [1]
Limerick: Lm	Good: wet for long periods.	Unsuitable: excess fines.	Poor: highly erodible silts and very fine sands; wet for long periods.	Subject to flooding; prolonged high water table at or near surface; drainage outlets generally not available; poor trafficability for long periods caused by wetness.	Generally adequate strength for low embankments.	Generally not applicable: subject to flooding; prolonged high water table at or near surface.
Madalin: Ma	Poor: low volume; clayey; generally wet.	Unsuitable: none present.	Poor: clayey material; sticky and plastic when wet.	Prolonged high water table at or near surface; ponded in places; nearly level or depressional relief; drainage outlets difficult to locate; cut slopes subject to seepage and sloughing; flat slopes required for stability; slope blanket protection needed; very poor trafficability caused by plastic and sticky clay that is wet for long periods.	Onsite investigation needed; wet, compressible, clayey material that has low strength.	Prolonged high water table at or near surface; some ponding; soft, wet, sticky, compressible clay; moderate shrink-swell potential.
*Nassau: NAC, NBC, NBF. For Rock outcrop part of NBC and NBF, see Rock outcrop.	Poor: coarse fragments; low volume.	Unsuitable: none present.	Poor: low volume.	Shallow over folded slate or shale bedrock at a depth of 10 to 20 inches; rock in most cuts; seepage above and through rock strata; generally good trafficability on NAC; NBC and NBF have extremely variable features over short distances; onsite investigation needed for all interpretations.	Adequate strength for high embankments; NBC and NBF are hilly through very steep; in places require benching to improve bonding.	Shallow over folded slate or shale bedrock at a depth of 10 to 20 inches; adequate strength; hilly through very steep.
Oakville: OaB, OaC, OKE.	Poor: sandy; low volume.	Good for sand; gravel with depth in places.	Good: requires water for proper compaction.	Highway grade location is not critical above seasonal water table at a depth of 2 feet in a few places; cut slopes erodible; hazard of seepage in cuts in a few places; generally good subgrade in cuts; in places subject to differential frost heave; poor trafficability in noncohesive sand; OKE is moderately steep and steep.	Generally adequate strength for moderately high embankments.	Generally adequate strength; seasonal high water table at a depth of 2 feet in a few places; OKE is moderately steep and steep.

See footnotes at end of table.

interpretations—Continued

Soil features affecting—Continued					
Ponds		Agricultural drainage	Irrigation	Diversions	Waterways
Reservoir areas	Embankments [2]				
Subject to flooding; moderate permeability throughout; prolonged high water table at or near surface.	Medium to low permeability; low to medium compressibility; good to poor compaction characteristics; generally wet; susceptible to piping; erodible.	Subject to flooding; prolonged high water table at or near surface; ditchbanks unstable; drainage outlets generally not available.	Generally not applicable; prolonged high water table at or near surface; excess water generally available.	Not applicable: nearly level; subject to flooding.	Not applicable: nearly level; subject to flooding; poorly drained.
Slow permeability; prolonged high water table at or near surface.	Clay that is generally wet and sticky; low to medium permeability; high compressibility; poor compaction characteristics; low strength; moderate shrink-swell potential.	Prolonged high water table at or near surface; slow permeability in subsoil and substratum; ditchbanks unstable; outlets difficult to locate.	Generally not applicable; prolonged high water table at or near surface; excess water generally available.	Not applicable: nearly level or depressional.	Not applicable: nearly level or depressional; poorly and very poorly drained.
Not applicable: shallow over folded slate or shale bedrock at a depth of 10 to 20 inches.	Not generally applicable: shallow over folded slate or shale bedrock at a depth of 10 to 20 inches; very low volume.	Not applicable: somewhat excessively drained.	Low or very low available water capacity; root zone is mainly in 10 to 20 inches above bedrock; moderate intake rate; hilly through very steep.	Shallow over folded slate or shale bedrock at a depth of 10 to 20 inches; very shaly; hilly through very steep.	Shallow over folded slate or shale bedrock at a depth of 10 to 20 inches; somewhat excessively drained; very shaly; hilly through very steep.
Sandy material; very rapid permeability.	Medium to high permeability; low to medium compressibility; susceptible to piping; good to fair compaction characteristics; erodible.	Not applicable: excessively drained.	Very low to moderate available water capacity; unrestricted root zone; high intake rate; OKE is moderately steep and steep.	Sandy material; very rapid permeability; erodible; subject to soil blowing; siltation hazard; low fertility; difficult to vegetate.	Sandy material; erodible; subject to soil blowing; siltation hazard; low fertility; difficult to vegetate; excessively drained.

TABLE 7.– *Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Embankment foundation	Foundations for low buildings [1]
Orthents and Psamments: OP.	Unsuitable	Highly variable.	Generally good: mostly canal dredgings, but onsite investigation needed.	Variable; onsite investigation needed.	Variable; onsite investigation needed.	Variable; onsite investigation needed.
Otisville: OtA, OtB, OVDK.	Poor: coarse fragments; sandy; low volume.	Good	Good: possible need for water for proper compaction.	Highway grade location not critical above seasonal water table at a depth of 3 feet in a few places; cut slopes subject to local seepage; embedded cobblestones can be dislodged in cuts by frost action; generally good subgrade in cuts; in places subject to differential frost heave; generally good trafficability; OVDK is rolling and hilly.	Generally adequate strength for moderately high embankments; can be underlain by wet, compressible material.	Adequate strength; seasonal water table at a depth of 3 feet in a few places; OVDK is rolling and hilly.
Palatine: PaB, PaC.	Poor: coarse fragments; low volume.	Unsuitable: none present.	Poor: low volume.	Moderately deep over soft shale bedrock at a depth of 20 to 40 inches; rock in most cuts; seepage above and through rock strata; generally good trafficability.	Adequate strength for high embankments.	Adequate strength; moderately deep over soft shale bedrock at a depth of 20 to 40 inches; in places seepage above and through rock strata.
Palms: Pm	Unsuitable: possible use as an amendment for mineral soils.	Unsuitable: none present.	Unsuitable	Prolonged high water table at or near surface; wet, compressible, organic material 16 to 50 inches thick over variable mineral soils; very poor trafficability.	Onsite investigation needed; 16 to 50 inches of wet, compressible, organic material over variable mineral soils.	Not applicable: prolonged high water table at or near surface; 16 to 50 inches; of wet, compressible, organic material over variable mineral soils.

See footnotes at end of table.

interpretations—Continued

Soil features affecting—Continued					
Ponds		Agricultural drainage	Irrigation	Diversions	Waterways
Reservoir areas	Embankments [2]				
Variable; onsite investigation needed.	Variable; onsite investigation needed.	Variable; onsite investigation needed.	Variable; onsite investigation needed.	Generally not applicable: nearly level in most places.	Generally not applicable: nearly level in most places.
Gravelly and sandy material; very pervious.	High permeability: low compressibility; good to fair compaction characteristics; generally good stability; pervious material suitable for outside shell.	Not applicable: excessively drained.	Very low available water capacity; root zone unrestricted, but is mainly in upper 20 inches; high intake rate; OVDK is rolling and hilly.	Sand and gravel; rapid permeability; low fertility; difficult to vegetate; OVDK is rolling and hilly.	Sand and gravel; rapid permeability; low fertility; difficult to vegetate; OVDK is rolling and hilly; excessively drained.
Moderately deep over soft shale bedrock at a depth of 20 to 40 inches.	Low volume; moderately deep over soft shale bedrock at a depth of 20 to 40 inches.	Not applicable: well drained to somewhat excessively drained.	Moderate to high available water capacity; root zone mainly 20 to 40 inches above bedrock; moderate to slow intake rate; PaC is sloping and erodible.	Moderately deep over soft shale bedrock at a depth of 20 to 40 inches; moderate permeability.	Moderately deep over soft shale bedrock at a depth of 20 to 40 inches; erodible; well drained to somewhat excessively drained.
Prolonged high water table at or near surface; 16 to 50 inches of organic material that has moderate to moderately rapid permeability over mineral soils that have variable permeability.	Poorly suited: 16 to 50 inches of wet, compressible, organic material over variable mineral soils.	Prolonged high water table at or near surface; 16 to 50 inches of organic material over variable mineral soils; high shrinkage where drained; subject to soil blowing.	Drainage needed; water level control needed for subirrigation.	Not applicable: nearly level or depressional relief.	Not applicable: nearly level or depressional relief; poorly drained.

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Embankment foundation	Foundations for low buildings [1]
*Pittsfield: PtB, PtC, PVC. For Amenia part of PVC, see Amenia series.	Poor: coarse fragments; low volume.	Unsuitable: none present.	Good: few to many large stones and boulders.	Highway grade location generally not critical; seasonal water table at a depth of 3 feet in a few places; bedrock in some deep cuts; cut slopes subject to local seepage and sloughing; boulders in cuts can be dislodged by frost action; generally good subgrade in cuts; subject to boulder heave; generally good trafficability.	Generally adequate strength for high embankments.	Adequate strength; seasonal water table at a depth of 3 feet in a few places; PVC is moderately steep.
Rhinebeck: RhA, RhB.	Poor: low volume; can be clayey.	Unsuitable: none present.	Generally poor: clayey material that is sticky and plastic when wet.	Seasonal high water table at a depth of 6 to 18 inches; highway grade location critical; cut slopes subject to seepage and slumping; flat slopes required for stability and generally need slope protection blankets; subgrade in cuts is compressible clayey material that is very sticky when wet; trafficability blanket generally required; poor trafficability when wet.	Generally adequate strength for low embankments; high compressibility; low strength.	Generally adequate strength; seasonal high water table at a depth of 6 to 18 inches; high compressibility; moderate shrink-swell potential.
*Rock outcrop: ROF, RPC, RPF. For Hollis part of ROF, see Hollis series; for Vergennes part of RPC and RPF, see Vergennes series.	Unsuitable	Unsuitable: none present.	Unsuitable	Rock outcrop consists of exposures of bare bedrock that is gently sloping to very steep; where associated with Farmington soils, Rock outcrop is dominantly limestone or dolomitic limestone; with Nassau soils, it is mainly folded slate, shale, and sandstone; with Hollis soils, it is mainly syenite or granite gneiss and, in places, quartzite; with Vergennes soils, it can be any of these kinds of bedrock; onsite investigation needed for interpretations.	Onsite investigation needed due to variable kinds of bedrock exposure.	Onsite investigation needed due to variable kinds of bedrock exposure.

See footnotes at end of table.

interpretations—Continued

Soil features affecting—Continued					
Ponds		Agricultural drainage	Irrigation	Diversions	Waterways
Reservoir areas	Embankments [2]				
Moderately rapid permeability in subsoil; moderate permeability in substratum; PtC and PVC are sloping through moderately steep.	Medium to low permeability; low to medium compressibility; fair to good compaction characteristics; susceptible to piping; erodible; few to many large stones and boulders.	Not applicable: well drained.	Moderate to high available water capacity; root zone mainly in upper 30 inches; moderate intake rate; PtC is sloping and erodible; PVC is stony.	Moderately rapid permeability in subsoil; moderate permeability in substratum; erodible; siltation hazard; stony and very stony; PVC is moderately steep.	Erodible; siltation hazard; stony and very stony; well drained; PVC is moderately steep.
Slow permeability in subsoil and substratum; seasonal high water table at a depth of 6 to 18 inches.	Low permeability; medium compressibility; fair to good compaction characteristics; sticky and plastic when wet; moderate shrink-swell potential; low strength.	Seasonal high water table at a depth of 6 to 18 inches; slow permeability in subsoil and substratum; ditchbanks unstable.	Drainage needed; high available water capacity; slow permeability in subsoil and substratum; slow intake rate; root zone mainly in upper 18 inches; RhB is erodible.	Slow permeability in subsoil and substratum; subject to prolonged flow; erodible.	Erodible; ditchbanks unstable; subject to prolonged flow; somewhat poorly drained.
Not applicable; exposed bedrock.	Not applicable; exposed bedrock.	Not applicable; exposed bedrock.	Not applicable; exposed bedrock.	Not applicable; exposed bedrock.	Not applicable; exposed bedrock.

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Embankment foundation	Foundations for low buildings [1]
Saco: Sa	Good: generally wet.	Unsuitable: none present	Poor: wet silty material.	Subject to frequent flooding; prolonged high water table at or near surface; drainage outlets generally not available; very poor trafficability caused by prolonged wetness.	Generally adequate strength for low embankments.	Not applicable: subject to frequent flooding.
Saprists, Aquepts, and Aquents: SB.	Unsuitable	Unsuitable	Generally unsuitable: variable material under water.	Under water most of time; avoid except on fills; not trafficable.	Variable; onsite investigation needed.	Generally not applicable: under water most of time.
Scriba: ScA, ScB, SDC.	Poor: coarse fragments; low volume.	Unsuitable: none present.	Good: can be wet; few to many large stones.	Seasonal high water table at a depth of 6 to 18 inches is perched on a fragipan at a depth of 12 to 18 inches; cut slopes subject to seepage and sloughing above pan; boulders in cuts can be dislodged by frost action; in places bedrock at a depth of 3½ feet in deep cuts; generally good subgrade in cuts, but seasonally wet and subject to boulder heave; seasonally poor trafficability when wet.	Adequate strength for high embankments.	Adequate strength; seasonal high water table at a depth of 6 to 18 inches; in places bedrock below a depth of 3½ feet.
Sun: Su, SV	Fair to poor: coarse fragments; low volume; generally wet.	Unsuitable: none present.	Poor: generally wet; few to many large stones.	Prolonged high water table at or near surface; nearly level or depressional relief; drainage outlets in many places not available; cuts not generally indicated; poor trafficability for long periods caused by wetness.	Generally adequate strength for high embankments.	Prolonged high water table at or near surface; generally adequate strength.
Teel: Te	Good: can be wet with depth.	Unsuitable: excess fines.	Fair to poor: highly erodible silts; can be wet.	Subject to flooding; seasonal high water table at a depth of 18 to 24 inches; cuts not indicated; seasonally poor trafficability when wet.	Generally adequate strength for low embankments; variable compressibility.	Not generally applicable; subject to flooding; seasonal high water table at a depth of 18 to 24 inches.

