SOIL SURVEY

Susquehanna County Pennsylvania

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
THE PENNSYLVANIA STATE UNIVERSITY
Agricultural Experiment Station and Agricultural Extension Service
and the
PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES
State Soil and Water Conservation Commission
Issued August 1973

Major fieldwork for this soil survey was done in the period 1958–67. Soil names and descriptions were approved in 1968. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1967. This survey was made cooperatively by the Soil Conservation Service and the Pennsylvania State University, Agricultural Experiment Station and Agricultural Extension Service; and the Pennsylvania Department of Environmental Resources, State Soil and Water Conservation Commission. It is part of the technical assistance furnished to the Susquehanna County Soil and Water Conservation District.

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

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

Finding and Using Information

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

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

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

Foresters and others can refer to the section "Use of the Soils for Woodland."

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

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

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

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

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

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SOIL SURVEY OF SUSQUEHANNA COUNTY, PENNSYLVANIA

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE PENNSYLVANIA STATE UNIVERSITY, AGRICULTURAL EXPERIMENT STATION AND AGRICULTURAL EXTENSION SERVICE, AND THE PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES, STATE SOIL AND WATER CONSERVATION COMMISSION

SUSQUEHANNA COUNTY is along the New York State line in northeastern Pennsylvania (fig. 1) and is the second county west of Pennsylvania's eastern border.

The county occupies an area of 836 square miles and had a population of 33,137 in 1960. Montrose, the county seat

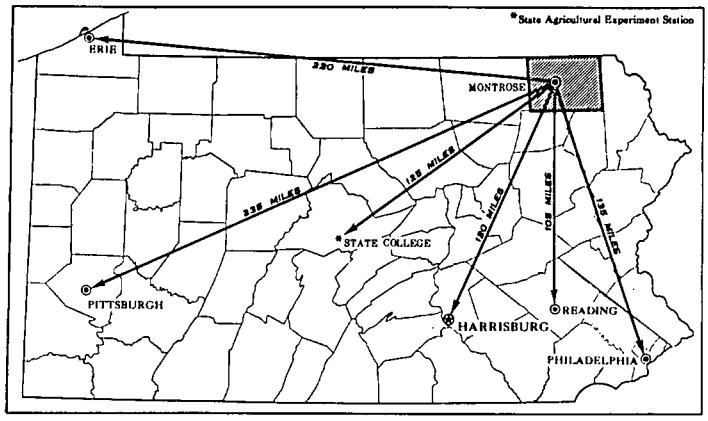

Figure 1.—**Location of Susquehanna County in Pennsylvania.**

and third largest borough, had a population of 2,363 in 1960. Forest City, the largest borough, had a population of 2,651, and Susquehanna Depot, next largest borough, had 2,591 in 1960.

Susquehanna County is part of the dissected Allegheny Plateau and has rolling hills and deeply entrenched streams. Elevation ranges from about 800 feet to about 2,700 feet. Mean annual temperature is less than 50° F. The county is drained by the Susquehanna River and by several of its tributaries.

The most extensive soils in the county are deep, gently sloping or sloping, and somewhat poorly or moderately well drained. About half the soils are used for cropland or are idle, and the other half are used for woodland. More than two-thirds of the woodland is in tracts less than 1 square mile in size.

The county has always been important for farming, but farmers are becoming fewer and farms larger. Rural nonfarmers are increasing in number and are responsible for most of the new homes built in rural areas. Dairy farming is the main type of farming in the county; beef cattle, sheep, and poultry are kept on a few farms.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Susquehanna County, where they are located, and how they can be used. The soil scientists went into the county knowing they were likely to find many soils they have already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The soil series and the soil phase are the categories of soil classification most used in a local survey (*14*).[1]

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

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such

[1] Italic numbers in parentheses refer to Literature Cited, p. 87.

differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Bath channery loam, 3 to 12 percent slopes, moderately eroded, is one of several phases within the Bath series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from the 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 other 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. One such kind of mapping unit, undifferentiated groups, is shown on the soil map of Susquehanna County.

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. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Lordstown and Oquaga channery silt loams, 3 to 12 percent slopes, moderately eroded is an example.

In most areas surveyed, there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be 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. Terrace escarpments is a land type in Susquehanna County.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are 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. Productivity ratings under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial interpretations or predictions. They test these interpretations by further study and by consultation with farmers, agronomists, engineers, and others. Then they adjust the interpretations according to the results of their studies and consultation. Thus, the interpretations 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 Susquehanna 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 showing 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 Susquehanna County are discussed in the pages that follow.

1. Volusia-Mardin association

Nearly level to sloping, somewhat poorly drained and moderately well drained soils on a dissected plateau

Rounded hilltops, sloping sides, and concave lower slopes and swales are typical of this association. Elevation ranges from 1,300 to 1,800 feet. Many natural and artificial ponds and lakes and a few continuously flowing streams are in this association. The many seasonal streams run full in spring but dry up in summer. The streambeds follow a kettle-to-kettle or swamp-to-swamp pattern near the headwaters and grade to deeply entrenched cuts near the major stream valleys. This association makes up about 20 percent of the county; it lies in the northwestern part of the county.

Volusia soils make up about 30 percent of the association. They are mainly in drainageways or on lower concave slopes. These are somewhat poorly drained soils that have a firm fragipan in the subsoil, which restricts the movement of water and the growth of roots. Seasonal wetness limits the intensity and kind of use of Volusia soils. Mardin soils make up about 20 percent of this association. They adjoin the Volusia soils on the lower slopes. Mardin soils are deeper over the fragipan and are not wet so late in spring as Volusia soils. Both major soils in this association are channery, flaggy, or very stony.

Of the soils that make up the other 50 percent of the association, the moderately deep Lordstown soils are the most common. Bath, Morris, and Wellsboro soils occur to a less extent. Very small areas of soils on flood plains are also included in this association.

The number of active farms in this association is small, and the total acreage used for farming has declined in

recent years. Cool temperatures and wet soils late in spring shorten the growing season. This association has many sites suitable for ponds and a natural potential for recreational development. Most of the area is idle or wooded and is well suited to trees. The seasonal high water table and slow permeability are limitations for most uses. Most of the association has severe limitations for septic tank disposal fields. There are many flagstone quarries.

2. *Morris-Wellsboro-Volusia association*

Gently sloping to moderately steep, somewhat poorly drained to moderately well drained soils on a dissected plateau

Rounded hilltops, sloping sides, and concave lower slopes and swales are typical of this association. Many ponds, lakes, and streams, both seasonal and continuously flowing, are in this association. Streams follow a kettle-to-kettle pattern in upstream areas and grade to deep trenches where they enter major valleys.

This association makes up about 35 percent of the county; most of it is in the southern half of the county. Soils in the southern third of the association are redder than in the northern third, and some soils north of Lakeview in the eastern part of the county are yellowish; the change is gradual and erratic.

Morris soils make up about 20 percent of the association. They are mainly in drainageways or on lower concave slopes. These are somewhat poorly drained soils that have a firm fragipan that restricts the movement of water and the penetration of roots. Seasonal wetness limits the intensity and kind of use.

Wellsboro soils make up about 20 percent of this association. They are generally upslope from the Morris and Volusia soils. They have a deeper fragipan and dry out earlier in spring than Morris and Volusia soils.

Volusia soils make up about 12 percent of the association and are similar to Morris soils, except for color. All major soils in this association are channery, flaggy, or very stony.

The minor soils that make up the remaining 48 percent of the association include Bath and Lackawanna soils that developed in glacial till on deep and moderately deep, well-drained uplands and some soils that developed in alluvial deposits.

Farming is still important in this association but has been declining. Soils in the southern part of this association warm up more quickly in spring and are more intensively farmed than soils in the northern part. A large part of this association has sites suitable for ponds. About half the area is wooded, and nearly all of it is suited to trees. Most of this association has severe limitations for many aspects of community development, particularly for onsite disposal of sewage effluent. The major limitations are a seasonal high water table and slow permeability. There are many flagstone quarries.

3. *Mardin-Volusia-Oquaga association*

Sloping to steep, somewhat poorly drained to well-drained soils on the sides and tops of hills next to major stream valleys

Viewed from roads in the bottoms of the valleys, this association appears to be made up of mountains. However, the steep slopes of the valleys were formed by streams cutting through a higher plateau, similar to associations 1 and 2; thus, there are deep valleys in the association, not high mountains. Long slopes, excessive relief, and rapid surface runoff are the chief characteristics of this association. Tributary streams cascade down these slopes into the main valley and deposit gravel fans in the bottoms. This association also includes the sloping areas and very stony areas around Elk Hill where a higher proportion of moderately deep soils are over hard bedrock. Most of this area is sodded or bushy and has several major roads and railroads.

This association makes up about 35 percent of the county and is well distributed throughout the county in long, thin, and contorted patterns.

Mardin soils, which make up about 15 percent of the association, are mainly upslope from the Volusia soils. They are moderately well drained and have a layer of friable soil material over a firm, slowly permeable fragipan. The fragipan restricts the movement of water and most roots to the permeable soil above it.