See footnote at end of table.

interpretations—Continued

Soil features affecting—Continued						
Ponds		Agricultural drainage	Irrigation	Diversions	Waterways
Reservoir areas	Embankments [2]					
Subject to frequent flooding; prolonged high water table at or near surface; moderate permeability.	Low to medium permeability; fair to poor stability; poor to good compaction characteristics; generally wet; susceptible to piping; erodible.	Subject to frequent flooding; prolonged high water table at or near surface; ditchbanks unstable; siltation hazard; outlets difficult to locate.	Not applicable: prolonged high water table at or near surface; excess available water.	Not applicable: nearly level; subject to frequent flooding.	Not applicable: nearly level; subject to frequent flooding.
Under water most of time; onsite investigation needed.	Variable material under water.	Under water most of time; outlets not available.	Not applicable: under water most of time.	Not applicable: under water most of time; nearly level.	Not applicable: under water most of time; nearly level.
Seasonal high water table at a depth of 6 to 18 inches; slow or very slow permeability in fragipan and substratum below a depth of 12 to 18 inches; in places bedrock below a depth of 3½ feet.	Low to medium permeability; low to medium compressibility; good to fair compaction characteristics; few to many large stones and boulders.	Seasonal high water table at a depth of 6 to 18 inches is perched on a fragipan at a depth of 12 to 18 inches; slow or very slow permeability in fragipan; seepage above pan; SDC is very stony.	Low to moderate available water capacity; low intake rate; root zone restricted to a depth of 12 to 18 inches above fragipan; ScB is gently sloping and sloping and erodible; SDC is very stony.	Slow or very slow permeability in fragipan at a depth of 12 to 18 inches; seepage above the pan; subject to prolonged flow; SDC is very stony.	Slow or very slow permeability in fragipan at a depth of 12 to 18 inches; seepage above pan; subject to prolonged flow; somewhat poorly drained; SDC is very stony.
Prolonged high water table at or near surface; slow permeability in substratum at depth of 20 to 40 inches.	Surface layer is high in organic-matter content; low to medium permeability; low to medium compressibility; good to fair compaction characteristics; few to many large stones; generally wet.	Prolonged high water table at or near surface; slow permeability in substratum at depth of 20 to 40 inches; ditchbanks unstable; SV is very stony; drainage outlets difficult to locate.	Not applicable: prolonged high water table at or near surface.	Not applicable: nearly level or depressional relief; prolonged high water table at or near surface.	Not applicable: nearly level or depressional relief; prolonged high water table at or near surface; very poorly drained to poorly drained.
Subject to flooding; seasonal high water table at a depth of 18 to 24 inches; moderate permeability; possible pervious layers with depth.	Medium to low permeability; low to medium compressibility; good to poor compaction characteristics; can be wet; susceptibility to piping; erodible.	Subject to flooding; seasonal high water table at a depth of 18 to 24 inches; ditchbanks unstable and erodible; siltation hazard; moderate permeability.	High available water capacity; moderate to slow intake rate; root zone not restricted in the absence of water table.	Not applicable: nearly level; subject to flooding.	Not applicable: nearly level; subject to flooding.

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Embankment foundation	Foundations for low buildings [1]
Vergennes: VeB, VeC, VeD.	Poor: high clay content; low volume.	Unsuitable: none present.	Poor to unsuitable: clayey material; sticky and plastic when wet.	Seasonal high water table at a depth of 18 to 24 inches; highway grade location critical on all units; cut slopes subject to seepage and slumping; flat slopes and protection blankets required; in places bedrock is below a depth of 3½ feet in cuts; subgrade in cuts is compressible clayey material; trafficability blanket required; very poor trafficability when wet.	Low strength; high compressibility; onsite investigation needed; VeD is moderately steep and subject to mass slippage.	Variable strength; seasonal high water table at a depth of 18 to 24 inches; moderate shrink-swell potential; in places bedrock below a depth of 3½ feet; VeD is moderately steep.
Wallington: Wa.	Generally good: in places is wet and has medium volume.	Unsuitable above a depth of 36 to 56 inches; possible good source below that depth; generally under water.	Fair to poor in upper 36 to 56 inches; highly erodible silts; generally good gravelly and sandy material below a depth of 36 to 56 inches; generally under water.	Seasonal high water table at a depth of 6 to 18 inches is perched on fragipan at a depth of 15 to 24 inches; highway grade location not critical if drainage outlets available; cut slopes are subject to seepage and sloughing and are erodible; seasonally wet subgrade in cuts; stratified substratum material below a depth of 36 to 56 inches is subject to differential frost heave; seasonally poor trafficability when wet.	Generally adequate strength for low embankments; variable compressibility.	Generally adequate strength; seasonal high water table at a depth of 6 to 18 inches.

[1] Engineers and others should not apply specific values to the estimates given for bearing capacity of soils.

interpretations—Continued

Soil features affecting—Continued					
Ponds		Agricultural drainage	Irrigation	Diversions	Waterways
Reservoir areas	Embankments [2]				
Very slow permeability in subsoil and substratum; seasonal high water table at a depth of 18 to 24 inches; VeD is moderately steep.	Low permeability; high compressibility; fair to poor compaction characteristics; low strength; moderate shrink-swell potential; clayey material is sticky and plastic when wet.	Seasonal high water table at a depth of 18 to 24 inches; very slow permeability in subsoil and substratum; ditchbanks unstable; VeD is moderately steep.	High available water capacity; slow intake rate; seasonal high water table at a depth of 18 to 24 inches; very slow permeability in subsoil and substratum; root zone mainly in upper 24 inches; erodible.	Very slow permeability in subsoil and substratum; poor workability when wet; erodible.	Erodible; clayey subsoil and substratum; moderately well drained; VeD moderately steep.
Pervious layers below a depth of 36 to 56 inches; seasonal high water table at a depth of 6 to 18 inches.	Material to depth of 36 to 56 inches has medium to low permeability; medium compressibility; fair to poor compaction characteristics; susceptible to piping; erodible. Material below depth of 36 to 56 inches has medium to high permeability; low compressibility; good to fair compaction characteristics; susceptible to piping; generally wet.	Seasonal high water table at a depth of 6 to 18 inches; moderately slow or slow permeability in fragipan at a depth of 15 to 24 inches; ditchbanks erodible; siltation hazard; prolonged flow.	Moderate to high available water capacity; slow intake rate; root zone mainly 15 to 24 inches above fragipan; seasonal high water table at a depth of 6 to 18 inches.	Not applicable: nearly level.	Not applicable: nearly level.

[2] Permeability ratings indicated for embankments are for compacted permeabilities based on the dominant Unified classification. They are not necessarily consistent with permeability ratings of the undisturbed soil.

slope, depth to bedrock, depth to the water table, stability of cut clopes, 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 sediment, and alluvium are variable. Peat and muck are unsuitable and should be avoided for this use.

Foundations for low buildings are affected by such soil features as load-supporting capacity, slope, depth to bedrock, stoniness, depth to the 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 the depth to fractured bedrock or other permeable material.

Embankments and dikes require soil material that is 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 are among the unfavorable factors.

Drainage of cropland and pasture 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; stability of slopes 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; accumulation 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 the water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff and seepage so that water 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.

Layout and construction of waterways 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 that affect waterways are seepage, natural soil drainage, available moisture capacity, susceptibility to siltation, and the ease of establishing and maintaining vegetation.

Significance of Geologic Deposits and Bedrock

Characteristics of the geologic deposits in which the soils of Washington County formed serve as a basis for placing the soils in broad categories for engineering uses. The following geologic deposits or materials occur in the county: deep glacial till, thin glacial till, glacial outwash, lacustrine and estuarine deposits, recent alluvium, organic deposits, and bedrock. The deposits and materials and their broad engineering significance are described in this section.

Deep glacial till

Glacial till deposits were formed when glaciers that pushed into Washington County from the north melted and left varying depths of ancient soil and ground up rock that had been picked up. The resulting deposits are highly variable assortments of soil and rock material, the particle size of which ranges from clay to ledgy rock fragments and boulders. 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 in this survey refer to those that are 3½ feet or more thick 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 down-wasting and back-wasting periods of glaciation, are generally less dense and more permeable.

Soils that formed mainly in deep glacial till that is dense and compact are those of the Amenia, Bernardston, Pittsfield, Scriba, and Sun series. The till in which soils of the Charlton series formed is generally less dense and is friable.

Very few of the soils that formed in deep till deposits are in flat areas. Slopes mainly range from gently sloping through very steep, and the terrain is such that cut and fill earthwork is involved in most construction. In many places bedrock restricts deep cuts in these deposits, especially in the hilly slate belt that covers more than the eastern half of the county.

For highway engineering purposes, earthwork involves both longitudinal and sidehill cuts and fills. In such better drained soils as Bernardston soils, which formed in dense till, properly designed cuts are fairly stable and subgrades are generally satisfactory. The constantly recurring exception is sloughing on cut slopes, which is associated with frost withdrawal or occurs where large amounts of runoff are received. This dense, slowly permeable or very slowly permeable till impedes infiltration. Unless intercepted, subsequent runoff causes severe sloughing. Also, boulders on cut slopes in places lose their embedment as a result of frost action. The soils that are not too steep and that formed in dense till furnish good embankment foundations for fills of 10 feet or more. They also furnish good foundation support for buildings. If properly compacted, material excavated from till deposits can be used to form stable embankments. In many areas in Washington County till deposits contain large stones and boulders that interfere with fill placement in thin lifts.

For residential developments, the sloping soils that formed in till deposits in places require considerable grading. The compact, impervious nature of the deposits imposes some difficulties where sewage disposal is by the septic tank method. In places the content of stones is high. Stones are a hazard to mowing equipment and on lawns and athletic fields.

Thin glacial till

This material is generally less than 3½ feet deep over bedrock. In all but a few places, the till has weathered and the less dense material of the solum extends to bedrock. Rock fragments are common in the soil mass, and bedrock generally occurs in cuts even in light grading.

Soils that formed in thin glacial till are those of the Farmington, Hollis, Nassau, and Palatine series. Farmington soils are underlain by hard calcic limestone or dolomite limestone that is durable and is a good source of material for crushing purposes. Hollis soils are underlain mainly by hard syenite and granite gneiss. Nassau soils are underlain by folded slate, slaty shale, and in a few places by phyllite and sandstone. This slaty material is fairly hard and is difficult to excavate with heavy equipment. Palatine soils, which are of limited extent in the vicinity of Fort Ann, are underlain by relatively soft, dark-colored shale that is generally rippable with heavy equipment. This shale weathers and is unstable if exposed to the effects of frost and alternate wetting and drying.

Soils that formed in thin till generally furnish satisfactory embankment foundations for deep fills of 10 feet or more. The soil material is so thin that little settlement can occur, and the bedrock is unyielding. However, on some steep or very steep soils benching or other bonding measures are needed to prevent fill from sliding.

Soils in thin till areas present limitations for residential use. Bedrock generally interferes with basement excavations; basement seepage is a hazard in places; rock excavation is required for sewer, water, and gas installations; and sewage disposal by the septic tank method is generally not feasible under natural conditions.

Soil that formed in thin till deposits are of low volume and, therefore, are a poor source of fill material if only the soil is used. If both the soil and underlying bedrock are used as fill material, considerable difficulty results in some areas in placing the fill material in layers thin enough to obtain good compaction with most standard compaction equipment. Examples are Farmington soils, which are shallow over calcic or dolomitic limestone and dolomite, and Hollis soils, which are shallow over syenite and granite gneiss.

Glacial outwash

These deposits consist mainly of sorted sand and gravel deposited by glacial melt water. They are on 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 that impede drainage.

Hoosic, Otisville, Herkimer, Fredon, and Halsey soils formed in deposits of glacial outwash.

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 that construction 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 somewhat excessively drained and excessively drained Hoosic and Otisville 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 heavy fills and structures. Unless slopes are too steep, outwash deposits generally have adequate strength to support low buildings and moderately high embankments of 5 to 10 feet. On cut slopes, in sandy strata of outwash, they are subject to erosion and sloughing. Also, cobblestones in places lose embedments in cuts as a result of frost action. If strata of silt and very fine sand, which retard internal drainage, are intercepted by a highway gradeline or are near the top of the subgrade in cuts, differential frost heaving occurs. Cuts in outwash material in places are dry during construction season, and it is difficult to foresee the potentially adverse moisture conditions that develop in wet seasons of the year.

Lacustrine deposits

For a considerable length of time, glacial lakes occupied extensive areas of the Hudson-Champlain Lowland and some other valleys in the county. These glaciolacustrine deposits are nearly free of stones and range from sand to clay. Included in this lacustrine deposit category are sandy glacial lake delta deposits and, because they are similar, old alluvial stream terrace and estuarine deposits.

Soils that formed in deep lacustrine silt and clay are the Hudson, Rhinebeck, and Madalin soils. Those that formed in deep lacustrine or estuarine clay are the Vergennes, Kingsbury, and Covington soils. Oakville soils formed in deep, sandy, deltaic deposits, and Claverack and Cosad soils formed around fringes of deltas where the deposits of sand are underlain by clay at a depth of 20 to 40 inches. Deep deposits of silt and very fine sand occur on high, level lake plains and old stream terraces, where the Hartland, Belgrade, and Wallington soils formed.

The soils that formed in these deposits are nearly level or depressional through steep. Except for the Oakville soils on sandy deposits, they are highly erodible even on slight grades. Oakville soils are subject to soil blowing and are difficult to vegetate in cuts or in graded areas because the available moisture capacity is very low and fertility is low. Wherever the Hartland soils, which are underlain by silt and very fine sand, and the Hudson or Vergennes soils, which are underlain by clayey deposits, are steep and are on the fronts of terraces or dissections, erosion is generally severe. Also, landslides and slips are numerous on the clayey deposits in which Hudson and Vergennes soils formed. These soils have very low shear strength. Cut slopes should be fairly flat, or a combination can be used along with a blanket of granular material to provide stability. Loading along the top of the slope or on any part of the steeper slopes on terrace fronts, such as highways and structures, should be avoided because the shear strength is very low.

The nearly level soils have very slow runoff, and in all but Oakville soils, which are underlain by deep sand, infiltration is restricted. Wetness generally increases with increasing depth, and experience has shown that some clayey and silty deposits in this area have a natural moisture content of 60 to 70 percent. Consequently, determining the moisture content is necessary before considering the use of these materials for borrow. Also, moisture content should be carefully controlled in building embankments with these materials.

Because they are weak, clayey, and silty, lacustrine and estuarine sediments are more difficult to use in engineering works than most other mineral soil material in the county. High highway gradelines are needed in level, wet soils, such as Covington and Madalin soils. Sites for high embankments and heavy structures or buildings in all areas of soils that formed in these finer textured sediments must be investigated thoroughly for strength, settlement characteristics, and height of the water table. These clayey and silty sediments are highly 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 and are difficult to work. A base course of granular material is needed beneath highway pavements and parking lots that are to be constructed on such clayey soils. Where crushed stone or gravel is used for a base course, consideration must be given to the use of sand as a filter under the gravel or stone to prevent the movement of the fine-textured lacustrine sediment into the base course.

During wet periods, trafficability is difficult over the finer textured soils and is poor on the noncohesive sand in which Oakville soils formed.

Recent alluvium

These deposits consist of strata of sediments of various textures deposited on flood plains along streams.

The land type Fluvaquents and soils of the Hamlin, Limerick, Saco, and Teel series formed in recent alluvium. All are subject to annual or sometimes more frequent periods of overflow, except along the Hudson River, where the flow is regulated. Except during periods of flooding, the water table in these deposits fluctuates and is determined by the water level of the adjacent streams. It is generally too high for even light cuts. Since the areas are subject to overflow, highway grade locations should be above flood elevation.

Soils that formed in alluvial deposits generally make poor foundations for bridges and high embankments. In places they are underlain by soft, wet, compressible lacustrine sediment. Thorough investigation and, on some locations, special analysis and design are required before constructing bridges or placing embankments.

These soils should be avoided as building sites because flooding is a hazard and the water table fluctuates. These features must be carefully evaluated before any areas are considered for building purposes.

Most alluvial soils are a good source of topsoil.

Organic deposits

Organic deposits are for the most part an accumulation of plant and animal remains. In places they include a minimal amount of inorganic material. They are in very poorly drained depressions.

Carlisle muck and Palms muck are the only soils in Washington County that formed in organic deposits. Such soils are entirely unsuitable for highway or other embankment sites or for building foundations because they are highly compressible and unstable. For highways, organic deposits and any other unsuitable material underlying them should generally be removed and replaced with suitable backfill. Backfill below the water table should be made with broken rock or granular material. The highway gradeline in these areas must be above the high water elevation. Organic soils can be used to amend the unsatisfactory physical features of both sandy and clayey soils that are to be used as topsoil.

Also included in this category is the land type Saprists, Aquepts, and Aquents, popularly termed Fresh water marsh. It consists of organic and mineral soil materials that are ponded with shallow water most of the year and require about the same kind of treatment as organic deposits.

Bedrock

Bedrock is an important consideration in planning engineering construction in Washington County. Exposures of bare bedrock, mapped as Rock outcrop in this survey, protrude through every type of surficial geologic deposit previously noted. In addition, bedrock is near the surface in many areas. The subsection "Physiography and Geology" describes the extent and geographical occurrence of the different kinds of bedrock in Washington County.

Frost Effects in Soils as Related to Construction

All soils in Washington County are subject in varying degrees to the effects of freezing and thawing of water on soil and rock materials and the structures built on them. Consequently, 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 soil texture and water conditions are uniform, for example, in the silty lacustrine and stream terrace deposits in which the Belgrade and

Wallington soils formed and the clayey deposits in which the Hudson, Rhinebeck, Vergennes, and Kingsbury soils formed.

Differential heave occurs where the soil texture varies in adjoining strata; at cut and fill transitions where there is an available source of water close to the surface; or in soils that contain various sizes of rock fragments in the frost zone, especially fragments more than 10 inches in diameter. Differential heaving also occurs where lateral drains, culverts, and approach fills to bridges and overpasses break the uniformity of the subgrade. Differential heave is most serious in nonuniform, stratified gravelly outwash deposits, in which the Hoosic, Otisville, Herkimer, Fredon, and Halsey soils formed. Large rock fragments that are involved in so-called "boulder heave" are most commonly found in soils that formed in glacial till on uplands, such as Charlton, Pittsfield, and Bernardston 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 cobblestones, stones, and boulders and soil creep. It also causes weathering and dislodgment of rock in rock cuts. During periods of thawing, loss of subgrade support occurs, and drainage is restricted by the still frozen layer during the process.

Embankments

During freezing weather, much greater compactive effort is required to obtain the minimum acceptable degree of compaction of soils. Because the temperature falls below 20° to 25° F. for long periods in Washington County, it is often virtually impossible to attain a satisfactory degree of densification with standard compaction equipment. Densification is difficult even when working with the clean sand and gravel of the Oakville, Hoosic, and Otisville soils.

Highway embankments constructed during freezing temperatures generally settle unevenly for a period of years. Consequently, the pavement becomes rough. Winter work on construction of embankments should be limited to the placement of rock fills. The surface of partly constructed embankments that are left exposed during the winter should be crowned and rolled smooth to shed water and keep infiltration to a minimum.

Town and Country Planning

This section contains information of interest to planning boards, land developers, homeowners, and others who want to know about nonfarm uses of soil. Table 8 rates the soils according to limiting properties that affect community developments and recreational uses. If the limiting soil properties are considered, adequate planning and design can be made before construction is started. Onsite investigation is needed, however, because soils are variable within areas shown on a soil map. Ratings in table 8 are not meant to replace onsite investigation.

Limitations are expressed as *slight, moderate,* or *severe.* For all these ratings, it is assumed that a good plant cover can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they can easily be overcome. A *moderate* limitation is one that can be overcome or modified by planning, design, or special maintenance. A *severe* limitation means that costly soil reclamation, special design, intensive maintenance, or a combination of these is required.

Considered in the column headed "Homesites" are buildings no more than three stories high, built with basements and supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Shopping centers and small industrial buildings are affected by the same criteria as homesites, but slope is rated more critically.

Local roads and streets, as rated, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of roads and streets are load-supporting capacity and stability of the subgrade and the workability and quantity of cut and fill material available. The AASHO and Unified classifications of the soil material and the shrink-swell potential indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material between depths of 18 inches and 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Ratings for lawns and landscaping are for the soil in place and not for areas where the original soil layers have been scalped or mixed by excavation. No im-

TABLE 8.—*Degree and kind of limitations to*

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 such to other series that appear in

Map symbols	Soils	Homesites	Shopping centers and small industrial buildings	Local roads and streets	Septic tank absorption fields	Lawns and landscaping
AmB	Amenia silt loam, 3 to 8 percent slopes.	Moderate: moderately well drained.	Moderate: moderately well drained; slope.	Slight	Severe: slow permeability.	Slight
BeA	Belgrade silt loam, 0 to 2 percent slopes.	Moderate: moderately well drained.	Moderate: moderately well drained.	Slight	Severe: moderate to slow permeability.	Slight
BeB	Belgrade silt loam, 2 to 6 percent slopes.	Moderate: moderately well drained.	Moderate: moderately well drained; slope.	Slight	Severe: moderate to slow permeability.	Slight
BnB	Bernardston gravelly silt loam, 3 to 8 percent slopes.	Slight to moderate: moderately well drained in places.	Moderate: slope; moderately well drained in places.	Slight	Severe: slow permeability.	Moderate: gravelly surface layer.
BnC	Bernardston gravelly silt loam, 8 to 15 percent slopes.	Moderate: moderately well drained in places; slope.	Severe: slope	Moderate: slope	Severe: slow permeability.	Moderate: slope; gravelly surface layer.
BnD	Bernardston gravelly silt loam, 15 to 25 percent slopes.	Severe: slope	Severe: slope	Severe: slope	Severe: slow permeability; slope.	Severe: slope
*BrB	Bernardston-Nassau shaly silt loams, 3 to 8 percent slopes. For Bernardston part of BrB, see BnB of Bernardston series; for Nassau part of BrB, see NAC of Nassau series.					
*BrC	Bernardston-Nassau shaly silt loams, 8 to 15 percent slopes. For Bernardston part of BrC, see BnC of Bernardston series; for Nassau part of BrC, see NAC of Nassau series.					

See footnote at end of table.

be considered in town and country planning

mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring the first column of this table]

Pipelines	Golf fairways	Athletic fields	Picnic areas	Paths and trails	Camp areas
Moderate: moderately well drained.	Slight	Moderate: moderately well drained; slow permeability; slope.	Slight	Slight	Moderate: slow permeability.
Moderate: moderately well drained.	Slight	Moderate: moderate to slow permeability.	Slight	Slight	Moderate: moderate to slow permeability.
Moderate: moderately well drained.	Slight	Moderate: moderate to slow permeability; slope.	Slight	Slight	Moderate: moderate to slow permeability.
Moderate: moderately well drained in places; gravelly subsoil and substratum.	Moderate: gravelly surface layer.	Severe: gravelly surface layer.	Slight	Slight	Moderate: slow permeability.
Moderate: moderately well drained in places; gravelly subsoil and substratum.	Moderate: slope; gravelly surface layer.	Severe: slope	Moderate: slope	Slight	Moderate: slope; slow permeability.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Severe: slope.

TABLE 8.—*Degree and kind of limitations to*

Map symbols	Soils	Homesites	Shopping centers and small industrial buildings	Local roads and streets	Septic tank absorption fields	Lawns and landscaping
*BSCK	Bernardston-Nassau shaly silt loams, rolling and hilly. For Bernardston part of BSCK, see BnD of Bernardston series; for Nassau part of BSCK, see NAC of Nassau series.					
BTC	Bernardston very stony soils, gently sloping through moderately steep.	Moderate: moderately well drained in places; slope. Severe in places: moderately steep slope.	Severe: slope	Moderate: slope. Severe in places.	Severe: slow permeability; slope in places.	Severe: very stony surface layer.
BUF	Bernardston soils, steep and very steep.	Severe: slope	Severe: slope	Severe: slope	Severe: slope; slow permeability.	Severe: slope
Ca	Carlisle muck	Severe: very poorly drained organic deposit.	Severe: very poorly drained organic deposit.	Severe: very poorly drained organic deposit.	Severe: frequent ponding.	Severe: very poorly drained organic deposit.
CHC	Charlton association, very stony, gently sloping and sloping.	Moderate: very stony surface layer; slope.	Severe: slope	Moderate: slope	Moderate: slope; moderate permeability; very stony surface layer.	Severe: very stony surface layer.
CHE	Charlton association, very stony, moderately steep and steep.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope; very stony surface layer.
ClA	Claverack loamy fine sand, 0 to 2 percent slopes.	Moderate: moderately well drained.	Moderate: moderately well drained.	Slight	Severe: very slow permeability in clayey substratum.	Severe: loamy fine sand surface layer.
ClB	Claverack loamy fine sand, 2 to 6 percent slopes.	Moderate: moderately well drained.	Moderate: moderately well drained; slope.	Slight	Severe: very slow permeability in clayey substratum.	Severe: loamy fine sand surface layer.
Cs	Cosad fine sandy loam.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Moderate: somewhat poorly drained.	Severe: very slow permeability in clayey substratum.	Moderate: somewhat poorly drained.
Cv	Covington silty clay loam.	Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained.	Severe: very slow permeability.	Severe: poorly drained.
FaB	Farmington loam, 0 to 8 percent slopes.	Severe: bedrock at depth of 10 to 20 inches.	Severe: bedrock at depth of 10 to 20 inches.	Severe: bedrock at depth of 10 to 20 inches.	Severe: bedrock at depth of 10 to 20 inches.	Severe: bedrock at depth of 10 to 20 inches.

See footnote at end of table.

be considered in town and country planning—Continued

Pipelines	Golf fairways	Athletic fields	Picnic areas	Paths and trails	Camp areas
Moderate: moderately well drained; slope; surface stones. Severe in places: slope.	Severe: very stony surface layer.	Severe: slope	Moderate: slope. Severe in places.	Moderate: very stony surface layer; slope in places.	Moderate: slope; slow permeability. Severe in places: moderately steep slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: very poorly drained organic deposit.	Severe: very poorly drained organic deposit.	Severe: very poorly drained organic deposit.	Severe: very poorly drained organic deposit.	Severe: very poorly drained organic deposit.	Severe: very poorly drained organic deposit.
Moderate: slope; very stony surface layer.	Severe: very stony surface layer.	Severe: slope; very stony surface layer.	Moderate: slope	Moderate: very stony surface layer.	Moderate: slope; very stony surface layer.
Severe: slope	Severe: slope; very stony surface layer.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: loamy fine sand surface layer and subsoil; clayey substratum.	Severe: loamy fine sand surface layer.	Moderate: very slow permeability; loamy fine sand surface layer.	Moderate: loamy fine sand surface layer.	Moderate: loamy fine sand surface layer.	Moderate: loamy fine sand surface layer; very slow permeability.
Severe: loamy fine sand surface layer and subsoil; clayey substratum.	Severe: loamy fine sand surface layer.	Moderate: very slow permeability; loamy fine sand surface layer; slope.	Moderate: loamy fine sand surface layer.	Moderate: loamy fine sand surface layer.	Moderate: loamy fine sand surface layer; very slow permeability.
Severe: somewhat poorly drained; loamy fine sand subsoil; clayey substratum.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.
Severe: poorly drained; clayey subsoil and substratum.	Severe: poorly drained.	Severe: poorly drained; very slow permeability.	Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained; very slow permeability.
Severe: bedrock at depth of 10 to 20 inches.	Severe: bedrock at depth of 10 to 20 inches.	Severe: bedrock at depth of 10 to 20 inches.	Slight	Slight	Slight.

TABLE 8.—*Degree and kind of limitations to*

Map symbols	Soils	Homesites	Shopping centers and small industrial buildings	Local roads and streets	Septic tank absorption fields	Lawns and landscaping
*FCC	Farmington-Rock outcrop association, nearly level through moderately steep. For Rock outcrop part, see Rock outcrop ROF.	Severe: bedrock at depth of 10 to 20 inches; very rocky.	Severe: bedrock at depth of 10 to 20 inches; slope in places.	Severe: bedrock at depth of 10 to 20 inches; slope in places.	Severe: bedrock at depth of 10 to 20 inches; slope in places.	Severe: bedrock at depth of 10 to 20 inches; slope in places; very rocky.
*FCF	Farmington-Rock outcrop association, steep and very steep. For Rock outcrop part of FCF, see Rock outcrop ROF.	Severe: slope; bedrock at depth of 10 to 20 inches; very rocky.	Severe: slope; bedrock at depth of 10 to 20 inches.	Severe: slope; bedrock at depth of 10 to 20 inches.	Severe: slope; bedrock at depth of 10 to 20 inches.	Severe: slope; bedrock at depth of 10 to 20 inches; very rocky.
FL	Fluvaquents	Severe: frequent flooding; dominantly poorly drained or very poorly drained.	Severe: frequent flooding; dominantly poorly drained or very poorly drained.	Severe: frequent flooding; dominantly poorly drained or very poorly drained.	Severe: frequent flooding; dominantly poorly drained or very poorly drained.	Severe: poorly drained; very gravelly and sandy surface layer in places.
Fr	Fredon silt loam	Severe: somewhat poorly drained or poorly drained.	Severe: somewhat poorly drained or poorly drained.	Moderate or severe: somewhat poorly drained or poorly drained.	Severe: somewhat poorly drained or poorly drained.	Moderate or severe: somewhat poorly drained or poorly drained.
Ha	Halsey mucky silt loam.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.
Hb	Hamlin silt loam	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.
HcA	Hartland very fine sandy loam, 0 to 2 percent slopes.	Slight	Slight	Slight	Slight	Slight
HcB	Hartland very fine sandy loam, 2 to 6 percent slopes.	Slight	Moderate: slope	Slight	Slight	Slight
HcC	Hartland very fine sandy loam, 6 to 12 percent slopes.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope	Moderate: slope
HcD	Hartland very fine sandy loam, 12 to 20 percent slopes.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope
HeA	Herkimer gravelly silt loam, 0 to 3 percent slopes.	Moderate: dominantly moderately well drained.	Moderate: dominantly moderately well drained.	Slight	Moderate: [1] dominantly moderately well drained.	Moderate: gravelly surface layer.
HeB	Herkimer gravelly silt loam, 3 to 8 percent slopes.	Moderate: dominantly moderately well drained.	Moderate: dominantly moderately well drained; slope.	Slight	Moderate: [1] dominantly moderately well drained.	Moderate: gravelly surface layer.