Volusia soils on the lower slopes make up about 15 percent of the association. They are somewhat poorly drained and have a fragipan in the subsoil. Wetness limits the intensity and kind of use of these soils.

Oquaga soils make up about 15 percent of the association. They are well-drained, reddish soils that have hard bedrock at a depth from 20 to 40 inches. All major soils in this association are channery, flaggy, or very stony.

The minor soils, which make up the remaining 55 percent of the association, include Chenango and Barbour soils as well as some soils that are similar to the major ones.

Not much farming is done in this association except where the areas of Chenango and Barbour soils are large enough to support a farm. Frost occurs late in spring and early in fall near the bottoms of the valleys, which are shaded in the early and late parts of the day by the valley sides. Most of this association has severe limitations for septic tank disposal fields because of slow permeability in the subsoil or restricted depth to bedrock, but Barbour soils have only slight limitations. This association also has potential for woodland and for recreation development, including ski slopes. There are many flagstone quarries.

4. *Morris-Wellsboro asssociation*

Level to sloping, somewhat poorly drained to moderately well drained soils on a high, undissected plateau

This association consists of soils on gently sloping plateaus having broad swamps, swales, and large lakes. It has subnormal relief, high elevations ranging from 1,700 to 2,100 feet, and correspondingly cool temperatures. Stream dissections are few and shallow and gradients are low. This association makes up 7 percent of the county and consists mostly of idle areas, degrading to brushland in the southeastern part of the county.

Morris soils make up about 30 percent of the association and are located in drainageways and on broad, gentle hilltops and ridgetops. They are somewhat poorly drained soils with a fragipan in the subsoil that restricts the movement of water and root penetration. Wetness limits the kind and intensity of use.

Wellsboro soils make up about 25 percent of the association. They are mainly on hillsides, lower slopes, and ridgetops. They are similar to Morris soils but have a fragipan deeper in the subsoil.

Both major soils in this association are channery, flaggy, or very stony.

Among the minor soils that make up the other 45 percent of the association are the deep, poorly drained Chippewa soils, very poorly drained Norwich soils, and the moderately deep, well-drained Oquaga and Lordstown soils.

There is not much farming in this association, because of wet soils, cold temperatures, and the short growing season. A large part of this association has sites suitable for ponds. Limitations for many aspects of community development are severe, especially for septic tank disposal fields. Major use limitations are slow permeability and a seasonal high water table.

5. *Chenango-Barbour-Volusia association*

Level to sloping, well-drained soils on flood plains and terraces, and somewhat poorly drained soils on lower valley slopes

This association (fig. 2) consists of soils on flood plains, fans, and terraces and soils that have fragipans on the lower valley sides. The elevations are less than 1,100 feet, and relief is subnormal. Many roads and boroughs of Susquehanna County are in this association. It is mostly in the northern half of the county and makes up about 3 percent of Susquehanna County.

Chenango soils make up about 30 percent of this association. They are deep, well-drained, permeable soils on terraces and alluvial fans.

Barbour soils make up about 10 percent of the association and are on flood plains and alluvial fans. These are deep, well-drained, permeable soils that are subject to flooding.

Volusia soils, which make up about 10 percent of the association, are on lower slopes at the edges of the valley bottom. They have a fragipan in the subsoil.

The other 50 percent of this association is made up mostly of soils of the Basher and Unadilla series on the low terraces and flood plains.

Figure 2.—Typical landscape in the Chenango-Barbour-Volusia association. The field in foreground is mostly Barbour fine sandy loam.

This association is well suited to farming, largely because most of the soils are deep and well drained. Frosts are likely late in spring and early in fall because of poor air drainage. For sewage effluent disposal, Chenango soils have a hazard of ground water contamination; Barbour soils have a flooding hazard; and Volusia soils have a seasonal high water table and slow permeability. Chenango soils are generally good sources of gravel.

Use and Management of the Soils

This section discusses the use and management of soils in Susquehanna County for field crops and pasture, for woodland, and for wildlife habitat. The properties and features that affect engineering practices and the limitations that affect recreation and town and country planning are enumerated, mainly in tables.

Management for Field Crops and Pasture [2]

This section explains the system of capability classification used by the Soil Conservation Service and discusses the management of soils by capability units. Estimated productivity ratings for field crops and pasture are also given.

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 requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for forest trees or engineering.

In the capability system, all kinds of soils are grouped at three levels, the capability class, subclass, and unit. These are discussed in the following paragraphs.

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

Class I soils have few limitations that restrict their use.

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

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

[2] Prepared in cooperation with Robert L. Bond, conservation agronomist, Soil Conservation Service, Harrisburg, Pa.

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, woodland, or wildlife habitat. (None in this county)

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, or water supply, or to esthetic purposes. (None in this county)

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 some parts of the United States but not in Susquehanna County, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in it are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, 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-2 or IIIs-1. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Management by capability units

In the following pages, each of the capability units in Susquehanna County is described. The names of the soil series represented are mentioned in the description of each unit, but that does not necessarily mean that all the soils of a given series are in the unit. The capability classification of each soil is given in the "Guide to Mapping Units" near the back of this survey, but Cut and fill land, which is a land type, is not given a capability classification.

Fundamental to good soil management is the selection of a suitable crop rotation and the application of conservation practices that will supplement this rotation in maintaining productivity of the soil and in controlling wetness or erosion. The practices to be applied depend on the nature of the soil and the intensity of the rotation used.

Conservation practices that can be applied on sloping soils are contour stripcropping, terracing, and establishing sod waterways. On sloping wet soils, surface water can be removed and erosion can be controlled by use of graded strips, terraces, and grassed waterways. Subsurface water can generally be removed by installing random tile drains or by digging open ditches where suitable outlets are available.

Practices to maintain and improve the organic-matter content and soil structure and to reduce erosion include the growing of winter cover crops, stubble mulching, minimum tillage, and the growing of green-manure crops. Such practices are needed most if crop rotation is intensive or cultivation is continuous. Lime and fertilizer should be applied according to the needs indicated by soil tests and according to the kind of crop to be grown.

Additional help in managing the soils can be obtained by consulting the local representatives of the Soil Conservation Service, the County Extension Service, or members of the staff of the State Agricultural Experiment Station.

CAPABILITY UNIT I–1

Barbour fine sandy loam is the only soil in this capability unit (fig. 3). It is a deep, well-drained, nearly level soil that has a very gravelly substratum. The surface layer is moderately coarse textured.

This soil has low to moderate available moisture capacity, and in many areas, deep-rooted crops are able to extract additional moisture from a water table in the substratum. The surface layer is easily worked.

This soil is suited to all crops commonly grown in the county, except those that cannot adapt to a relatively short, frost-free season. The soil is subject to flooding

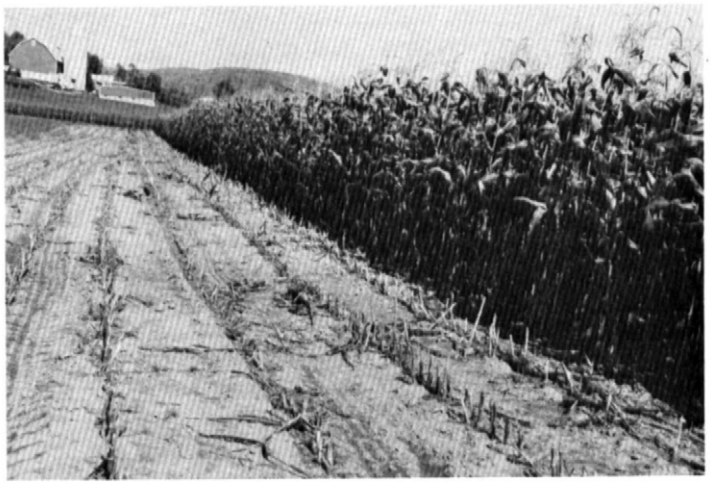

Figure 3.—**Corn in Barbour fine sandy loam, which is in capability unit I–1.**

but is seldom flooded during the cropping season. In places irrigation is practical for high-value crops. Continuous row crops can be grown without soil damage if lime and fertilizer requirements are met and organic matter and tilth are maintained.

CAPABILITY UNIT I–2

Unadilla silt loam is the only soil in this capability unit. It is a deep, well-drained, nearly level soil that developed on low terraces. The surface layer has medium texture. This soil has a high available moisture capacity.

This soil is easily tilled and is suited to all crops commonly grown in the county. Crops nearly always respond well to use of fertilizer. In places irrigation is practical on high-value crops. Continuous row crops can be grown without soil damage if lime and fertilizer requirements are met and organic matter and tilth are maintained.

CAPABILITY UNIT IIe–1

This capability unit consists of deep, well-drained, gently sloping soils of the Bath and Lackawanna series. These soils have a medium-textured surface layer. They are channery, moderately eroded, and have a moderate available moisture capacity.