See footnote at end of table.

be considered in town and country planning—Continued

Pipelines	Golf fairways	Athletic fields	Picnic areas	Paths and trails	Camp areas
Severe: bedrock at depth of 10 to 20 inches; slope in places.	Severe: bedrock at depth of 10 to 20 inches; slope in places; very rocky.	Severe: bedrock at depth of 10 to 20 inches; very rocky; slope in places.	Moderate: very rocky; slope. Severe in places: slope.	Moderate: very rocky; slope.	Moderate: very rocky. Severe in places: slope.
Severe: slope; bedrock at depth of 10 to 20 inches; very rocky.	Severe: slope; bedrock at depth of 10 to 20 inches; very rocky.	Severe: slope; bedrock at depth of 10 to 20 inches; very rocky.	Severe: slope	Severe: slope	Severe: slope.
Severe: frequent flooding; very gravelly in places; dominantly poorly drained or very poorly drained.	Severe: very gravelly and sandy surface layer in places; dominantly poorly drained or very poorly drained.	Severe: dominantly poorly drained or very poorly drained; very gravelly and sandy surface layer in places.	Severe: dominantly poorly drained or very poorly drained; frequent flooding.	Severe: dominantly poorly drained or very poorly drained; frequent flooding.	Severe: frequent flooding; dominantly poorly drained or very poorly drained.
Severe: somewhat poorly drained or poorly drained.	Moderate or severe: somewhat poorly drained or poorly drained.	Severe: somewhat poorly drained or poorly drained.	Moderate or severe: somewhat poorly drained or poorly drained.	Moderate or severe: somewhat poorly drained or poorly drained.	Severe: somewhat poorly drained or poorly drained.
Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.
Severe: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.	Slight	Severe: subject to flooding.
Slight	Slight	Slight	Slight	Slight	Slight.
Slight	Slight	Moderate: slope	Slight	Slight	Slight.
Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope	Slight	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Severe: slope.
Severe: very gravelly subsoil and substratum.	Moderate: gravelly surface layer.	Severe: gravelly surface layer.	Slight	Slight	Slight.
Severe: very gravelly subsoil and substratum.	Moderate: gravelly surface layer.	Severe: gravelly surface layer; slope in places.	Slight	Slight	Slight.

TABLE 8.—*Degree and kind of limitations to*

Map symbols	Soils	Homesites	Shopping centers and small industrial buildings	Local roads and streets	Septic tank absorption fields	Lawns and landscaping
*HLE	Hollis-Charlton association, moderately steep and steep. For Charlton part, see Charlton series, unit CHE.	Severe: bedrock at a depth of 10 to 20 inches; very rocky; slope.	Severe: bedrock at a depth of 10 to 20 inches; very rocky; slope.	Severe: slope; bedrock at a depth of 10 to 20 inches; very rocky.	Severe: slope; bedrock at a depth of 10 to 20 inches; very rocky.	Severe: slope; bedrock at a depth of 10 to 20 inches; very rocky.
*HNC	Hollis-Rock outcrop association, gently sloping and sloping. For Rock outcrop part, see Rock outcrop ROF.	Severe: bedrock at a depth of 10 to 20 inches; very rocky.	Severe: bedrock at a depth of 10 to 20 inches; very rocky; slope in places.	Severe: bedrock at a depth of 10 to 20 inches; very rocky.	Severe: bedrock at a depth of 10 to 20 inches; very rocky.	Severe: bedrock at a depth of 10 to 20 inches; very rocky.
HoA	Hoosic gravelly sandy loam, 0 to 3 percent slopes.	Slight	Slight	Slight	Slight [1]	Moderate: gravelly surface layer.
HoB	Hoosic gravelly sandy loam, 3 to 8 percent slopes.	Slight	Moderate: slope	Slight	Slight [1]	Moderate: gravelly surface layer.
HoC	Hoosic gravelly sandy loam, 8 to 15 percent slopes.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope.	Moderate: slope; gravelly surface layer.
HSDK	Hoosic gravelly sandy loam, rolling and hilly.	Severe: slope	Severe: slope	Severe: slope	Severe [1]: slope	Severe: slope
HTF	Hoosic and Otisville soils, steep and very steep.	Severe: slope	Severe: slope	Severe: slope	Severe [1]: slope	Severe: slope
HvB	Hudson silt loam, 2 to 6 percent slopes.	Moderate: moderately well drained; moderate shrink-swell potential.	Moderate: slope; moderately well drained; moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.	Severe: very slow permeability.	Slight
HvC	Hudson silt loam, 6 to 12 percent slopes.	Moderate: slope; moderately well drained; moderate shrink-swell potential.	Severe: slope	Moderate: slope; moderate shrink-swell potential.	Severe: very slow permeability.	Moderate: slope.
HvD	Hudson silt loam, 12 to 20 percent slopes.	Severe: slope	Severe: slope	Severe: slope	Severe: slope; very slow permeability.	Severe: slope
HWE	Hudson and Vergennes soils, steep and very steep.	Severe: slope	Severe: slope	Severe: slope	Severe: slope; very slow permeability.	Severe: slope
KbA	Kingsbury silty clay, 0 to 2 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Moderate: somewhat poorly drained; moderate shrink-swell potential.	Severe: very slow permeability; somewhat poorly drained.	Severe: silty clay surface layer.
KbB	Kingsbury silty clay, 2 to 6 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Moderate: somewhat poorly drained; moderate shrink-swell potential.	Severe: very slow permeability; somewhat poorly drained.	Severe: silty clay surface layer.

See footnote at end of table.

be considered in town and country planning—Continued

Pipelines	Golf fairways	Athletic fields	Picnic areas	Paths and trails	Camp areas
Severe: slope; bedrock at a depth of 10 to 20 inches; very rocky.	Severe: slope; bedrock at a depth of 10 to 20 inches; very rocky.	Severe: slope; bedrock at a depth of 10 to 20 inches; very rocky.	Severe: slope	Moderate: slope; very rocky. Severe in places.	Severe: slope.
Severe: bedrock at a depth of 10 to 20 inches; very rocky.	Severe: bedrock at a depth of 10 to 20 inches; very rocky.	Severe: slope; bedrock at a depth of 10 to 20 inches; very rocky.	Moderate: very rocky; slope in places.	Moderate: very rocky.	Moderate: very rocky.
Severe: very gravelly subsoil and substratum.	Moderate: gravelly surface layer.	Severe: gravelly surface layer.	Slight	Slight	Slight.
Severe: very gravelly subsoil and substratum.	Moderate: gravelly surface layer.	Severe: gravelly surface layer; slope in places.	Slight	Slight	Slight.
Severe: very gravelly subsoil and substratum.	Moderate: slope; gravelly surface layer.	Severe: slope	Moderate: slope	Slight	Moderate: slope.
Severe: slope; very gravelly subsoil and substratum.	Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Severe: slope.
Severe: slope; very gravelly subsoil and substratum.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: silty clay subsoil and substratum.	Slight	Severe: very slow permeability	Slight	Slight	Severe: very slow permeability.
Severe: silty clay subsoil and substratum.	Moderate: slope	Severe: slope; very slow permeability.	Moderate: slope	Slight	Severe: very slow permeability.
Severe: slope; silty clay subsoil and substratum.	Severe: slope	Severe: slope; very slow permeability.	Severe: slope	Moderate: slope	Severe: slope; very slow permeability.
Severe: slope; silty clay subsoil and substratum.	Severe: slope	Severe: slope; very slow permeability.	Severe: slope	Severe: slope	Severe: slope; very slow permeability.
Severe: somewhat poorly drained; clay subsoil and substratum.	Severe: silty clay surface layer.	Severe: somewhat poorly drained; silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: somewhat poorly drained; very slow permeability; silty clay surface layer.
Severe: somewhat poorly drained; clay subsoil and substratum.	Severe: silty clay surface layer.	Severe: somewhat poorly drained; silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: somewhat poorly drained; very slow permeability; silty clay surface layer.

TABLE 8.—*Degree and kind of limitations to*

Map symbols	Soils	Homesites	Shopping centers and small industrial buildings	Local roads and streets	Septic tank absorption fields	Lawns and landscaping
Lm	Limerick silt loam	Severe: frequent flooding; poorly drained.	Severe: frequent flooding; poorly drained.	Severe: frequent flooding; poorly drained.	Severe: frequent flooding; poorly drained.	Severe: frequent flooding; poorly drained.
Ma	Madalin silty clay loam.	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.	Severe: slow permeability; poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.
NAC	Nassau shaly silt loam, undulating through hilly.	Severe: bedrock at a depth of 10 to 20 inches; slope in places.	Severe: bedrock at a depth of 10 to 20 inches; slope.	Severe: bedrock at a depth of 10 to 20 inches; slope in places.	Severe: bedrock at a depth of 10 to 20 inches; slope in places.	Severe: bedrock at a depth of 10 to 20 inches; slope in places.
*NBC	Nassau-Rock outcrop association, undulating through hilly. For Rock outcrop part, see Rock outcrop ROF.	Severe: bedrock at a depth of 10 to 20 inches; very rocky; slope in places.	Severe: bedrock at a depth of 10 to 20 inches; very rocky; slope.	Severe: bedrock at a depth of 10 to 20 inches; very rocky; slope in places.	Severe: bedrock at a depth of 10 to 20 inches; slope in places.	Severe: bedrock at a depth of 10 to 20 inches; very rocky; slope in places.
*NBF	Nassau-Rock outcrop association, steep and very steep. For Rock outcrop part, see Rock outcrop ROF.	Severe: slope; bedrock at a depth of 10 to 20 inches; very rocky.	Severe: slope; bedrock at a depth of 10 to 20 inches; very rocky.	Severe: slope; bedrock at a depth of 10 to 20 inches; very rocky.	Severe: slope; bedrock at a depth of 10 to 20 inches; rocky.	Severe: slope; bedrock at a depth of 10 to 20 inches; very rocky.
OaB	Oakville loamy fine sand, 0 to 5 percent slopes.	Slight	Slight	Slight	Slight [1]	Severe: loamy fine sand surface layer.
OaC	Oakville loamy fine sand, 5 to 15 percent slopes.	Moderate: slope	Moderate: slope. Severe in places.	Moderate: slope	Moderate [1]: slope.	Severe: loamy fine sand surface layer.
OKE	Oakville loamy fine sand, moderately steep and steep.	Severe: slope	Severe: slope	Severe: slope	Severe [1]: slope	Severe: slope; loamy fine sand surface layer.
OP	Orthents and Psamments. Properties too variable to be estimated.					
OtA	Otisville gravelly sandy loam, 0 to 3 percent slopes.	Slight	Slight	Slight	Slight [1]	Moderate: gravelly surface layer.
OtB	Otisville gravelly sandy loam, 3 to 8 percent slopes.	Slight	Moderate: slope	Slight	Slight [1]	Moderate: gravelly surface layer.
OVDK	Otisville gravelly sandy loam, roll- and hilly.	Moderate or severe: slope.	Severe: slope	Moderate or severe: slope.	Moderate or severe [1]: slope.	Moderate or severe: gravelly surface layer; slope in places.

See footnote at end of table.

be considered in town and country planning—Continued

Pipelines	Golf fairways	Athletic fields	Picnic areas	Paths and trails	Camp areas
Severe: poorly drained; frequent flooding.	Severe: frequent flooding; poorly drained.	Severe: poorly drained; frequent flooding.	Severe: poorly drained.	Severe: poorly drained.	Severe: frequent flooding; poorly drained.
Severe: poorly drained and very poorly drained; silty clay subsoil and substratum.	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: bedrock at a depth of 10 to 20 inches; very shaly subsoil; slope.	Severe: bedrock at a depth of 10 to 20 inches; slope in places.	Severe: bedrock at a depth of 10 to 20 inches; shaly surface layer; slope.	Moderate: slope. Severe in places: slope.	Slight. Moderate in places: slope.	Moderate: slope. Severe in places: slope.
Severe: bedrock at a depth of 10 to 20 inches; very rocky; very shaly subsoil; slope in places.	Severe: bedrock at a depth of 10 to 20 inches; very rocky; slope in places.	Severe: slope; bedrock at a depth of 10 to 20 inches; very rocky.	Moderate: very rocky; slope. Severe in places: slope.	Moderate: slope; very rocky.	Moderate: very rocky; slope. Severe in places: slope.
Severe: slope; bedrock at a depth of 10 to 20 inches; very rocky; very shaly subsoil.	Severe: slope; bedrock at a depth of 10 to 20 inches; very rocky.	Severe: slope; bedrock at a depth of 10 to 20 inches; very rocky.	Severe: slope	Severe: slope	Severe: slope.
Severe: loamy fine sand subsoil; fine sand substratum.	Severe: loamy fine sand surface layer.	Severe: loamy fine sand surface layer.	Moderate: loamy fine sand surface layer.	Moderate: loamy fine sand surface layer.	Moderate: loamy fine sand surface layer.
Severe: loamy fine sand subsoil; fine sand substratum.	Severe: loamy fine sand surface layer.	Severe: slope; loamy fine sand surface layer.	Moderate: slope; loamy fine sand surface layer.	Moderate: loamy fine sand surface layer.	Moderate: slope; loamy fine sand surface layer.
Severe: slope; loamy fine sand subsoil; fine sand substratum.	Severe: slope; loamy fine sand surface layer.	Severe: slope; loamy fine sand surface layer.	Severe: slope	Severe: slope	Severe: slope.
Severe: very gravelly loamy sand subsoil and substratum.	Moderate: gravelly surface layer.	Severe: gravelly surface layer.	Slight	Slight	Slight.
Severe: very gravelly loamy sand subsoil and substratum.	Moderate: gravelly surface layer.	Severe: gravelly surface layer.	Slight	Slight	Slight.
Severe: very gravelly loamy sand subsoil and substratum; slope in places.	Moderate or severe: gravelly surface layer; slope in places.	Severe: gravelly surface layer; slope.	Moderate or severe: slope.	Moderate: slope	Moderate or severe: slope.

TABLE 8.—*Degree and kind of limitations to*

Map symbols	Soils	Homesites	Shopping centers and small industrial buildings	Local roads and streets	Septic tank absorption fields	Lawns and landscaping
PaB	Palatine shaly silt loam, 3 to 8 percent slopes.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Moderate: bedrock a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Moderate: shaly surface layer.
PaC	Palatine shaly silt loam, 8 to 15 percent slopes.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; slope.	Moderate: bedrock a depth of 20 to 40 inches; slope.	Severe: bedrock at a depth of 20 to 40 inches.	Moderate: shaly surface layer; slope.
Pm	Palms muck	Severe: very poorly drained organic deposit.	Severe: very poorly drained organic deposit.	Severe: very poorly drained organic deposit.	Severe: very poorly drained organic deposit.	Severe: very poorly drained organic deposit.
PtB	Pittsfield stony fine sandy loam, 3 to 8 percent slopes.	Slight	Moderate: slope	Slight	Slight	Moderate: stony fine sand surface layer.
PtC	Pittsfield stony fine sandy loam, 8 to 15 percent slopes.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope	Moderate: slope; stony fine sandy loam surface layer.
PVC	Pittsfield-Amenia association, very stony, gently sloping through moderately steep.	Moderate: very stony surface layer; slope. Severe in places: slope.	Severe: slope	Moderate: slope. Severe in places: slope.	Moderate: slope. Severe in places: slope.	Severe: very stony surface layer; slope in places.
RhA	Rhinebeck silt loam, 0 to 2 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Moderate: somewhat poorly drained; moderate shrink-swell potential.	Severe: slow permeability; somewhat poorly drained.	Moderate: somewhat poorly drained.
RhB	Rhinebeck silt loam, 2 to 6 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Moderate: somewhat poorly drained; moderate shrink-swell potential.	Severe: slow permeability; somewhat poorly drained.	Moderate: somewhat poorly drained.
*ROF	Rock outcrop-Hollis association, moderately steep through very steep. For Hollis part, see Hollis series, unit HLE.	Severe: bare rock	Severe: bare rock.	Severe: bare rock.	Severe: bare rock.	Severe: bare rock.
*RPC	Rock outcrop-Vergennes association, gently sloping through moderately steep. For Rock outcrop part, see Rock outcrop ROF.	Severe: very rocky; slope in places.	Severe: very rocky; slope in places.	Severe: very rocky; slope in places.	Severe: very slow permeability; very rocky; slope in places.	Severe: very rocky.

See footnote at end of table.

be considered in town and country planning—Continued

Pipelines	Golf fairways	Athletic fields	Picnic areas	Paths and trails	Camp areas
Severe: bedrock at a depth of 20 to 40 inches.	Moderate: shaly surface layer.	Severe: shaly surface layer.	Slight	Slight	Slight.
Severe: bedrock at a depth of 20 to 40 inches.	Moderate: shaly surface layer; slope.	Severe: shaly surface layer.	Moderate: slope	Slight	Moderate: slope.
Severe: very poorly drained organic deposit.	Severe: very poorly drained organic deposit.	Severe: very poorly drained organic deposit.	Severe: very poorly drained organic deposit.	Severe: very poorly drained organic deposit.	Severe: very poorly drained organic deposit.
Moderate: gravelly fine sandy loam subsoil and substratum.	Moderate: stony fine sandy loam surface layer.	Moderate: slope; stony fine sandy loam surface layer.	Slight	Slight	Slight.
Moderate: slope; gravelly fine sandy loam subsoil and substratum.	Moderate: slope; stony fine sandy loam surface layer.	Severe: slope	Moderate: slope	Slight	Moderate: slope.
Moderate: very stony surface layer; gravelly fine sandy loam subsoil and substratum; slope. Severe in places: slope.	Severe: very stony surface layer; slope in places.	Severe: slope	Moderate: slope	Moderate: very stony surface layer; slope in places.	Moderate: very stony surface layer; slope. Severe in places: slope.
Severe: somewhat poorly drained; silty clay subsoil.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.
Severe: somewhat poorly drained; silty clay subsoil.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.
Severe: bare rock	Severe: bare rock	Severe: bare rock	Severe: bare rock	Severe: bare rock	Severe: bare rock.
Severe: very rocky; clay subsoil and substratum.	Severe: very rocky.	Severe: very rocky; slope; very slow permeability.	Moderate: very rocky silty clay loam; slope. Severe in places: slope.	Moderate: very rocky silty clay loam.	Moderate: very rocky silty clay loam; slope. Severe in places; slope.

TABLE 8.—*Degree and kind of limitations to*

Map symbols	Soils	Homesites	Shopping centers and small industrial buildings	Local roads and streets	Septic tank absorption fields	Lawns and landscaping
*RPF	Rock outcrop-Vergennes association, steep and very steep. For Rock outcrop part, see Rock outcrop ROF.	Severe: slope; very rocky.	Severe: slope; very rocky.	Severe: slope; very rocky.	Severe: slope; very slow permeability; very rocky.	Severe: slope; very rocky.
Sa	Saco silt loam	Severe: frequent flooding; very poorly drained.	Severe: frequent flooding; very poorly drained.	Severe: frequent flooding; very poorly drained.	Severe: frequent flooding; very poorly drained.	Severe: frequent flooding; very poorly drained.
SB	Saprists, Aquepts, and Aquents.	Severe: flooded with shallow water.	Severe: flooded with shallow water.	Severe: flooded with shallow water.	Severe: flooded with shallow water.	Severe: flooded with shallow water.
ScA	Scriba gravelly silt loam, 0 to 3 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Moderate: somewhat poorly drained.	Severe: slow permeability; somewhat poorly drained.	Moderate: gravelly silt loam surface layer; somewhat poorly drained.
ScB	Scriba gravelly silt loam, 3 to 8 percent slopes.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Moderate: somewhat poorly drained.	Severe: slow permeability; somewhat poorly drained.	Moderate: gravelly silt loam surface layer; somewhat poorly drained.
SDC	Scriba very stony soils, nearly level through sloping.	Severe: somewhat poorly drained.	Severe: slope; somewhat poorly drained.	Moderate: slope; somewhat poorly drained.	Severe: slow permeability; somewhat poorly drained.	Severe: very stony surface layer.
Su	Sun loam	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.	Severe: slow permeability; poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.
SV	Sun very stony soils.	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; slow permeability.	Severe: very stony surface layer; poorly drained and very poorly drained.
Te	Teel silt loam	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject flooding.	Moderate: subject to flooding.
VeB	Vergennes silty clay loam, 2 to 6 percent slopes.	Moderate: moderately well drained; moderate shrink-swell potential.	Moderate: moderately well drained; moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.	Severe: very slow permeability.	Moderate: silty clay loam surface layer.
VeC	Vergennes silty clay loam, 6 to 12 percent slopes.	Moderate: slope; moderately well drained; moderate shrink-swell potential.	Severe: slope	Moderate: slope; moderate shrink-swell potential.	Severe: very slow permeability.	Moderate: silty clay loam surface layer; slope.
VeD	Vergennes silty clay loam, 12 to 20 percent slopes.	Severe: slope	Severe: slope	Severe: slope	Severe: slope; very slow permeability.	Severe: slope
Wa	Wallington silt loam, sandy substratum.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained.	Moderate: somewhat poorly drained.	Severe: slow permeability; somewhat poorly drained.	Moderate: somewhat poorly drained.

[1] Pollution of water supply is a hazard.

be considered in town and country planning—Continued

Pipelines	Golf fairways	Athletic fields	Picnic areas	Paths and trails	Camp areas
Severe: slope; very rocky; clay subsoil and substratum.	Severe: slope; very rocky.	Severe: slope; very rocky; very slow permeability.	Severe: slope	Severe: slope	Severe: slope; very slow permeability.
Severe: frequent flooding; very poorly drained.	Severe: frequent flooding; very poorly drained.	Severe: frequent flooding; very poorly drained.	Severe: frequent flooding; very poorly drained.	Severe: very poorly drained.	Severe: frequent flooding; very poorly drained.
Severe: flooded with shallow water.	Severe: flooded with shallow water.	Severe: flooded with shallow water.	Severe: flooded with shallow water.	Severe: flooded with shallow water.	Severe: flooded with shallow water.
Severe: somewhat poorly drained.	Moderate: gravelly silt loam surface layer; somewhat poorly drained.	Severe: somewhat poorly drained; gravelly silt loam surface layer.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.
Severe: somewhat poorly drained.	Moderate: gravelly silt loam surface layer; somewhat poorly drained.	Severe: somewhat poorly drained; gravelly silt loam surface layer.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.
Severe: somewhat poorly drained.	Severe: very stony surface layer.	Severe: slope; somewhat poorly drained; gravelly and very stony surface layer.	Moderate: somewhat poorly drained; slope.	Moderate: somewhat poorly drained; very stony surface layer.	Severe: somewhat 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.	Severe: poorly drained and very poorly drained.
Severe: poorly drained and very poorly drained.	Severe: very stony surface layer; poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained; very stony surface layer.	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.	Severe: poorly drained and very poorly drained.
Severe: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.	Slight	Severe: subject to to flooding.
Severe: clay subsoil and substratum.	Moderate: silty clay loam surface layer.	Severe: very slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Severe: very slow permeability.
Severe: clay subsoil and substratum.	Moderate: silty clay loam surface layer; slope.	Severe: slope; very slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Severe: very slow permeability.
Severe: slope; clay subsoil and substratum.	Severe: slope	Severe: slope; very slow permeability.	Severe: slope	Moderate: slope; silty clay loam surface layer.	Severe: slope; very slow permeability.
Severe: somewhat poorly drained.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.

Figure 18.—Shale and gravel in Nassau soil. Establishing a lawn is difficult.

portation of fill or topsoil is considered. The main features considered are natural drainage or wetness, slope, depth to bedrock, texture of the surface layer, surface stoniness and rockiness, and flood hazard (fig. 18).

Rated in the column headed "pipelines" are excavations that require digging or trenching to a depth of less than 6 feet. Examples are excavations for pipelines, sewer lines, and phone and power transmission lines. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or a high water table.

Golf fairways are subject to moderate traffic by foot and motorized golf carts and to frequent mowing. Traps, roughs, or greens are not considered in the ratings. The in-place soil is rated. Not considered are areas where the original soil layers have been scalped or mixed by excavation. No importation of fill or topsoil is considered. The main features considered are natural drainage or wetness, slope, depth to bedrock, texture of the surface layer, surface stoniness and rockiness, and flood hazard.

Athletic fields are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The best soils have a nearly level surface that is free of coarse fragments and rock outcrops, has good drainage, does not flood during periods of heavy use, and has a surface that is firm after rain but not dusty when dry. If grading and leveling are required, depth to rock is important.

Picnic areas are attractive natural or landscaped tracts used mainly for preparing meals and eating outdoors (fig. 19). These areas are subject to heavy foot traffic. Most vehicular traffic, however, is confined to access roads. The best soils are firm when wet but not dusty when dry, are not flooded during the season of use, and are not sloping or stony. Slopes and stones can greatly increase the cost of leveling sites or of building access roads.

Paths and trails are used for local and cross-country travel by foot or on horseback. Design and layout should require little or no cutting and filling. The best soils are firm when wet but not dusty when dry, are flooded no more than once during the season of use, have slopes of less than 15 percent, and have few or no rocks or stones on the surface.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking

Figure 19.—Picnic area in the Adirondacks on Hollis-Rock outcrop association, gently sloping and sloping.

areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have mild slopes, good drainage, a surface free of rocks and coarse fragments, no flooding during periods of heavy use, and a surface that is firm after rain but not dusty when dry.

Formation and Classification of the Soils

This section describes the major factors of soil formation, relates these factors to the formation and morphology of the soils of Washington County, and explains some of the processes of soil formation. It also defines the current system of soil classification and classifies the soils according to that system.

Factors of Soil Formation

Soils are a complex mixture of weathered rocks, minerals, organic matter, water, and air in varying proportions. They form through the chemical and physical weathering of the unconsolidated parent material as influenced by the kind of climate; living organisms, particularly vegetation; relief, or topography; and the time these factors have affected development (*9*). In Washington County the local differences in the soils are mainly the result of differences in parent material and relief. This is because climate and vegetation are fairly uniform throughout the county, and most of the soil material has been exposed to the soil-forming processes for about the same length of time.

Parent material

Most soils in Washington County formed in mineral material deposited by glaciers during the Wisconsin age. These deposits are termed glacial till, glacial outwash consisting of sorted sand and gravel, deltaic deposits consisting mainly of sand, and glacial lake or estuarine deposits of silt and clay. More recently, alluvium has been deposited in the valleys along streams. The mineral material in all of these depositional units is derived mainly from mixtures of the underlying bedrock, which in Washington County consists mostly of shale, slate, sandstone, limestone, and syenite and granite gneisses. In places organic soils are forming in decomposed plant material that has accumulated in wet depressions. Table 9 shows relationships of some soils in Washington County to parent material, geology, natural drainage class, and soil classification.

As the glaciers moved over the county, they carried

TABLE 9.—*Soil series arranged to show relationships in position, parent material, and drainage*

Parent material, soil texture, and other characteristics	Soil drainage class				
	Well drained through excessively drained	Moderately well drained	Somewhat poorly drained	Poorly drained	Very poorly drained
Soils on Glacial Till					
Calcic limestone prominent:					
Shallow, loamy over limestone	Farmington				
Deep, coarse-loamy		Amenia		Sun	Sun.
Calcareous dark shale prominent:					
Moderately deep, loamy-skeletal over shale.	Palatine				
Syenite and granite gneisses prominent:					
Shallow, loamy over gneiss	Hollis				
Deep, coarse-loamy	Charlton				
Slate and shale prominent:					
Shallow, loamy-skeletal over shale or slate.	Nassau				
Deep, coarse-loamy	Bernardston	Bernardston	Scriba	Sun	Sun.
Syenite, sandstone, granite gneiss, and limestone prominent:					
Deep, coarse-loamy	Pittsfield				
Soils on Gravelly Outwash					
Shale, slate, sandstone, and gneiss prominent:					
Deep, sandy-skeletal, sandy loam through loam fine earth B horizon to a depth of 22 inches.	Hoosic				
Deep, sandy-skeletal, loamy fine sand or coarser fine earth B horizon below a depth of 10 to 15 inches.	Otisville				
Deep, loamy-skeletal		Herkimer			
Deep, coarse-loamy over sandy or sandy-skeletal.			Fredon	Fredon	Halsey.
Soils on Sands of Deltas					
Deep, sandy	Oakville				
Soils on Lacustrine Deposits and Stream Terraces					
Deep, very fine		Vergennes	Kingsbury	Covington	
Deep, fine		Hudson	Rhinebeck	Madalin	Madalin.
Deep, sandy over clayey		Claverack	Cosad		
Deep, coarse-silty	Hartland	Belgrade	Wallington		
Soils on Recent Alluvium					
Deep, coarse-silty	Hamlin	Teel	Teel	Limerick	Saco.
Organic Soils					
Deep, sapric					Carlisle.
Moderately deep over loamy material, sapric.					Palms.

large quantities of rock, much of which was ground into fragments that range from boulders to clay in size. Some of these materials were later deposited directly by the ice in a heterogeneous mass called glacial till. In Washington County the Bernardston, Charlton, Pittsfield, and Scriba soils are examples of soils that formed in glacial till.

As the glacial ice melted, enormous quantities of water ran off. This water carried and sorted the glacially transported material. Some of the material was redeposited in layers of sand and gravel to form outwash plains, kames, eskers, and deltas. The sand and gravel pits in the county are examples of these deposits. The Hoosic and Otisville soils formed in sand and gravelly outwash and deltaic deposits. Oakville soils formed in sandy deltas. Also, large quantities of finely ground rock were carried by melt water and deposited in the quiet waters of glacial lakes and estuaries. These particles were the size of silt and clay. Beds of silt and clay were left in many of these lakes when they were drained. The silt and clay in the Hudson Valley are in beds of this kind that were laid down in the huge glacial lake that once occupied the Hudson Valley. The Hudson and Rhinebeck soils are examples of soils that formed in lake-laid sediments. The Champlain Valley was also occupied by a tremendously large glacial lake and, subsequently, an estuary of the Champlain Sea, in which mainly clay was deposited. The Vergennes and Kingsbury soils are examples of soils that formed in this material.

In a few places, shallow ponds were created when the glacier receded. In these shallow waters, the remains of water-tolerant plants accumulated. Carlisle muck and Palms muck soils are forming where these remains have accumulated.