The soils of this unit are easily tilled and are generally suited to all crops commonly grown in the county. The hazard of erosion is moderate if these soils are cultivated. Erosion and droughtiness can be reduced by using conservation practices, such as growing green-manure crops or cover crops and returning crop residue to the soil. In places irrigation of these soils is practical if high-value crops are grown and sufficient water is available. Stripcropping and the use of a cropping system that includes 2 years of row crops in 5 help control erosion.

CAPABILITY UNIT IIe–2

This capability unit consists of one undifferentiated mapping unit, which is Lordstown and Oquaga channery silt loams, 3 to 12 percent slopes, moderately eroded. These soils are moderately deep, well drained, and on ridgetops and benches. They have a medium-textured surface layer and are underlain by sandstone bedrock. The available moisture capacity is low.

These soils are easily tilled and are suited to all crops commonly grown in the county. The hazard of erosion is moderate if the soils are cultivated. Some droughtiness affects crops, even in normal years. Crops subject to frost heaving, such as alfalfa, are suited to this soil. The available moisture capacity and fertilizer holding capacity can be increased by conservation practices, such as returning crop residue to the soil and growing cover crops and green-manure crops. Stripcropping and using a cropping system that includes 2 years of row crops in each 5 years help control erosion.

CAPABILITY UNIT IIw–1

Basher silt loam is the only soil in this capability unit. It is a deep, moderately well drained soil that developed in alluvial deposits along many streams. It has a medium-textured surface layer.

This soil has high available moisture capacity, and deep-rooted crops are often able to extract additional moisture from a water table in the substratum.

This soil is generally suited to all crops commonly grown in the county, except the more frost-susceptible ones. It is subject to flooding and retains a high water table after flooding recedes. Plants grow slowly in spring because this soil is usually cold and wet at that time. Wet spots can be tile-drained if outlets are available. Crops are seldom damaged by flooding, but spring plowing should be delayed until the major part of the flooding season has passed. Continuous row crops can be grown without soil damage if lime and fertilizer requirements are met and organic matter and tilth are maintained.

CAPABILITY UNIT IIw–2

This capability unit consists of deep, moderately well drained, gently sloping, channery soils of the Wellsboro and Mardin series (fig. 4). These soils are generally on lower slopes and knolls. They have a medium-textured surface layer that has been moderately eroded. They also have a firm fragipan in the subsoil that restricts the movement of water and growth of roots. Available moisture capacity is moderate.

The soils in this unit are easily tilled and are generally suited to all crops commonly grown in the county. A seasonal high water table in the subsoil makes it difficult for roots to function in this layer during wet seasons. These soils are usually too wet for tillage and too cold for plant growth before May. It may be practical to drain wet spots in this soil by tile, or to divert surface water. Stripcropping and a cropping system that includes 3 years of row crops in 5 will help control erosion. On long slopes, diversions are helpful in controlling surface runoff.

CAPABILITY UNIT IIs–1

This capability unit consists of nearly level and gently sloping Chenango soils on outwash terraces and alluvial fans. These soils are deep, well-drained, and have a gravelly, medium-textured surface layer. They have a low available moisture capacity, but roots, especially those of alfalfa, penetrate very deeply and in places tap ground water in the substratum.

These soils are easily tilled and are suited to all crops commonly grown in the county, except shallow-rooted crops, such as oats and Ladino clover, which are affected by drought in normal summers. Capacity for available moisture and plant nutrient storage is improved by returning crop residue to the soil. Split applications of fertilizer reduce the loss of fertilizer elements by leaching. In places irrigation is practical for high-value crops, but applications of water should be small and frequent because of the low available moisture capacity.

Continuous row crops can be grown on this soil if lime and fertilizer requirements are met and organic-matter content and tilth are maintained.

CAPABILITY UNIT IIIe–1

Deep, well-drained, moderately eroded, sloping soils of the Bath, Chenango, and Lackawanna series are in this capability unit. These soils have a medium-textured surface layer. Bath and Lackawanna soils are channery, have a moderate available moisture capacity, and are on upper hillsides, knobs, and ridges. Chenango soil is a gravelly soil on outwash terraces. It has low available moisture capacity.

Figure 4.—In foreground and in right background is Mardin channery silt loam, 3 to 8 percent slopes, moderately eroded, which is in capability unit IIw–2. The soil in the field at the edge of the woods is Mardin channery silt loam, 15 to 25 percent slopes, moderately eroded, which is in capability unit IVe–2.

These soils are easily tilled and are generally suited to all crops commonly grown in the county. The hazard of erosion is high if the soils are cultivated. Erosion and droughtiness can be reduced by using conservation practices, such as growing cover crops and returning crop residue to the soil. The use of stripcropping and a cropping system that includes 1 year of a row crop in 5 will help control erosion. Where Chenango soil receives runoff water from upslope, diversions are necessary in many places.

CAPABILITY UNIT IIIe–2

This unit consists of deep, moderately well drained, sloping, channery soils of the Mardin and Wellsboro series on hillsides and lower slopes. These soils have a medium-textured, channery (fig. 5) surface layer that has been moderately eroded. A firm fragipan in the lower part of the subsoil restricts the movement of water and the growth of roots. Available moisture capacity is moderate.

The soils of this unit are easily tilled and are generally suited to all crops commonly grown in the county. The hazard of erosion is high if these soils are cultivated. A seasonal high water table restricts the growth of roots during wet seasons. These soils are usually too wet for tillage and too cold for much plant growth before mid-April. It is sometimes practical to tile-drain wet spots. Runoff, especially from heavy summer rains, can deplete topdressed fertilizer. Using stripcropping and a cropping system that includes 1 year of a row crop in 5 will help to control erosion. On long slopes diversions may also be needed.

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CAPABILITY UNIT IIIe–3

This unit consists of one undifferentiated mapping unit, which is Lordstown and Oquaga channery silt loams, 12 to 20 percent slopes, moderately eroded. These soils are on the upper parts of ridges. They have a medium-textured, channery surface layer. They are underlain by solid sandstone bedrock at depths ranging from 20 to 40 inches. Available moisture capacity is low.

Figure 5.—A cultivated area of Wellsboro channery silt loam, 8 to 15 percent slopes, moderately eroded, which is in capability unit IIIe–2. Numerous channery sandstone fragments and flagstones are on the surface.

The soils in this unit are easily tilled and are suited to all crops commonly grown in the county. The hazard of erosion is high if these soils are cultivated. Some droughtiness affects shallow-rooted crops, such as oats and Ladino clover. The available moisture capacity and fertilizer storage capacity of the soils can be increased by conservation practices, such as returning crop residue to the soil and growing cover crops. Topdressed fertilizer can be lost by runoff from heavy summer rains. Using stripcropping and a cropping system that includes 1 year of a row crop in 5 will help control erosion.

CAPABILITY UNIT IIIe–4

This capability unit consists of deep, somewhat poorly drained, sloping, channery soils of the Morris and Volusia series; they are generally on lower slopes. These soils have a medium-textured surface layer that has been moderately eroded. A firm fragipan in the subsoil restricts the movement of water and the growth of roots. Available moisture capacity is moderate. The hazard of erosion is high if the soils are cultivated.

These soils are suited to water-tolerant crops, such as birdsfoot trefoil, and to most grasses. Alfalfa is poorly suited because of frost heaving. These soils are usually too wet for tillage and too cold for much plant growth before May. Diversions, however, can remove much of the seepage that keeps these soils wet. Stripcropping and a cropping system that includes 1 year of a row crop in 5 will help control erosion. Diversions are generally needed for erosion control on longer slopes.

CAPABILITY UNIT IIIw–1

This capability unit consists of deep, somewhat poorly drained, nearly level and gently sloping, channery soils of the Morris and Volusia series in upland depressions and on broad hilltops. These soils have a medium-textured surface layer that has been moderately eroded. A firm fragipan in the subsoil restricts the movement of water and the growth of roots and causes a seasonal high water table. Available moisture capacity is moderate.

The soils of this unit are easily tilled and are suited to water-tolerant crops, such as birdsfoot trefoil, and to most grasses. It is not practical to grow alfalfa on these soils because of frost heaving. The soil is usually too wet for tillage and too cold for much plant growth before June. Diversions improve drainage by carrying off the seepage that keeps these soils wet; interceptor tile are also used. Damaging erosion can be controlled by graded stripcropping and a cropping system that includes 1 year of row crops in 5. Sometimes diversions are also necessary on long slopes.

CAPABILITY UNIT IIIs–1

Well-drained, gently sloping, flaggy soils of the Bath, Lackawanna, Lordstown, and Oquaga series are in this capability unit. They are on ridgetops and benches. These soils have a medium-textured surface layer. Available moisture capacity is low to moderate.

The soils of this unit are suited to all crops commonly grown in the county. However, flagstones interfere with tillage and cause excessive wear on machinery. The Lordstown and Oquaga soils tend to be droughty but can be improved by conservation practices, such as returning crop residue to the soil and growing cover crops. Stripcropping and a system that includes 1 year of a row crop in 5 will help to control erosion.

CAPABILITY UNIT IIIs–2

This capability unit consists of deep, gently sloping, flaggy soils of the Mardin and Wellsboro series. These soils are mostly on lower slopes and ridgetops. They are moderately well drained and moderately eroded. A firm fragipan in the lower part of the subsoil restricts the movement of water and the growth of roots and causes a seasonal high water table. These soils have a moderate inherent fertility.

Sandstone fragments and flagstones make tillage difficult and cause excessive wear on machinery, and the flagstones make frequent tillage impractical. The soils of this unit are suited to all crops common to the county, but growing crops subject to frost heaving is sometimes not practical on some of these soils unless they are drained by tile or diversions. These soils are usually too wet for tillage and too cold for much plant growth before May. The use of stripcropping and a cropping system that includes 1 year of a row crop in 5 will help control erosion.

CAPABILITY UNIT IVe–1

This capability unit consists of deep, well-drained, moderately steep, gravelly Chenango soil on outwash terraces and channery Lackawanna soil on the sides of ridges and hills. Both soils have a medium-textured surface layer. Chenango soil has low available moisture capacity; Lackawanna soil has moderate. The hazard of erosion is high if the soils are cultivated.

The steepness of slopes makes tillage difficult. The soils of this unit are suited to small grain, hay, and pasture crops. Large amounts of topdressed fertilizer can be lost by runoff, especially from heavy summer rains. Erosion can be controlled by the use of stripcropping and a cropping system that includes row crops only occasionally.

CAPABILITY UNIT IVe–2

This capability unit consists of deep, moderately well drained, moderately steep, channery soils of the Mardin and Wellsboro series. These soils are on hillsides (see fig. 4, p. 7). They have a medium-textured surface layer and moderate available moisture capacity. A firm fragipan in the lower part of the subsoil restricts the movement of water and the growth of roots. The hazard of erosion is high if the soils are cultivated. The slope makes tillage difficult.

These soils are suited to most small grain, pasture, and hay crops. Large amounts of topdressed fertilizer can be lost by runoff water, especially from heavy summer rains. Stripcropping and a cropping system that includes row crops only occasionally will help control erosion.

CAPABILITY UNIT IVe–3

This capability unit consists of one undifferentiated mapping unit, which is Lordstown and Oquaga channery silt loams, 20 to 30 percent slopes, moderately eroded. These soils are on convex sides of ridges. They have a medium-textured, channery surface layer and are underlain by solid sandstone bedrock at depths ranging from

20 to 40 inches. Available moisture capacity is low. The hazard of erosion is high if the soils are cultivated. Steepness of slope makes tillage difficult.

The soils in this unit are suited to most pasture and hay crops commonly grown in the county. They are not well suited to shallow-rooted crops. Large amounts of topdressed fertilizer can be lost from runoff water. Erosion can be controlled by growing hay or pasture crops and by periodic reseeding of a row crop and small grain.

CAPABILITY UNIT IVe-4

This capability unit consists of well-drained, flaggy, moderately steep soils of the Bath, Lackawanna, Lordstown, and Oquaga series. These soils are on convex sides of ridges and hills. These soils have a medium-textured surface layer that has been moderately eroded. The surface is cluttered with sandstone fragments and flagstones. The soils have a low or moderate available moisture capacity. The hazard of erosion is high if the soils are cultivated. The steepness of slope and amount of coarse fragments make tillage difficult.

These soils are best suited to long-term pasture or hay crops, including alfalfa; they may be cropped more intensively if slope and coarse fragments permit more frequent tillage. Large amounts of topdressed fertilizer can be lost from runoff water. Erosion can be controlled by growing hay or pasture crops or periodic reseeding to a row crop and small grain.

CAPABILITY UNIT IVe-5

This unit consists of deep, moderately steep, flaggy soils of the Mardin and Wellsboro series and moderately steep channery soil of the Volusia series. The Wellsboro and Mardin soils are moderately well drained, and the Volusia soil is somewhat poorly drained. All the soils have a medium-textured, moderately eroded surface layer. A fragipan in the subsoil restricts the movement of water and the growth of roots and causes a seasonal high water table. These soils have moderate available moisture capacity. The hazard of erosion is high if the soils are cultivated.

These soils are suited to small grain, pasture, and hay crops that are not affected by seasonal wetness. They are better suited to long-term hay crops or to pasture than to other crops. In many places they are not suited to crops that are subject to frost heaving.

These soils are usually too wet for tillage and too cold for plant growth early in spring. Diversions improve drainage by removing excess water. Erosion can be controlled if the cropping system includes row crops only occasionally. The flagstones and moderately steep slopes make frequent tillage impractical.

CAPABILITY UNIT IVw-1

Wyalusing silt loam is the only soil in this capability unit. It is a deep, poorly drained, nearly level soil on flood plains. The surface layer has a medium texture. The soil generally has sand or gravel in the substratum. The available moisture capacity is high.

This soil is easily tilled and is suited to the common water-tolerant crops, such as birdsfoot trefoil and most grasses. It is not practical to grow alfalfa on this soil because of frost heaving. This soil is often too wet to work or to traverse. If suitable outlets are available, this soil may be tile drained. It is well suited to hay and pasture in dry years and to continuous row crops if artificially drained and fertilized as required.

CAPABILITY UNIT IVw-2

This capability unit consists of nearly level and gently sloping, poorly and very poorly drained soils of the Chippewa and Norwich series. These soils have a medium-textured or fine-textured surface layer and are on lower slopes and in upland depressional areas. A firm fragipan in the subsoil restricts the movement of water and the growth of roots and causes a high water table early in spring, late in fall, and in winter. The available moisture capacity is moderate to low.

These soils are suited to water-tolerant pasture and hay crops; growing alfalfa is not practical. The soil is usually too wet for tillage and too cold for plant growth before mid-June. Seepage can be reduced on these soils if water diversions are used. Drainage can be improved by open surface drains if outlets are available, but installation of drains to permit production of cultivated crops generally is not feasible.

CAPABILITY UNIT IVs-1

This capability unit consists of moderately well drained and well drained, sloping, flaggy soils of the Bath, Lackawanna, Lordstown, Mardin, Oquaga, and Wellsboro series. These soils have a medium-textured surface layer and are moderately eroded. The movement of water and the growth of roots are restricted by bedrock, which is at depths of 20 to 40 inches in Lordstown and Oquaga soils and by a fragipan in the lower part of the subsoil in the Bath, Lackawanna, Mardin, and Wellsboro soils. The soils have low to moderate available moisture capacity. Sandstone fragments and flagstones make tillage difficult and cause excessive wear on machinery.

The soils of this unit are suited to all crops common to the county. Some crops are subject to frost heaving on Mardin and Wellsboro soils. Erosion can be controlled by graded stripcropping and if the cropping system includes 1 year of a row crop in 5. However, flagstones make frequent tillage impractical.

CAPABILITY UNIT IVs-2

Deep, somewhat poorly drained, gently sloping and sloping, flaggy soils of the Morris and Volusia series are in this capability unit. They have a medium-textured surface layer, but sandstone fragments and flagstones are on the surface. A firm fragipan in the subsoil restricts the movement of water and the growth of roots and causes a seasonal high water table. The soils have a moderate available moisture capacity. The sandstone fragments and flagstones make tillage difficult and cause excessive wear on machinery.

The soils of this unit are suited to most common water-tolerant crops. These crops include birdsfoot trefoil and most grasses, but alfalfa is not suited because it is subject to frost heaving. These soils are usually too wet for tillage and too cold for much plant growth before mid-May. In places draining wet spots in this soil by tile or removing excess water by diversions is practical. Graded

stripcropping and a cropping system that includes 1 year of a row crop in 5 will help control erosion. However, the flagstones make frequent tillage impractical.

CAPABILITY UNIT VIw–1

Holly silt loam is the only soil in this capability unit. This soil is on flood plains or in upland depressions. It is deep, poorly drained, and has a medium-textured surface layer. This soil is subject to flooding, and the water level is usually within 6 inches of the surface early in spring, late in fall, and in winter. It has a high available moisture capacity.

This soil is poorly suited to crops because of wetness but is suited to water-tolerant pasture grasses, such as reed canarygrass.

CAPABILITY UNIT VIs–1

This capability unit consists of very stony, nearly level to moderately steep soils of the Bath, Lackawanna, Lordstown, Mardin, Oquaga, and Wellsboro series.

Most of these soils are wooded and, even if cleared, are too stony to cultivate. They can be used for improved pasture occasionally but only if enough stones are removed to permit liming and mowing. They are suited to permanent pasture if they are not too stony to be limed and fertilized. If cleared, the steeper slopes have a high hazard of erosion and should be seeded as soon as possible. Clearing these soils, however, is seldom practical.

CAPABILITY UNIT VIs–2

This unit consists of deep, medium-textured, somewhat poorly drained, moderately steep, flaggy soils of the Morris and Volusia series. A firm fragipan in the subsoil restricts the movement of water and growth of roots and causes a seasonal high water table. These soils have a moderate available moisture capacity. The steepness of these soils and flagstones on the surface make tillage difficult.

The soils of this unit are suited to pasture crops that are tolerant of wetness. Alfalfa is generally not suitable because of frost heaving. These soils are usually too wet for tillage and too cold for much plant growth before mid-April. The hazard of erosion is high on this soil, but controlled grazing and other pasture management practices that will reduce the need for renovation will help to control erosion.