After the ice disappeared and the surface of the area was exposed to the atmosphere, the soil-forming processes became active. The removal of glacial drift and redeposition by streams have continued, however, as the present streams build and alter their flood plains by dropping material in some places and washing it away in others. Much of the material on the bottom lands of rivers has been deposited so recently that there has been little change in characteristics other than depositional layerings. The Hamlin and Teel soils formed in recent alluvial deposits.

Climate

Washington County has a cool-temperate, humid, continental climate. Winters are long and cold. Summers are short and mild. The average annual precipitation is about 40 inches and is fairly evenly distributed throughout the year. Detailed information on climate is in the section "Environmental Factors Affecting Soil Use."

Climate effects soil formation through its influence on chemical, physical, and biological processes. The larger the amount of water that passes through the soil, the more the chemical composition of the soil is altered. Leaching of soluble materials depends largely on the amount of rainfall. Freezing, thawing, and diurnal differences in temperature affect the physical weathering of rocks and soils. Temperature also affects biological activity and chemical reaction. When soil is frozen, little biological activity takes place. Decomposition of organic matter increases as the average annual temperature increases. Climate throughout Washington County is fairly uniform, and differences among the soils in the county are not directly attributable to differences in climate.

Living organisms

All living organisms in and on the soils influence soil formation. The native vegetation in Washington County was originally forest. The forest was mainly hardwoods and lesser amounts of white pine, hemlock, and red spruce. The principal hardwoods were beech, birch, maple, ash, hickory, oak, and chestnut, most of which contained some calcium and other bases in their leaves. In the areas cleared of forest, the soils became more acid because nearly all the bases released from the decomposed leaves were leached from the soil. Organic matter from vegetation is generally responsible for the dark color of the surface layer and is a source of plant nutrients in the soil.

Much of the county has been plowed and limed, and the undulations and mounds caused by tree throw have been smoothed. Liming and plowing has increased the base status and lowered the carbon-nitrogen ratio (*3*) and has also increased the population of earthworms. Earthworms mix and incorporate organic matter from the surface layer down into the soil, and the earthworm channels and plant roots increase the permeability of the soil. Small rodents, insects, and burrowing animals also mix the soil. Bacteria and fungi break down organic matter in the soil into simpler compounds.

Relief

The slope and shape of the land surface determine to a considerable extent the amount of water that enters and passes through the soil. They also affect the height of the water table. The water table is generally closer to the surface in level and depressional soils than in sloping and steep soils. Where other factors are equal, the largest amount of runoff is on the steepest soils. According to Norton and Smith (*8*), the most important effect of slope is that it influences the moisture content of the soil.

The amount of water that stands on, is contained in, or moves through a soil affects the oxidation, the breakdown, and the removal of minerals from the soil. The translocation is most noticable in permeable material through which water can move readily.

In depressions, where the water table is at or near the surface for long periods, the subsoil is generally dull gray. Where the water table is deep, bright shades of yellowish brown and reddish brown are common in the subsoil. On gently sloping to moderately sloping soils, where the water table fluctuates, mixtures of gray and yellowish brown are common.

Time

The soil materials of Washington County have been exposed to soil-forming process since the last glacier receded, 10,000 to 15,000 years ago. This is a very short period of geologic time.

Soils form rapidly in their youth. In young soils, plant nutrients are quickly released from the minerals, plant growth increases, and organic matter accumulates. Water leaches many of the soluble compounds from soils. Many soils are now acid because the limestone originally present has been leached out. In some permeable soils, fine clay particles have moved down from the surface layer and have accumulated in the subsoil. Thus, as soils age, breakdown of the soil material continues. Soil processes, however, reach a state of near equilibrium with their environment. After a long period of exposure to a given set of conditions, the relative rates of processes in places change only a little during hundreds or even thousands of years unless the environment changes.

The soils in Washington County are relatively young. Soils on the low bottom lands are generally subject to overflow and receive new sediments with each flooding. These soils either have a weak color differentiation between horizons or do not show horizon differences that are the result of soil-forming processes. Upland soils have distinct horizonation caused by transformation of the original material.

Processes of Soil Formation

If a vertical cut is made in a soil, several layers, or horizons, are evident. The differentiation of horizons is the result of many soil-forming processes. The most important of these are physical breakdown of particles, leaching of salts that are more or less soluble, accumulation of organic matter, chemical weathering of primary minerals and the formation of silicate clay minerals, translocation of silicate clay minerals from one horizon to another by percolating water, accumulation of some iron colloids, and formation of dense or compact layers in the subsoil.

Some of these processes take place in all the soils, but the number of active processes and the degree of their activity vary from one soil to another (*9*).

In all mineral soils, more organic matter has accumulated to form an A1 horizon. In wooded areas, mineral soils have an organic horizon at the surface, designated as an 01 or 02 horizon, depending on the extent to which the organic material has decomposed. If the soils are cleared and plowed, their organic and A1 horizons lose their identity as they are mixed into the plow layer, which is called an Ap horizon. This horizon is enriched in organic matter and is generally distinct from the underlying horizons because it is darker and more friable. The Saco soils are examples of soils that have a distinct, dark-colored Ap horizon.

The upper horizons of a soil are normally more leached of bases and silicate clays than the lower horizons. The leached part of the A horizon that is too far below the surface to be influenced by surface organic matter is called the A2 horizon. Normally, it is the lightest colored horizon in the soil. It is well expressed in the Scriba and similar soils.

In some soils, the clay removed from the A or upper part of the B horizon is accumulated in the subsoil in a horizon designated as the B2t horizon. Of all the horizons in a soil, the B2t horizon contains the highest concentration of translocated clay. The Hudson soils have a well-expressed B2t horizon.

The B horizon of some soils includes a layer of accumulated organic matter, iron, and aluminum. These substances have moved from overlying horizons and are precipitated in the subsoil. These layers are spodic horizons. The Charlton soils in Washington County have a spodic horizon. The B horizon of other soils includes a layer of altered material, but has no accumulated organic matter, iron, or aluminum. This altered layer is a color B, or cambic, horizon. Nassau soils have a cambic horizon. Washington County, except in the Adirondacks, lies in a tension zone in which both cambic horizons and spodic horizons occur and are difficult to differentiate.

A fragipan, or Bx horizon, is evident in the subsoil of some of the deep soils in the county. Examples are the Bernardston and Scriba soils, which formed in glacial till, and the Wallington soils, which formed in lake-laid silt and very fine sand. The fragipan is very firm and brittle when moist and very hard and seemingly cemented when dry, but slakes or fractures when immersed in water. Soil particles are so tightly packed that bulk density is high and pore space is low in relation to the horizons above. Genesis of these horizons is not fully understood. In the case of the Bernardston and Scriba soils, the compacting effect of the overriding ice may have influenced their formation, but in the case of Wallington soils, this compacting influence did not occur. Studies show that, regardless of the mode of deposition, swelling and shrinking take place in alternating wet and dry periods. This may account for the packing of the soil particles and also for a gross polygonal pattern of cracks that is characteristic of most fragipans. Clay, silica, and oxides of aluminum are the cementing agents most likely to cause brittleness and hardness.

Characteristics that indicate relative wetness, or class of drainage, are evident in soils (*13*). Excess water commonly produces mottles, or a pattern of colors, that are mainly gray. The extent of mottling indicates the degree of gleying, or the process of chemical reduction and transfer of iron. Gleyed soil material is normally gray or bluish gray.

In soils that are well aerated, the subsoil is normally brown or yellowish brown. A soil is considered well drained if it is free of mottles to a depth of 20 to 24 inches and shows only brown colors. An example is Charlton soils. Ordinarily, moderately well drained soils are wet for short periods, but are free of mottles to a depth of 16 to 20 inches. The Amenia soils are examples of moderately well drained soils.

In areas where the soils are wet for long periods and are considered poorly drained, the B21g horizon shows the effect of moderate or intense reduction of iron. This horizon is dominantly gray, but contains a few brown mottles. Within some areas of poorly drained soils are small depressions that remain saturated most of the year unless they are artifically drained. In such places drainage is very poor, and the surface layer has a high organic-matter content. The Sun soils are examples of poorly drained and very poorly drained soils.

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 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 large areas, such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study, readers interested in developments of the current system should search the latest literature available (*10, 14*).[8]

[8] UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE. Soil taxonomy of the National Cooperative Soil Survey 1970. [Unpublished material]

The current system of classification has six categories. Beginning with the broadest, these categories are the order, the suborder, the great group, the subgroup, the family, and the 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 or origin, are grouped.

Table 10 shows the classification of the soil series of Washington County by family, subgroup, and order. Categories in the current system are briefly defined in the paragraphs that follow.

Order.—Ten soil orders are recognized in the current system. The properties used to differentiate the 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 in *sol* (Ent–i–sol).

Suborder.—Each order is divided into suborders, primarily on the basis of soil characteristics that produce classes having the greatest genetic similarity. A suborder has a narrower climatic range than an order. The criteria for suborders reflect either the presence or absence of waterlogging or differences in climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is *Aquent* (*Aqu*, meaning water or wet, and *ent*, from Entisol).

Great group.—Each suborder is divided 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 has 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 Fluvaquents (*Fluv*, meaning flood plain; *aqu*, for wetness or water; and *ent*, from Entisols).

Subgroup.—Each great group is divided into subgroups, one representing the central (typic) segment of the group, and others, called intergrades, made up of soils that have mostly properties of one great group but also one or more properties of another great group, suborder, or order. Subgroups are also 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

TABLE 10.—*Soil series classified according to the current system of classification*

Series	Family	Subgroup	Order
Amenia	Coarse-loamy, mixed, mesic	Aquic Eutrochrepts	Inceptisols.
Belgrade	Coarse-silty, mixed, mesic	Aquentic Haplorthods	Spodosols.
Bernardston	Coarse-loamy, mixed, mesic	Entic Fragiorthods	Spodosols.
Carlisle	Euic, mesic	Typic Medisaprists	Histosols.
Charlton	Coarse-loamy, mixed, mesic	Entic Haplorthods	Spodosols.
Claverack	Sandy over clayey, mixed, nonacid, mesic	Aquic Udorthents	Entisols.
Cosad	Sandy over clayey, mixed, nonacid, mesic	Aquic Udorthents	Entisols.
Covington	Very fine, illitic, mesic	Mollic Ochraqualfs	Alfisols.
Farmington	Loamy, mixed, mesic	Lithic Eutrochrepts	Inceptisols.
Fredon	Coarse-loamy over sandy or sandy-skeletal, mixed, nonacid, mesic.	Aeric Haplaquepts	Inceptisols.
Halsey	Coarse-loamy over sandy or sandy-skeletal, mixed, nonacid, mesic.	Mollic Haplaquepts	Inceptisols.
Hamlin	Coarse-silty, mixed, mesic	Dystric Fluventic Eutrochrepts	Inceptisols.
Hartland	Coarse-silty, mixed, mesic	Entic Haplorthods	Spodosols.
Herkimer	Loamy-skeletal, mixed, mesic [1]	Dystric Eutrochrepts	Inceptisols.
Hollis	Loamy, mixed, mesic	Entic Lithic Haplorthods	Spodosols.
Hoosic	Sandy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Hudson	Fine, illitic, mesic	Glossoboric Hapludalfs	Alfisols.
Kingsbury	Very fine, illitic, mesic	Aeric Ochraqualfs	Alfisols.
Limerick	Coarse-silty, mixed, nonacid, mesic	Typic Fluvaquents	Entisols.
Madalin	Fine, illitic, mesic	Mollic Ochraqualfs	Alfisols.
Nassau	Loamy-skeletal, mixed, mesic	Lithic Dystrochrepts	Inceptisols.
Oakville	Mixed, mesic	Typic Udipsamments	Entisols.
Otisville	Sandy-skeletal, mixed, mesic	Typic Udorthents	Entisols.
Palatine	Loamy-skeletal, mixed, mesic	Typic Hapludolls	Mollisols.
Palms	Loamy, mixed, euic, mesic	Terric Medisaprists	Histosols.
Pittsfield	Coarse-loamy, mixed, mesic	Dystric Eutrochrepts	Inceptisols.
Rhinebeck	Fine, illitic, mesic	Aeric Ochraqualfs	Alfisols.
Saco	Coarse-silty, mixed, nonacid, mesic	Fluvaquentic Humaquepts	Inceptisols.
Scriba	Coarse-loamy, mixed, mesic	Aeric Fragiaquepts	Inceptisols.
Sun	Coarse-loamy, mixed, nonacid, mesic	Aeric Haplaquepts	Inceptisols.
Teel	Coarse-silty, mixed, mesic	Fluvaquentic Eutrochrepts	Inceptisols.
Vergennes	Very fine, illitic, mesic	Glossaquic Hapludalfs	Alfisols.
Wallington	Coarse-silty, mixed, mesic	Aeric Fragiaquepts	Inceptisols.

[1] Herkimer soils are classified as coarse-loamy in other areas.

great group. An example is Typic Fluvaquents (a typical Fluvaquent).

Family.—Families are established within each 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, mineral content, 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, mineral content, and so on that are used as family differentiae. (See table 10.) An example is the coarse-silty, mixed, nonacid, mesic family of Typic Fluvaquents.

Series.—The series is a narrower category within the family. All the soils of a given series formed in a particular kind of parent material and have genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the soil profile. Among the differentiating characteristics are color, structure, reaction, consistence, and mineral and chemical composition.

A detailed description of each soil series in the county is given in the section "Descriptions of the Soils."

Environmental Factors Affecting Soil Use

This section describes the natural and cultural features that affect the use and management of the soils in Washington County. Natural features considered are the climate, physiography and geology, drainage, water supply, and natural vegetation. Cultural features are transportation facilities, manufacturing and business services, and trends in soil use.

Climate [9]

The climate of Washington County is determined mainly by the airmasses and weather systems that originate over land areas of North America. The region lies in the zone of prevailing westerly winds, within which migratory eddies of high and low pressure move generally eastward across the continent. The Atlantic Ocean has a secondary influence and contributes some moderating, maritime characteristics to the climate. Currents in the upper atmosphere transport considerable moisture to the area from the Gulf of Mexico and Atlantic Ocean. Thus, the climate of Washington County is classified as humid-continental.

The county is affected by most weather systems in their normal movement toward the northeastern United States. The favored tracks of storms through the St. Lawrence Valley, across the middle latitudes of the country and parallel to the east coast, are close to the region and bring a variety of weather. Temperature, humidity, winds, and other atmospheric conditions normally undergo noticeable change within a few days. The weather during a given week often differs from that of the preceding week. Seasonal weather is commonly variable from year to year.

Geographic influences on the weather are the Adirondack Mountains to the northwest and the long, north-south Hudson River Valley. The Adirondacks tend to shield the county from strong, chilling northwest winds in winter. The valley affords a channel for flow of mild, sometimes warm and humid air from the south or southwest. It is also subject to heavy precipitation and strong winds from the vigorous storms that travel up the Atlantic Coast from time to time. The county is far enough distant from the Great Lakes that their influence on the weather is minor.

Topography and elevation produce some variation of climate within the county. The hilly terrain and higher elevation in the northwestern and eastern parts of the county sometimes result in somewhat cooler temperatures and slightly heavier precipitation than at the lower elevations near the Hudson River. Tables 11 and 12 show temperature and precipitation data taken from data at Whitehall and Salem.