CAPABILITY UNIT VIs–3

This capability unit consists of Mixed alluvial land, which is a miscellaneous land type. This land type is subject to stream overflow, is too gullied, or too gravelly and cobbly for tillage or cropping. However, it is suited to

TABLE 1.—*Estimated productivity ratings for soils used for*

[In columns A are productivity ratings for normal management, and in columns B are ratings for improved management.

Soils	Corn (100=85 bu. grain or 17 tons silage per acre)		Oats (100=60 bu. per acre)	
	A	B	A	B
Barbour fine sandy loam	100	130	100	125
Basher silt loam	85	125	90	115
Bath channery loam, 3 to 12 percent slopes, moderately eroded	75	120	90	115
Bath channery loam, 12 to 20 percent slopes, moderately eroded	70	115	85	110
Bath flaggy loam, 3 to 12 percent slopes, moderately eroded	65	105	85	110
Bath flaggy loam, 12 to 20 percent slopes, moderately eroded	60	100	75	100
Bath flaggy loam, 20 to 30 percent slopes, moderately eroded			75	100
Bath very stony loam, 0 to 12 percent slopes				
Bath very stony loam, 12 to 30 percent slopes				
Bath very stony loam, 30 to 60 percent slopes				
Chenango gravelly silt loam, 0 to 3 percent slopes	95	125	100	125
Chenango gravelly silt loam, 3 to 12 percent slopes, moderately eroded	75	120	90	115
Chenango gravelly silt loam, 12 to 20 percent slopes, moderately eroded	70	115	85	110
Chenango gravelly silt loam, 20 to 30 percent slopes, moderately eroded	70	95	85	100
Cut and fill land				
Holly silt loam				
Lackawanna channery silt loam, 3 to 12 percent slopes, moderately eroded	75	120	85	115
Lackawanna channery silt loam, 12 to 20 percent slopes, moderately eroded	70	115	85	110
Lackawanna channery silt loam, 20 to 30 percent slopes, moderately eroded	70	105	85	110
Lackawanna flaggy silt loam, 3 to 12 percent slopes	65	105	85	110
Lackawanna flaggy silt loam, 12 to 20 percent slopes, moderately eroded	60	100	75	100
Lackawanna flaggy silt loam, 20 to 30 percent slopes, moderately eroded			75	100
Lackawanna very stony silt loam, 0 to 12 percent slopes				
Lackawanna very stony silt loam, 12 to 30 percent slopes				

See footnote at end of table.

permanent pasture where it is not too cobbly or cut up by stream channels for liming and fertilizing. Generally, it is difficult to establish satisfactory stands of grasses and legumes on this land type by conventional methods.

CAPABILITY UNIT VIIc-1

This capability unit consists of Terrace escarpments. This land type is very steep and droughty.

These Terrace escarpments normally support little or no vegetation. Some areas can be planted to trees suitable to the site. To control erosion, vegetation should be maintained on this land type wherever possible.

CAPABILITY UNIT VIIw-1

This capability unit consists of Peat. This deep, very poorly drained organic material is continually flooded and unsuitable for farm use unless it is drained. However, draining these areas is generally not practical because subsidence is so great after drainage that lower outlets must be installed periodically to keep them drained. It is more suitable for wetland wildlife habitat.

CAPABILITY UNIT VIIs-1

This capability unit consists of steep and very steep, very stony soils of the Bath, Lackawanna, Lordstown, Mardin, Oquaga, and Wellsboro series.

These soils are mostly wooded and are best suited to this use. It is not practical to clear these soils because of steepness, wetness, and stoniness.

CAPABILITY UNIT VIIs-2

This capability unit consists of deep, nearly level to moderately steep, very stony, somewhat poorly drained to very poorly drained Chippewa, Morris, Norwich, and Volusia soils.

Most of the soils in this unit are wooded and, even if cleared, are too stony to cultivate. Permanent pasture can be maintained where these soils are not too stony to be limed and fertilized. Some areas of these soils can be used for improved pasture only if enough stones are removed to permit liming and mowing.

Productivity ratings

Table 1 shows estimated productivity ratings for most field crops and pasture grown in the county. These predictions are averages for a period of 10 years or more. Each rating denotes the productivity of the soil for a given crop in relation to a standard index of 100. The standard index represents the average yield per acre obtained on the more productive soils in the county. The average yield per acre represented by the standard index

field and forage crops at two levels of management

The absence of data indicates that the soil is not suited to the specified crop at the specified level of management]

Hay				Pasture			
Alfalfa-grass (100=3.0 tons per acre)		Grass-legume (other than alfalfa) (100=2.5 tons per acre)		Bluegrass (100=100 cow-acre-days [1])		Tall grass (100=100 cow-acre-days [1])	
A	B	A	B	A	B	A	B
100	135	100	140	100	160	150	230
85	115	100	140	100	160	125	200
85	135	80	140	80	160	125	230
80	135	75	140	75	160	120	230
75	125	70	130	70	150	115	215
75	125	70	130	70	150	110	215
65	115	60	110	60	130	100	195
				65	120		
				55	100		
100	135	100	140	100	160	150	230
85	135	80	125	80	145	125	230
80	135	75	120	75	140	120	230
75	115	75	110	75	130	115	200
				50	70		
85	135	80	140	80	160	125	230
80	135	75	140	75	160	120	230
80	125	75	130	75	150	120	215
75	125	70	130	70	150	115	215
75	125	70	130	70	150	110	215
65	115	60	110	60	130	100	195
				65	120		
				55	100		

TABLE 1.—*Estimated productivity ratings for soils used for*

Soils	Corn (100=85 bu. grain or 17 tons silage per acre)		Oats (100=60 bu. per acre)	
	A	B	A	B
Lackawanna very stony silt loam, 30 to 50 percent slopes				
Lordstown and Oquaga channery silt loams, 3 to 12 percent slopes, moderately eroded	50	95	65	115
Lordstown and Oquaga channery silt loams, 12 to 20 percent slopes, moderately eroded	45	95	60	110
Lordstown and Oquaga channery silt loams, 20 to 30 percent slopes, moderately eroded	35	90	60	100
Lordstown and Oquaga flaggy silt loams, 3 to 12 percent slopes	45	85	60	110
Lordstown and Oquaga flaggy silt loams, 12 to 20 percent slopes, moderately eroded	35	75	50	100
Lordstown and Oquaga flaggy silt loams, 20 to 30 percent slopes, moderately eroded			50	90
Lordstown and Oquaga very stony silt loams, 0 to 12 percent slopes				
Lordstown and Oquaga very stony silt loams, 12 to 30 percent slopes				
Lordstown and Oquaga very stony silt loams, 30 to 70 percent slopes				
Mardin channery silt loam, 3 to 8 percent slopes, moderately eroded	65	105	75	110
Mardin channery silt loam, 8 to 15 percent slopes, moderately eroded	60	100	75	100
Mardin channery silt loam, 15 to 25 percent slopes, moderately eroded	60	95	65	100
Mardin flaggy silt loam, 3 to 8 percent slopes, moderately eroded	60	95	65	100
Mardin flaggy silt loam, 8 to 15 percent slopes, moderately eroded	55	90	65	90
Mardin flaggy silt loam, 15 to 25 percent slopes, moderately eroded			60	85
Mardin very stony silt loam, 0 to 8 percent slopes				
Mardin very stony silt loam, 8 to 25 percent slopes				
Mardin very stony silt loam, 25 to 50 percent slopes				
Mixed alluvial land				
Morris channery silt loam, 0 to 3 percent slopes	50	90	60	100
Morris channery silt loam, 3 to 8 percent slopes, moderately eroded	55	90	60	100
Morris channery silt loam, 8 to 15 percent slopes, moderately eroded	55	75	50	90
Morris flaggy silt loam, 3 to 8 percent slopes, moderately eroded	50	75	50	90
Morris flaggy silt loam, 8 to 15 percent slopes, moderately eroded	50	70	45	85
Morris flaggy silt loam, 15 to 25 percent slopes, moderately eroded				
Morris very stony silt loam, 0 to 8 percent slopes				
Morris very stony silt loam, 8 to 25 percent slopes				
Norwich and Chippewa soils, 0 to 3 percent slopes				
Norwich and Chippewa soils, 3 to 8 percent slopes				
Norwich and Chippewa very stony soils, 0 to 8 percent slopes				
Peat				
Terrace escarpments				
Unadilla silt loam	90	125	90	125
Volusia channery silt loam, 0 to 3 percent slopes	50	90	60	100
Volusia channery silt loam, 3 to 8 percent slopes, moderately eroded	55	90	60	100
Volusia channery silt loam, 8 to 15 percent slopes, moderately eroded	55	75	50	90
Volusia channery silt loam, 15 to 25 percent slopes, moderately eroded	50	70	50	90
Volusia flaggy silt loam, 3 to 8 percent slopes	50	75	50	90
Volusia flaggy silt loam, 8 to 15 percent slopes	50	70	45	85
Volusia flaggy silt loam, 15 to 25 percent slopes				
Volusia very stony silt loam, 0 to 8 percent slopes				
Volusia very stony silt loam, 8 to 25 percent slopes				
Wellsboro channery silt loam, 3 to 8 percent slopes, moderately eroded	65	105	75	110
Wellsboro channery silt loam, 8 to 15 percent slopes, moderately eroded	60	100	75	100
Wellsboro channery silt loam, 15 to 25 percent slopes, moderately eroded	60	95	65	90
Wellsboro flaggy silt loam, 3 to 8 percent slopes, moderately eroded	60	95	65	100
Wellsboro flaggy silt loam, 8 to 15 percent slopes, moderately eroded	55	90	65	90
Wellsboro flaggy silt loam, 15 to 25 percent slopes, moderately eroded			60	85
Wellsboro very stony silt loam, 0 to 8 percent slopes				
Wellsboro very stony silt loam, 8 to 25 percent slopes				
Wellsboro very stony silt loam, 25 to 50 percent slopes				
Wyalusing silt loam	65	95	60	85

[1] Cow-acre-days is a term used to express the carrying capacity of pasture. It is the number of animal units carried per acre multiplied by the number of days the pasture is grazed during a single grazing season without injury to the sod. An acre of pasture that provides 30

field and forage crops at two levels of management—Continued

Hay				Pasture			
Alfalfa-grass (100=3.0 tons per acre)		Grass-legume (other than alfalfa) (100=2.5 tons per acre)		Bluegrass (100=100 cow-acre-days [1])		Tall grass (100=100 cow-acre-days [1])	
A	B	A	B	A	B	A	B
65	105	70	110	70	130	100	180
65	105	70	105	65	125	95	175
55	95	55	105	55	120	85	160
65	95	70	105	70	125	95	165
60	95	65	105	65	120	90	160
55	80	50	90	50	105	80	135
				55	95		
				45	80		
65	120	70	135	70	155	100	205
65	115	70	130	70	150	95	200
65	110	70	125	65	145	95	190
65	110	70	110	70	130	95	190
60	105	65	105	65	125	90	180
60	105	65	105	65	120	90	175
				55	95		
				50	85		
				50	90		
		60	115	60	135	75	170
		60	115	60	135	75	170
		60	115	60	130	75	165
		55	110	55	130	70	160
		55	105	55	125	70	155
				50	105		
				40	100		
				40	100		
90	135	100	140	100	160	135	230
		60	115	60	135	75	170
		60	115	60	135	75	170
		60	115	60	130	75	165
		55	110	55	130	70	160
		55	110	55	130	70	160
		55	105	55	125	70	155
				50	100		
65	120	70	135	70	155	100	205
65	115	70	130	70	150	95	200
65	110	70	125	70	145	95	190
65	110	70	110	70	130	95	190
60	105	65	105	65	125	90	180
60	105	65	105	65	120	90	175
				55	95		
				50	85		
		80	115	80	135	100	170

[1] days of grazing for 2 cows has a carrying capacity of 60 cow-acre-days.

is given at the head of the columns of each crop. The ratings are based on yields of crops during the growing seasons when the soil survey was made.

The predicted productivity ratings are given under two levels of management. In columns A are the ratings to be expected under the average management commonly practiced. The improved management indicated in columns B is based on the assumption that farmers use most of the suited crop varieties, fertilizer rates according to the results of soil tests, and measures that control insects and plant diseases. The management practices are applied at the proper time and in such a way as to be effective. Among other soil and water conservation measures are minimum tillage, contour tillage, stripcropping, crop-residue management, diversions, drainage, and waterways.

Irrigation is not considered in arriving at these yields. The yields in columns B are not intended to be maximum yields obtainable; they vary for the different soils but usually represent an increase over present average yields for the county.

A rating of 50 indicates that the soil is only about half as productive for the specified crop as a soil with the index of 100; however, a rating of more than 100 can be assigned to some soils.

Bath channery loam, 3 to 12 percent slopes, moderately eroded, for example, has a normal management rating of 75 for corn, 90 for oats, 85 for alfalfa-grass hay, 80 for grass-legume hay, 80 for bluegrass pasture, and 125 for tall-grass pasture. Consequently, under the normal or prevailing level of management one can expect to obtain yields per acre of 12.8 tons of corn silage, 54 bushels of oats, 2.6 tons of alfalfa-grass hay, 2.0 tons of grass-legume hay, 80 cow-acre-days of bluegrass pasture, and 125 cow-acre-days of tall-grass pasture.

Under improved management this same soil has a productivity rating of 120 for corn, 115 for oats, 135 for alfalfa-grass hay, 140 for grass-legume hay, 160 for bluegrass pasture, and 230 for tall-grass pasture. This means that yields per acre under improved management may equal 20 tons of corn silage, 69 bushels of oats, 4 tons of alfalfa-grass hay, 4 tons of grass-legume hay, 160 cow-acre-days of bluegrass pasture, and 230 cow-acre-days of tall-grass pasture.

Use of the Soils for Woodland [3]

Susquehanna County originally had a dense cover of trees, but clearing for farms and cutting for commercial purposes eliminated nearly all of the virgin stands of timber. Now the commercial woodland, which occupies more than 40 percent of the land area, consists of second- and third-growth stands (fig. 6). The principal forest types (*11*) that make up the present woodland in this county, as given by the U.S. Forest Service (*16*), are the sugar maple-beech-yellow birch, the hemlock, and the aspen-gray birch.

The sugar maple-beech-yellow birch forest type consists dominantly of sugar maple, beech, and yellow birch, but associated with these are varying admixtures of basswood, red maple, hemlock, northern red oak, ash, white pine, black cherry, black birch, and paper birch. This forest type makes up 78 percent of the total woodland in the county.

Figure 6.—Good growth of trees typical of the stands in Susquehanna County.

The hemlock forest type consists either of pure stands of eastern hemlock or stands that are predominantly eastern hemlock. Among the associated species are beech, sugar maple, yellow birch, basswood, ash, red maple, black cherry, and black birch. This forest type makes up 6 percent of the total woodland in this county.

The aspen-gray birch forest type consists predominantly of a mixture of quaking aspen, bigtooth aspen, and gray birch. The principal associated species are pin cherry, red maple, yellow birch, paper birch, white pine, ash, and sugar maple. This forest type makes up 8 percent of the total woodland in this county.

Other forest types make up the remaining 8 percent of the total woodland in this county.

Sawtimber makes up approximately 18 percent of the acreage in commercial forests; poletimber makes up 56 percent; and seedlings and saplings make up the rest in woodland (*11*).

In general the soils in this county are capable of supporting a good growth of sugar maple, black cherry, ash, and red oak. At the present time, however, the stands in

[3] By V. C. Miles, woodland specialist, Soil Conservation Service.

many wooded areas are made up predominantly of red maple and beech. Trees grow slowly on the shallow soils and on the deep, very poorly drained soils.

A landowner can encourage the more desirable kinds of trees to grow in his woodland by using good woodland management. The soils and the climate are favorable, and help in planning a program of woodland improvement can be obtained from local technicians. The effort the landowner is willing to make toward improving his woodland probably depends on general economic conditions.

The returns from soils which are *excellent*, *very good*, or *good* growing sites will generally justify the expenditure of money for management purposes. However, consideration should be given to the potential yield, quality of the particular species growing on the site, and the market potential. The species and proportion of poor quality stems growing on such sites may prohibit the investment of money for management purposes. Also, the conversion of such areas from their present state to their potential capacity may not be economically justifiable.

Soils which are *fair* growing sites are the most difficult to appraise for management. A thorough appraisal of the woodland as to species and quality on the site is essential. Also, the market possibility should be investigated. A proper analysis of all these interrelated factors is essential to determine the intensity of management.

The returns from the soils that are *poor* growing sites generally will not economically justify management for the production of wood products. However, woodland is, in most cases, the most practical land use for these soils. Because of unfavorable soil characteristics, these soils will generally not show a profitable return if used for crops or grass. Although returns may be slight to none for woodland, this land use is the most economical.

Eighteen percent of the existing woodland in the county is on soils that are excellent woodland sites. Other woodland acreage is classified as follows: 5 percent is *very good;* 74 percent, *good;* 0.5 percent, *fair;* and 2.5 percent, *poor.*

Table 2 gives each soil a rating as to management problems and hazards, species suitability, and quality of the site for producing timber.

Hazard of erosion—The ratings for this hazard indicate the amount or intensity of practices required to reduce or control erosion on the different soils. Slight indicates that the risk of erosion is low when wood products are harvested, and that few, if any, practices are needed to control erosion. Moderate indicates that erosion control measures are needed on skid roads and logging roads immediately after wood products are harvested. Severe means that erosion, especially gullying, is a severe hazard when wood products are harvested. Harvesting and other operations should be done across the slope as much as possible. Skid trails and logging roads should be laid out on as low grades as feasible, and water disposal systems should be carefully maintained during logging operations. Erosion control measures are needed on logging roads and skid trails immediately after logging.