The winters are long and cold. The average daily minimum temperature is lower than 10° F. in much of the county. The occurrence of below-zero temperatures ranges from about 20 days per winter in the river valley up to about 25 days at the higher elevations. In most winters the coldest temperature ranges between minus 15 and minus 25° F. Summers are pleasantly warm, marked by occasional intrusions of warm, humid air from the south and drier, relatively cool air from the west or northwest. Temperatures of 90° F. or higher occur on 5 to 10 days in most summers.

The freeze-free season ranges from an average length of 160 to 170 days near the Hudson River to 120 days in the higher terrain of the eastern part of Washington County.

An average annual precipitation of 34 to 36 inches prevails over much of the county, but some localities near the Vermont border average about 39 inches. Monthly amounts increase from a minimum of 2.0 to 2.5 inches in winter to a maximum of 3.5 to 3.8 inches in May, June, and July. Precipitation is normally adequate for farming and the maintenance of water resources. Serious droughts are uncommon, but temporary periods of deficient moisture for crops can occur during the growing season.

Total seasonal snowfall averages from 60 to 65 inches in most of Washington County, but amounts slightly in excess of 70 inches prevail in the southeastern corner. During December, January, and February monthly accumulations of 12 to 24 inches are common. A snow cover is common from early December until mid-March. Maximum depth usually occurs in February.

Sunshine ranges from an average of 40 percent of possible sunshine in November and December to 60 to 65 percent during summer.

The county is not subject to frequent damaging storms. Occasionally a severe storm of freezing rain occurs in winter. Much precipitation during the warm season comes from thunderstorms, which are sometimes accompanied by locally damaging winds and in-

[9] By A. BOYD PACK, climatologist for New York, National Weather Service, U.S. Department of Commerce.

TABLE 11.—*Temperature and precipitation data*

[Snowfall data from Whitehall, Washington County, elevation 125 feet. All other data from Salem, Washington County, elevation 490 feet]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Seven years in 10 will have:		Average monthly total	Three years in 10 will have:		Snowfall	
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		More than—	Less than—	Average monthly total	Seven years in 10 will have more than—
	°F	°F	°F	°F	Inches	Inches	Inches	Inches	Inches
January	31	6	47	-12	2.6	3.5	1.7	16	11
February	34	8	46	-15	2.4	2.9	1.9	16	11
March	43	20	59	4	2.8	3.2	2.2	11	6
April	56	32	72	19	3.4	3.7	2.6	1	[1] 3
May	68	42	82	28	3.8	4.4	2.9	[2] T	
June	78	51	89	39	3.8	4.5	2.9	0	--
July	82	56	90	43	3.7	4.2	2.8	0	--
August	80	53	88	40	3.5	4.2	2.3	0	....
September	73	45	87	30	3.6	4.4	2.5	0	--
October	63	35	78	22	2.8	3.3	2.1	0	T
November	49	27	65	13	3.5	4.3	2.5	3	[3] 1
December	35	13	52	-7	3.1	3.9	2.4	13	6
Annual	58	32	92	-20	39.0	41.6	36.4	60	50

[1] One year in 10.
[2] Trace.
[3] Five years in 10.

tense downpours of rain. The greatest storm hazard is heavy snowfall, generated by vigorous storms moving up the Atlantic Coast. Tornadoes are very rare, and the paths of tropical hurricanes are seldom close enough to the county to result in serious damage to property and crops.

Physiography and Geology [10]

Washington County is broadly divided into three physiographic areas: the Adirondack Mountains, the Hudson-Champlain Lowland, and Taconic Uplands (*4*). Each of these three regions has distinct and different topographic and geologic features that influenced soil formation and the use of soils in these areas.

All of the county was covered many times by ice sheets several thousand feet thick. These glaciers advanced across the county from the north during the Pleistocene epoch. They eroded and smoothed bedrock surfaces and laid down the unconsolidated deposits in which most of the soils in Washington County formed. These deposits, which are of varying thickness, consist mainly of unsorted glacial till and beds of sand, gravel, silt, and clay that was sorted and laid down by melt water from the glacier (*5*). Figure 20 shows (1) recent alluvium of fine sand and silt on flood plains and river terraces, (2) lacustrine deposits of varved clay and silt, (3) delta deposits of fine

[10] BRUCE A. BENTON, geologist, Soil Conservation Service, helped prepare this section.

TABLE 12.—*Probabilities of last freezing temperature in spring and first in fall*

[Data from Salem, Washington County, elevation 490 feet]

Probability	Dates for given probability of 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 14	April 25	May 15	May 29	June 6.
2 years in 10 later than	April 9	April 21	May 9	May 23	June 1.
5 years in 10 later than	March 31	April 11	April 27	May 10	May 23.
Fall:					
1 year in 10 earlier than	October 21	October 7	September 27	September 19	September 6.
2 years in 10 earlier than	October 27	October 13	October 2	September 24	September 10.
5 years in 10 earlier than	November 8	October 26	October 12	October 3	September 19.

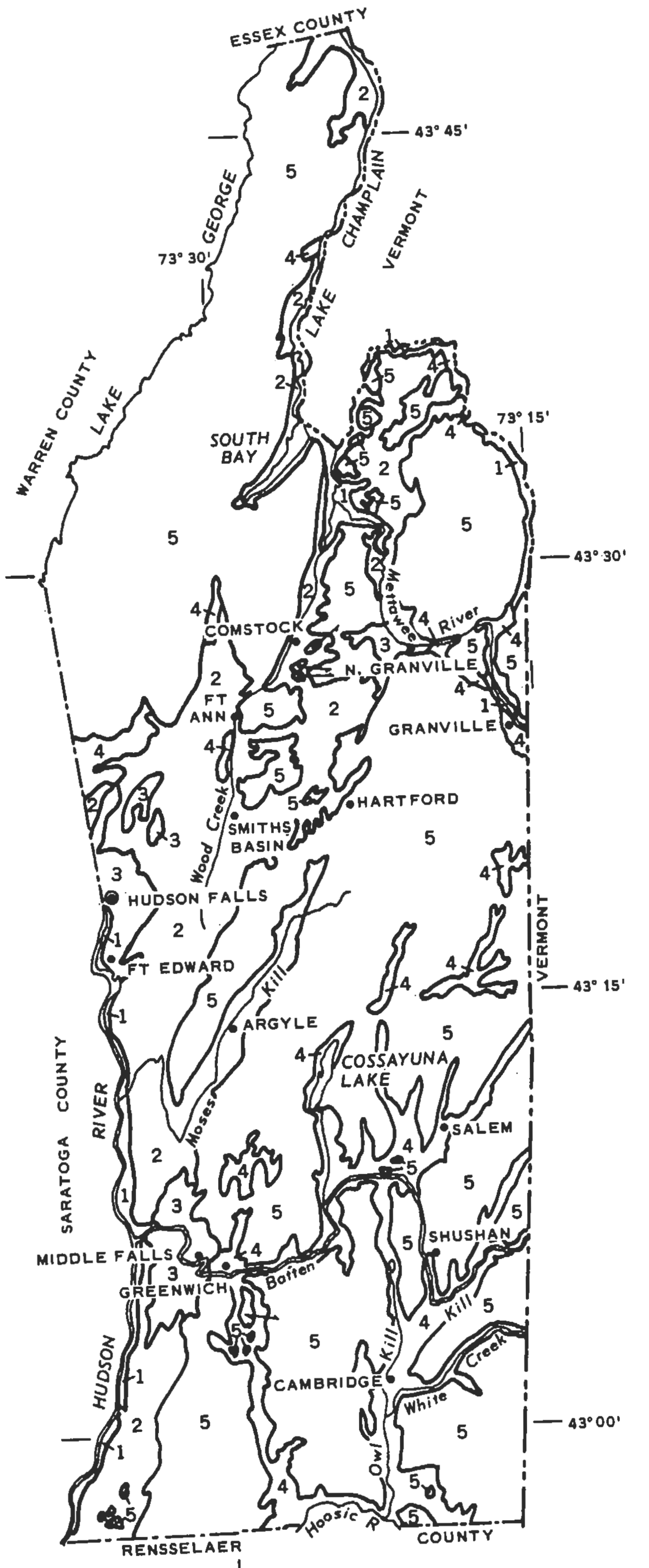

***Figure 20.*—Map of Washington County showing surface geology.**

gravel, sand, and clayey sand, (4) outwash of fine gravel and sand, and (5) outcrop of bedrock and till. All but alluvium and bedrock are Pleistocene deposits. The composition of these glacial deposits is strongly influenced by the underlying bedrock in the three physiographic regions. Also, there are extensive areas of shallow soils, such as those of the Hollis, Farmington, and Nassau series, as well as many rock outcrops in all areas. Consequently, the bedrock is a geologic feature that greatly affects both farm and nonfarm uses in any given area.

The Adirondack Mountain area in the northwestern part of the county is underlain by crystalline rocks of the Grenville Series and associated igneous rocks of Precambrian age. Syenite, the most common of the igneous rocks in Washington County, is closely associated and mixed with schist and gneiss of the Grenville Series. Many scattered exposures of this bedrock are throughout the rugged mountain landscape. The till derived from these crystalline rocks is sandy and contains many boulders. Soils of the Charlton series formed in the deeper deposits, and those of the Hollis series formed in the thin deposits of this till.

South and east of the Adirondack Mountain area is the Hudson-Champlain Lowland, a broad depression eroded in soft shale and limestone by glacial ice and by the preglacial and interglacial Hudson River. The bedrock consists of nearly level sandstone, limestone, and shale of early Paleozoic age. It includes the Potsdam Sandstone, the Beekmantown Limestone, limestone of the Trenton Group, and the Snake Hill Shale Formation (fig. 21). These formations are separated from rocks of the Adirondacks by major high angle faults and from those of the Taconic Uplands on the east by great thrust faults. Figure 21 shows (1) the Snake Hill Formation, (2) Walloomsac Slate, (3) the Trenton Group and Beekmantown Limestone, (4) the Taconic Sequence of rocks, (5) Potsdam Sandstone and associated dolomite, and (6) the Grenville Series and associated igneous rocks. Figure 21 is adapted from maps by T.N. Dale, R. Ruedemann, H. P. Cushing, D. H. Newland, and H. Vaughan.

Most of this Hudson-Champlain Lowland was occupied by glacial Lakes Albany and Vermont. Also, an estuary of the Champlain Sea occupied part of the Champlain Lowland. Consequently, many of the soils in this area formed in glacial melt water deposits. These include the Hudson, Rhinebeck, and Madalin soils, which formed in the silt and clay of glacial Lake Albany and the Vergennes, Kingsbury, and Covington soils, which formed in the clay of glacial Lake Vermont and the estuary of the Champlain Sea. Large deltas were formed where the glacial Hudson River, Metawee River, and Batten Kill flowed into these glacial lakes. (See figure 20.) These sandy and gravelly deltaic deposits are those in which the Oakville soils and some of the Otisville and Hoosic soils formed. Fringing the delta are thin sandy deposits underlain by lake-laid or estuarine clay. The Claverack and Cosad soils formed in these areas. In the northern half of the Hudson-Champlain Lowland, several exposures of bedrock, mainly limestone, and many islands of till protrude above the lake plain or estuarine plain.

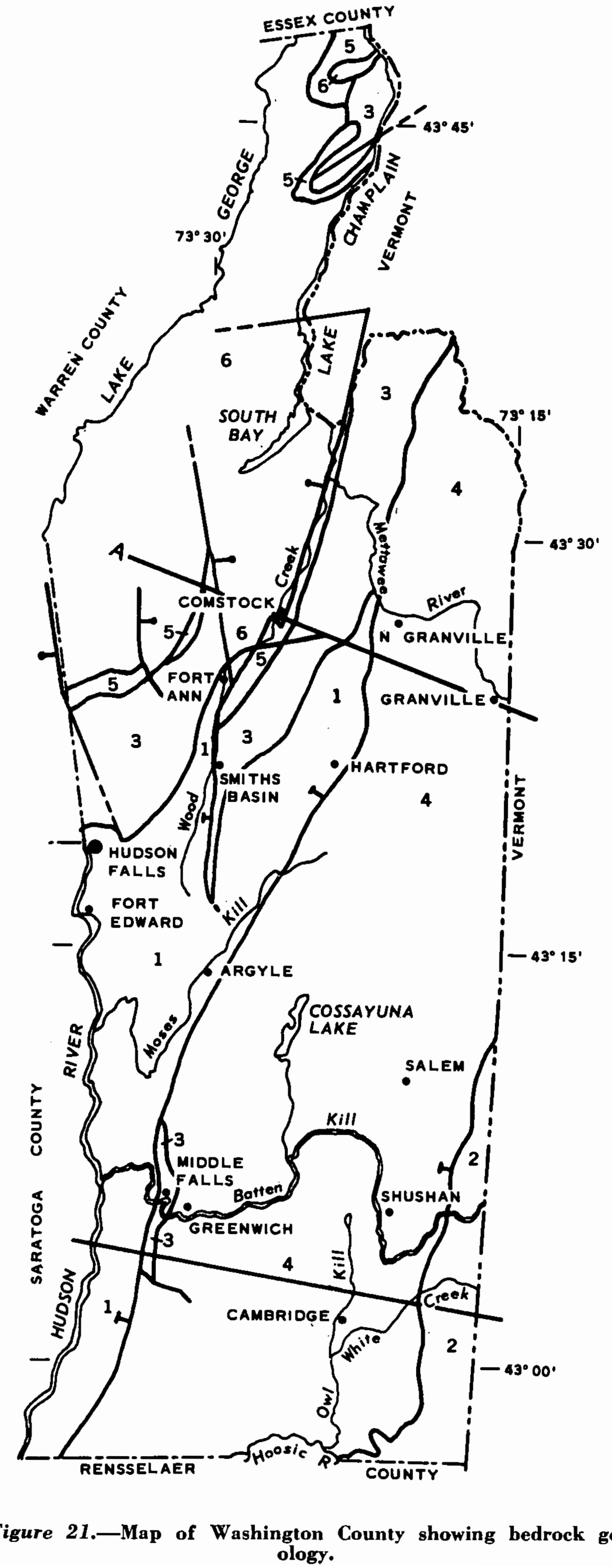

Figure 21.—**Map of Washington County showing bedrock geology.**

Where the till is thin over limestone, the Farmington soils formed; where it is thin and derived mainly from dark-colored, calcareous shale, the Palatine soils formed. Along the southern border of the Adirondacks, a lobe of deep till extends into the Lowland. It is derived mainly from the crystalline rocks of the Adirondacks mixed with the limestone, dolomitic limestone, and sandstone of this lowland region. It is sandy loam that contains many stones and boulders. Pittsfield soils formed in this material.

The Taconic Uplands covers more than the eastern half of the county. Its western boundary, along the Hudson-Champlain Lowland, is abrupt and marked by a low range of hills that extends the length of the county. The relief, affected by the closely folded bedrock, is irregular and hilly throughout the region. The bedrock consists of a series of metamorphosed grits, slates, shales, and interbedded limestones and lesser amounts of phyllite, quartzite, graywacke, and argillite. This bedrock complex is represented on figure 21, the bedrock geology map, by the Taconic Sequence and the Walloomsac Slate, which are of Cambrian and Ordovician age. The firm, dense till derived from the mixture of these rocks is dominantly loam and, to a lesser extent, silt loam. Many fragments of the underlying rock are contained in these till deposits.