Equipment limitations.—Ratings in this column are based on the characteristics of the soils and topographic features that restrict or prohibit the use of equipment for harvesting trees or planting seedlings. Steepness of slope, stoniness, and wetness are the principal soil limitations that restrict the use of equipment. Slight means that there are few limitations. Moderate means that some problems exist, such as stones and boulders, moderately steep slopes, or wetness of the soil part of the year. Severe means that prolonged wetness of the soil, steepness, or stoniness severely limit the use of equipment. If the rating is severe, track-type equipment is best for general use, and winches or similar special equipment are needed for some kinds of work.

Seedling mortality.—Seedling mortality refers to the loss of naturally occurring or planted tree seedlings resulting from unfavorable characteristics of the soils. Slight means that less than 25 percent of the planted seedlings are likely to die and satisfactory restocking from the initial planting can be expected. Adequate restocking ordinarily results from natural regeneration. Moderate indicates that between 25 and 50 percent of planted seedlings are likely to die and some replanting is ordinarily needed. Natural regeneration cannot always be relied upon for adequate and early restocking. Severe indicates that more than 50 percent of planted seedlings are likely to die, and special preparation of the seedbed, superior planting techniques, and considerable replanting are needed for adequate and immediate restocking. Restocking cannot be expected to result from natural regeneration if the rating for seedling mortality is severe.

Plant competition.—Plant competition refers to the rate at which brush, grass, and undesirable trees are likely to invade the different kinds of soil. Plant competition is rated separately for both conifers and hardwoods, but the kinds of rating used are identical. Plant competition is slight if unwanted plants do not prevent adequate regeneration and early growth or interfere with adequate development of planted seedlings. It is moderate if competing plants delay natural or artificial regeneration, both establishment and growth, but do not prevent the natural development of a fully stocked normal stand. Competition is severe if adequate natural or artificial regeneration can be obtained only by intensive site preparation and maintenance that includes weeding.

Windthrow hazard.—The ratings for windthrow hazard represent an evaluation of the factors that control the development of tree roots and consequently the likelihood that trees will be uprooted by wind. Slight indicates that normally no trees are blown down by the wind. Moderate indicates that some trees are expected to be blown down during periods of excessive soil wetness and high wind. Severe indicates that many trees are expected to be blown down during periods of soil wetness and moderate or high winds.

Suitable species.—The species suitability means that the listed trees are recommended because they are fast growing and have high economic value. In planning the development of an existing woods, it would be advisable to review the list of trees. The objectives of the landowner will determine which species to favor when plantations are to be started. The trees listed in the "For planting or seeding" column would be better for these particular soils.

Quality of site.—Ratings in this column indicate the general ability of these soils to produce the timber specified. The ratings are based on sample plots located within

TABLE 2.—*Soil interpre-*

Soil series and map symbols	Management problems			
	Hazard of erosion	Equipment limitations	Seedling mortality	Plant competition
				Conifers
Barbour: Ba	Slight	Slight	Slight	Severe
Basher: Bc	Slight	Slight	Slight	Severe
Bath:				
BeB2, BeC2, BfB2, BfC2, BsB	Slight	Slight	Slight	Moderate
BfD2, BsD	Slight	Moderate	Slight	Moderate
BsF	Moderate	Severe	Slight	Moderate
Chenango:				
CnA, CnB2, CnC2	Slight	Slight	Moderate	Moderate
CnD2	Slight	Moderate	Moderate	Moderate
Chippewa: Mapped only with Norwich soils. See Norwich series for interpretations.				
Cut and fill land: Cu. Not suited for the growing of commercial tree crops.				
Holly: Hw	Slight	Severe	Severe	Severe
Lackawanna:				
LaB2, LaC2, LfB, LfC2, LgB	Slight	Slight	Slight	Moderate
LaD2, LfD2, LgD	Slight	Moderate	Slight	Moderate
LgF	Moderate	Severe	Slight	Moderate
Lordstown:				
LkB2, LkC2	Slight	Slight	Moderate	Moderate
LkD2	Slight	Moderate	Moderate	Moderate
LoB, LoC2	Slight	Slight	Moderate	Moderate
LoD2	Slight	Moderate	Moderate	Moderate
LsB	Slight	Slight	Moderate	Moderate

tations for woodland

Management problems—Continued		Suitable species—		Quality of site for sugar maple, black cherry, ash, and oak
Plant competition—Continued	Windthrow hazard	To favor in existing stands	For planting or seeding	
Hardwoods				
Moderate	Slight	Red oak, black walnut, ash, sugar maple, and basswood.	White pine, larch, black walnut, Austrian pine, and Norway spruce.	Excellent.
Moderate	Slight	Red oak, ash, black walnut, sugar maple, and basswood.	White pine, larch, black walnut, and Norway spruce.	Excellent.
Slight	Slight	Sugar maple, ash, red oak, and black cherry.	White pine, larch, Norway spruce, and red pine.	Good.
Slight	Slight	Sugar maple, ash, red oak, and black cherry.	White pine, larch, Norway spruce, and red pine.	Good.
Slight	Slight	Sugar maple, ash, red oak, and black cherry.	White pine, larch, Norway spruce, and red pine.	Good.
Slight	Slight	Red oak, ash, white pine, sugar maple, and black cherry.	White pine, larch, and Norway spruce.	Very good.
Slight	Slight	Red oak, ash, white pine, sugar maple, and black cherry.	White pine, larch, and Norway spruce.	Very good.
Severe	Moderate	Pin oak, red maple, and ash	White pine and white spruce	Fair.
Slight	Slight	Red oak, ash, sugar maple, and black cherry.	Red pine, white pine, larch, and Norway spruce.	Good.
Slight	Slight	Red oak, ash, sugar maple, and black cherry.	Red pine, white pine, larch, and Norway spruce.	Good.
Slight	Slight	Red oak, ash, sugar maple, and black cherry.	Red pine, white pine, larch, and Norway spruce.	Good.
Slight	Moderate	Red oak, sugar maple, white pine, ash, and black cherry.	White pine, red pine, larch, and Norway spruce.	Good.
Slight	Moderate	Red oak, sugar maple, white pine, ash, and black cherry.	White pine, red pine, larch, and Norway spruce.	Good.
Slight	Slight	Red oak, sugar maple, white pine, ash, and black cherry.	White pine, red pine, larch, and Norway spruce.	Good.
Slight	Slight	Red oak, sugar maple, white pine, ash, and black cherry.	White pine, red pine, larch, and Norway spruce.	Good.
Slight	Slight	Red oak, sugar maple, white pine, ash, and black cherry.	White pine, red pine, larch, and Norway spruce.	Good.

TABLE 2.—*Soil interpretations*

Soil series and map symbols	Management problems			
	Hazard of erosion	Equipment limitations	Seedling mortality	Plant competition
				Conifers
Lordstown—Continued				
LsD	Slight	Moderate	Moderate	Moderate
LsF	Moderate	Severe	Moderate	Moderate
Mardin:				
McB2, McC2, MfB2, MfC2, MgB	Slight	Slight	Slight	Moderate
McD2, MfD2, MgD	Slight	Moderate	Slight	Moderate
MgF	Moderate	Severe	Slight	Moderate
Mixed alluvial land: Mn. Not suited for the growing of commercial tree crops.				
Morris:				
MoA, MoB2, MoC2, MrB2, MrC2, MsB.	Slight	Moderate	Moderate	Severe
MrD2, MsD	Moderate	Moderate	Moderate	Severe
Norwich: NcA, NcB, NsB	Slight	Severe	Severe	Severe
Oquaga: Mapped only with Lordstown soils. See Lordstown series for interpretations.				
Peat: Pt. Not suited for the growing of commercial tree crops.				
Terrace escarpments: Te. Not suited for the growing of commerical tree crops.				
Unadilla: Us	Slight	Slight	Slight	Moderate
Volusia:				
VcA, VcB2, VcC2, VfB, VfC, VsB	Slight	Moderate	Moderate	Severe
VcD2, VfD, VsD	Moderate	Moderate	Moderate	Severe

for woodland—Continued

Management problems—Continued		Suitable species—		Quality of site for sugar maple, black cherry, ash, and oak
Plant competition—Continued Hardwoods	Windthrow hazard	To favor in existing stands	For planting or seeding	
Slight	Slight	Red oak, sugar maple, white pine, ash, and black cherry.	White pine, red pine, larch, and Norway spruce.	Good.
Slight	Slight	Red oak, sugar maple, white pine, ash, and black cherry.	White pine, red pine, larch, and Norway spruce.	Good.
Slight	Slight	Red oak, sugar maple, black cherry, ash, hemlock, and white pine.	Red pine, white pine, Norway spruce, and larch.	Good.
Slight	Slight	Red oak, sugar maple, black cherry, ash, hemlock, and white pine.	Red pine, white pine, Norway spruce, and larch.	Good.
Slight	Slight	Red oak, sugar maple, black cherry, ash, hemlock, and white pine.	Red pine, white pine, Norway spruce, and larch.	Good.
Moderate	Moderate	Sugar maple, red oak, hemlock, ash, and black cherry.	White pine, larch, Norway spruce, and white spruce.	Very good.
Moderate	Moderate	Sugar maple, red oak, hemlock, ash, and black cherry.	White pine, larch, Norway spruce, and white spruce.	Very good.
Severe	Severe	Red maple	Unplantable. Use natural reseeding.	Poor.
Slight	Slight	Sugar maple, white pine, hemlock, ash, black cherry, and yellow birch.	White pine, red pine, larch, and Norway spruce.	Good.
Moderate	Moderate	Sugar maple, red oak, black cherry, hemlock, and ash.	White pine, larch, Norway spruce, and white spruce.	Good.
Moderate	Moderate	Sugar maple, red oak, black cherry, hemlock, and ash.	White pine, larch, Norway spruce, and white spruce.	Good.