In the deeper deposits of till in the Taconic Uplands, the Bernardston, Scriba, and Sun soils formed. Some of these deeper deposits occupy long, oval, drumlinlike landscapes that have a general north-south trend. Others are in deeper pockets between folds of the underlying bedrock. Thin till deposits are extensive throughout this region. They are marked by numerous exposures of slaty bedrock. Soils of the Nassau series formed in the thin till deposits of this slaty area. In addition to the till deposits, the greater amounts of glacial outwash in the county are along the stream valleys that are tributary to the Hudson River in this Taconic region. (See figure 20.) They occur as nearly level valley fill deposits or as rolling and hilly kames and kame terraces along sides of valleys. These gravel and sand deposits are deep and are generally well sorted and stratified in the valley fill deposits and poorly sorted in the kame and kame terrace deposits. These are the outwash deposits in which the Herkimer, Fredon, and Halsey soils and some of the Hoosic and Otisville soils formed.

Along the flood plains of the larger streams throughout the county are deposits of silt and very fine sand alluvium that has been laid down in recent time. These are the materials in which the Hamlin, Teel, and Saco soils formed. Also, in some of the larger valleys are minor amounts of high-level glacial lake and old river terrace deposits of silt and very fine sand. The Hartland and Belgrade soils formed in these deposits.

Drainage [11]

Two major drainage basins, the Hudson and Champlain, each occupy about half the county (*4*). The di-

[11] BRUCE A. BENTON, geologist, Soil Conservation Service, helped prepare this section.

vide crosses the county about midway between its northern and southern limits. North of the divide, drainage is by Lake Champlain and the St. Lawrence River to the Atlantic Ocean. South of the divide, it is by way of the Hudson River, also into the Atlantic.

The northern part of the Taconic Uplands is drained by the Poultney and Metawee Rivers and their tributaries, and the Champlain Lowlands, by Wood Creek. Numerous smaller streams in the Adirondacks flow directly into Lake Champlain and Lake George.

South of the divide, the Hudson River flows out of the Adirondacks and turns south at Hudson Falls, where it forms part of the western boundary of the county. Two major drainage systems, that of the Batten Kill and Hoosic River, empty into the Hudson from the east. The Batten Kill rises in Vermont, winds its way through the south-central part of the Taconic area, and empties into the Hudson at Clarks Mills. The Hoosic River drains the southern area of the county and forms part of its southern boundary.

Water Supply [12]

Supplies of water adequate for domestic and farm use are available throughout the county from wells and springs (*4*). The occurrence, quantity, and quality of these supplies are controlled by both the unconsolidated surficial deposits and the bedrock formations of the area.

Except for stratified gravel and sand outwash and deltaic deposits, the surficial deposits of till, lacustrine sediments, and alluvium yield relatively small amounts of water. (See figure 20.) The stratified deposits of gravel and sand offer the best possibilities for the development of large supplies. The average yield of properly constructed wells is about 100 gallons per minute. It is believed that relatively shallow wells yield much larger quantities with modern methods of well construction and development (*4*).

The ground water in the bedrock in Washington County is contained mainly in joints and cleavage cracks. Although the bedrock generally yields only small supplies of ground water, water of satisfactory quality and sufficient quantity for domestic and farm use can be obtained almost everywhere in the county from drilled wells that penetrate the bedrock. The average yield of 231 wells for which records were collected is 9 gallons per minute (*4*). The average depth of these wells is 144 feet, but ranges from as little as 40 feet to 990 feet. Some of the water from limestone is hard and contains iron, hydrogen sulfide, and other minerals in troublesome amounts, but the water is generally satisfactory.

An estimated 4 million gallons of ground water is withdrawn daily in Washington County. Slightly more than half this amount is used for public supply. Five of nine municipalities have public systems using wells, or springs as a source. Other principal users are industrial and commercial establishments, farms, and rural homes.

[12] BRUCE A. BENTON, geologist, Soil Conservation Service, helped prepare this section.

Natural Vegetation

The original vegetation was trees. The Adirondack Mountains were covered with northern hardwoods of beech, birch, and maple and some hemlock, spruce, and white pine. The clay flats in the Hudson-Chaplain Lowland supported oak and white pine (*5*). The Taconic Uplands supported northern hardwoods, chestnut, oaks, hemlock, and white pine. White pine was the dominant tree on the sand plains and gravelly terraces. The original forests have been cut several times, and thus the original forest composition in many places has been changed.

Transportation Facilities

Transportation facilities in Washington County consist of highway systems, railroad service, the Champlain Barge Canal, and airfields. Interstate 87, the Adirondack Northway, is about 5 miles west of Hudson Falls and Fort Edward. It extends from Albany north to the Canadian border. Although it is slightly west of Washington County, it flows traffic in and out of the county. U.S. Route 4 extends from the southwestern edge and continues north diagonally to the northeastern edge, where it joins Vermont. N.Y. Route 22 runs north from New York City to the Canadian border. It extends through the entire length of Washington County. In addition, other State and county roads provide a good network of roads.

Railroads serve the manufacturing centers with rail freight. No passenger service is available at this time. The Albany to Montreal route goes through the county. It enters at Fort Edward, extends north to Whitehall, and continues north along the western shore of Lake Champlain.

The Champlain Barge Canal (fig. 22) connects the Hudson River with Lake Champlain. Fuel oil and gasoline are the main products carried. Many pleasure craft also use the canal.

A commercial airfield, the Warren County Airport at Glens Falls, is next to the western edge of Washington County. It is easily accessible to many users. Small landing fields for light planes are located at Granville in the northern part of the county and at Cambridge in the southern part.

Manufacturing and Business Services

Papermaking, machinery manufacture, and electronic component manufacture are leading industries. These industries are located in Hudson Falls, Fort Edward, and Greenwich. Slate mining (fig. 23) is a unique industry located in Granville. Slate is cut into pieces for floors and patios. Folding furniture is also made in Granville. Other industries are scattered throughout the county.

Livestock auctions in Argyle and Cambridge provide markets for all kinds of livestock. A seed-treating and packaging center for national distribution is located in Cambridge. Several sawmills purchase softwood and hardwood logs, and pulp mills in the vicinity

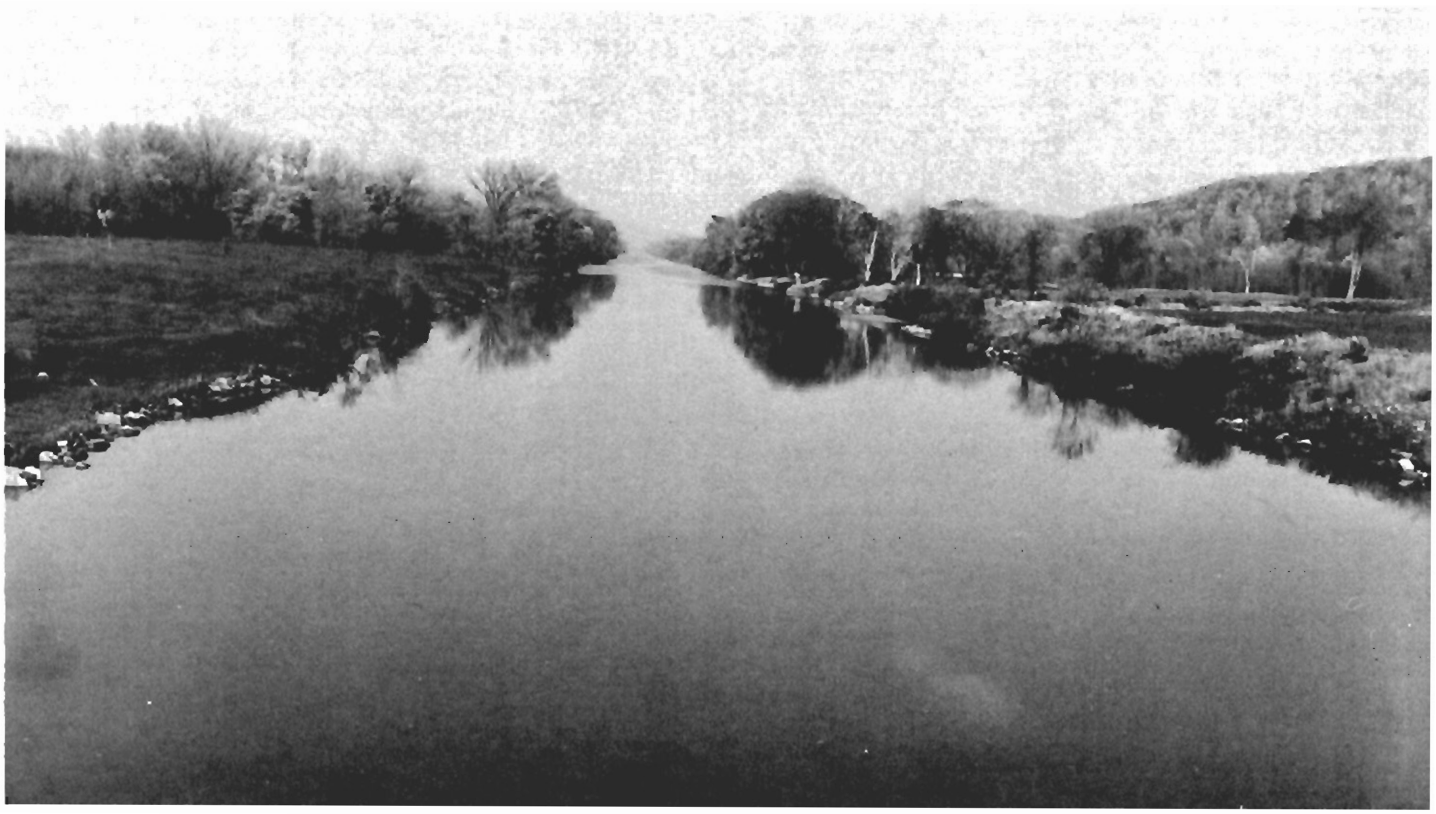

Figure 22.—**Champlain Barge Canal cuts through an area of Kingsbury and Vergennes soils. The canal connects the Hudson River and Lake Champlain.**

buy pulpwood. Washington County has many businesses that sell and service farm machinery and other farm needs.

Trends in Soil Use

The 1969 Census of Agriculture shows that 50 percent, or 267,339 acres, of Washington County is in farms. Dairying is the main type of farming, but fruit, poultry products, vegetables, potatoes, and maple syrup are also important.

As in the rest of New York State, the trend is toward a decrease in the number of farms and an increase in the average size of farms. In 1959, the 1,625 farms in Washington County averaged 216 acres per farm. The 1969 Census of Agriculture shows 1,038 farms and an average size of 258 acres. In 1959, 66 percent of the land area was in farms, compared to 50 percent in 1969. Potatoes were a major crop in the 1800's. In 1870, Washington County ranked as the leading potato-growing county in the country (*12*). Today, only a few farms grow potatoes.

The population of Washington County has shown a slight increase, from 47,376 in 1905 to 52,700 in 1970. Rapid urbanization and changes in land use have not taken place in Washington County.

Farming is concentrated mainly in the Champlain Valley, Hudson Valley, and the hilly eastern half of the county. The most stony and rocky farms have been allowed to return to forest land, and many former farms are now used as rural residences or vacation homes. No farms are in the Adirondacks. This is an isolated, forested region that has few people and few roads. The shallow, very rocky and very stony soils have always grown trees. The eastern shore of Lake George lies at the foot of the mountains. Accessible areas on Lake George have vacation resorts, homes, and summer cottages. Most of the lake frontage is not accessible by road and is an uninhabited, natural area. There is a State-owned camping site in this area that can be reached only by boat. The potential is good for additional recreational developments in other sections of the county.

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***Figure 23.*—Slate quarry in an area of Nassau soil near Granville.**

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere; but that in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Alluvial soil. Soil consisting of or deriving from alluvium.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

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.

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.

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.

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.

Delta. An alluvial deposit, formed largely beneath the water, where a stream or river drops its load of sediment on entering a body of more quiet water. Commonly triangular in shape.

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.

Drumlin (geology). A smooth, elongated hill of glacial drift, normally compact and unstratified. Commonly asymmetric in shape, having a blunt nose pointing in the direction from which the vanished glacier advanced, and a more gentle, longer slope pointing in the opposite direction.

Erodible. Susceptible to erosion.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Esker (geology). A winding, steep-walled ridge of stratified sand and gravel showing evidence of deposition by water. Eskers are only a few feet wide, but range from a fraction of a mile to more than 100 miles in length. Commonly 10 to 50 feet high, but a few range to heights of more than 100 feet.

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.

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.

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 lake. A lake that forms, after the ice has melted, in the bedrock basin from which a mountain glacier flows. Also called a *tarn.*

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glacial outwash. Stratified sand and gravel deposited by glacial melt water streams. Commonly the deposits occupy valley positions on landforms known as valley trains or outwash terraces, eskers, kames, kame terraces, and outwash fans or deltas.

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.

Glaciolacustrine deposits (geology). Material moved by glaciers, deposited in lake water, and exposed by lowering of the water level or by elevation of the land.

Graded stripcropping. Growing of crops in strips that are graded toward a protected waterway.

Grassed waterways. 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.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rains. The distinction between gully and rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by normal tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage. V-shaped gullies result if the material is more difficult to erode with depth; whereas U-shaped gullies result if the lower material is more easily eroded than that above it.

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.

Internal 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.

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, soil. Areas of soil of the same kind outlined on the soil map and identified by a symbol.

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.

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 soil material, Histosols. *Fibric material* is the least decomposed of all the organic material. It contains a large amount of fiber that is well preserved and readily identifiable as to botanical origin. It has the lowest bulk density of all the organic material and the highest water content at saturation. *Hemic material* is intermediate in degree of decomposition. It is more highly decomposed than fibric material, but less decomposed than sapric material. It is also intermediate in bulk density, fiber content, and water content at saturation. *Sapric material* is the most highly decomposed of the organic material. It also has the highest bulk density, the lowest fiber content, and the lowest water content at saturation.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Productivity (of soil). The present capability of a soil for producing a specified plant or sequence of plants under a specified system of management. It is measured in terms of output, or harvest, in relation to input of production for the specific kind of soil under a specified system of management.

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

Relief. The elevations or inequalities of a land surface, considered collectively.

Runoff (hydraulics). The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called groundwater runoff or seepage flow from ground water.

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.

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 layers between the surface layer and the substratum.

Substratum. Any layers below the surface layer and subsoil; the C or R horizons.

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. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

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."

Tier. An arbitrary division of the control section in Histosols. Classification at the suborder level is based on the kind of material in the *subsurface tier.* Classification at the subgroup level is based on the kind of material in the *bottom tier.* Classification at the series or phase level is based on the *surface tier.*

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.

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.

Varves. Distinctly marked seasonal deposits of sediment, regardless of its origin, that usually consist of two layers.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In many places an upper or perched water table is 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.

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