TABLE 2.—*Soil interpretations*

Soil series and map symbols	Management problems			
	Hazard of erosion	Equipment limitations	Seedling mortality	Plant competition
				Conifers
Wellsboro:				
WeB2, WeC2, WlB2, WlC2	Slight	Slight	Slight	Moderate
WeD2, WlD2, WsB, WsD	Slight	Moderate	Slight	Moderate
WsF	Moderate	Severe	Slight	Moderate
Wyalusing: Wy	Slight	Severe	Severe	Severe

the county and adjacent counties. Other soils in the county that have characteristics similar to those of the soils studied were assumed to have approximately the same rating. Yield information on oak is based on data by G. L. Schnur (*9*). The ratings are based on the average height attained by the dominant and codominant trees at the age of 50 years. Foresters using this rating can determine the volume of timber that normal stands will produce at different ages. A site index of 85 or better is rated excellent, and the expected yield at age 50 is 13,750 or more board feet per acre (published data for oak does not go beyond site index 80) (International rule). A site index of 75 to 84 is rated very good, and the expected yield at age 50 is about 13,750 board feet per acre. A site index of 65 to 74 is rated good, and the expected yield at age 50 is about 9,750 board feet per acre. A site index of 55 to 64 is rated fair, and the expected yield at age 50 is about 6,300 board feet per acre. A site index of less than 54 is rated poor, and the expected yield at age 50 is less than 3,250 board feet per acre.

The site index for other trees such as white pine, sugar maple, ash, and larch vary somewhat, but the better sites have the taller trees of the same species at the 50-year age. More information on site index for other tree species can be obtained from the USDA Soil Conservation Service and the Pennsylvania Department of Forests and Waters.

Use of the Soils for Wildlife [4]

In Susquehanna County, as elsewhere, the kinds and the abundance of wildlife greatly depend upon the kinds of soil although this relationship between the soil and and wildlife is not always easily distinguished. The soil affects wildlife through its influence on the vegetation that grows and the food and cover it provides.

[4] CLAYTON L. HEINEY, wildlife biologist, Soil Conservation Service.

Under natural conditions, the patterns of combinations of vegetation in an area depend on the distribution of the various kinds of soil. An area is inhabited by the kinds of wildlife that have their habitat requirements met by the vegetation in the area. If the natural conditions in the area are altered by drainage or by the other practices used in managing farmland or woodland, the kinds and patterns of vegetation change. With this change in vegetation, there may also be a change in the kinds and numbers of wildlife.

All the soils in the county are suitable for producing some kinds of wildlife, but some soils are more suitable for producing cultivated crops. On the soils in capability classes I, II, III, and IV, crops are more valuable than wildlife, but wildlife can sometimes be plentiful on these soils and is considered a secondary crop. Soils in classes VII and VIII are generally used for wildlife and are better suited to that use and to producing wood products.

Many practices used primarily to improve the soils and to increase crop production also benefit wildlife. Contour stripcropping and crop rotation provide a mixture of cover and increase the amount of food and cover that wildlife can use. During winter, cover crops and crop residue are used by wildlife for food and cover. Diversion terraces and grassed waterways provide travel lanes and nesting places. Food and cover for wildlife are increased by fertilizing and liming the soils.

Practices used primarily to benefit wildlife supplement the practices used primarily to increase the crop. If hedgerows are planted on cropland, they furnish travel lanes, food, and cover, and they also fence the field and give some protection to the soils. Plantings of grasses and legumes along field borders provide nesting places and food for wildlife. Small patches of corn, small grain, and soybeans that are planted to supply food for wildlife are particularly valuable in abandoned or idle areas, especially if these patches are located near good cover or between wooded areas and open fields.

for woodland—Continued

Management problems—Continued		Suitable species—		Quality of site for sugar maple, black cherry, ash, and oak
Plant competition—Continued Hardwoods	Windthrow hazard	To favor in existing stands	For planting or seeding	
Slight	Slight	Red oak, sugar maple, black cherry, ash, hemlock, and white pine.	Red pine, white pine, larch, and Norway spruce.	Good.
Slight	Slight	Red oak, sugar maple, black cherry, ash, hemlock, and white pine.	Red pine, white pine, larch, and Norway spruce.	Good.
Slight	Slight	Red oak, sugar maple, black cherry, ash, hemlock, and white pine.	Red pine, white pine, larch, and Norway spruce.	Good.
Severe	Moderate	Red maple	White pine and white spruce	Fair.

Habitat for wetland wildlife can be made or improved by digging ponds in pastures or, for shallow water impoundments, by installing special structures for water control in marshy areas.

Fish are killed by industrial waste, sewage, insecticides, and herbicides. The greatest danger to fish in the waters of the county is from pollution and erosion sediments. Soil erosion is particularly damaging. As sediments are washed into rivers and streams, they settle and cover spawning beds and recently hatched fish. The sediments destroy food and food-producing areas. By filling pools, sediments cause water temperature to rise to a point that is harmful to fish. Erosion of the streambanks is particularly damaging. Commonly this erosion is caused by overgrazing, which should be controlled. The streambanks can also be protected by plantings. But protecting the streambank is not enough. The entire watershed should be protected by carrying out a complete plan that protects every farm and all of the land in the watershed.

White-tailed deer are considered forest species, but they neither prefer nor do well in large, mature forests. They prefer a combination consisting of brush or young trees, lesser amounts of mature trees, and small open areas. Because Susquehanna County has a good interspersion of these kinds of cover, deer are found throughout the county.

Gray and black squirrels are fairly abundant throughout the county. They seem to prefer woodlots and ridges where beech trees predominate. They are also abundant where cornfields intersperse the woodland.

Cottontail rabbits are the most abundant game animal, and they are distributed countywide. They are most numerous in brushy areas interspersed with grassland and cropland. Fewer rabbits are found in large, cultivated fields and dense woodland.

Ruffed grouse are distributed over the entire county, especially where there is good brushy cover and where the ridges are too steep for farming. The population seems to be highest in the northwestern corner of the county in the Volusia-Mardin and the Mardin-Volusia-Oquaga soil associations.

Small populations of wild turkeys capable of limited reproduction occur in parts of the county. The greatest population is in the northeast corner of the county between New Milford and Hallstead where mature oak trees are predominant. A good population also inhabits the northwest corner where turkeys seem to overlap the grouse range.

Very small populations of pheasants and quail are found in the extreme southwestern part of the county at the lower and warmer elevations. A fair population of doves inhabit most of the county where fields of corn and small grain adjoin meadows and small woodlots.

An excellent population of woodchucks furnishes good hunting throughout the county. A fair population of snowshoe hares inhabits State Game Land 35. Small populations of woodcock inhabit localized areas.

Waterfowl, mainly mallards along with some black ducks, appear seasonally and reproduce naturally on the many ponds and natural bodies of water. Geese stop during the migration seasons, but they do not reproduce.

Beaver, muskrat, and mink populations are excellent throughout the county. Red fox and some gray fox are present along with raccoons in good numbers. Skunk, opossum, and weasel are also present in good numbers.

The county has an excellent population of songbirds, robins, blue jays, woodpeckers, grossbeaks, bluebirds, cedar waxwings, Baltimore orioles, brown thrashers, indigo buntings, scarlet tanagers, and cardinals.

The numerous ponds, lakes, and streams produce excellent populations of largemouth bass, pickerel, bluegills, catfish, trout, and perch.

In table 3, the soils of the county are rated according to their suitability for six kinds of wildlife food and cover, two kinds of water developments, and three groups of wildlife (*1*). The categories rated in table 3 are described in the following paragraphs.

TABLE 3.—*Soil suitability*

Soil series and map symbols	Wildlife habitat elements				
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants
Barbour: Ba	Poorly suited	Suited	Suited	Well suited	Suited
Basher: Bc	Suited	Well suited	Well suited	Well suited	Poorly suited
Bath:					
BeB2, BeC2	Suited	Well suited	Well suited	Well suited	Poorly suited
BfB2, BfC2, BfD2	Poorly suited	Suited	Well suited	Well suited	Poorly suited
BsB, BsD, BsF	Not suited	Poorly suited	Well suited	Well suited	Poorly suited
Chenango:					
CnA	Well suited	Well suited	Well suited	Well suited	Poorly suited
CnB2, CnC2	Suited	Well suited	Well suited	Well suited	Poorly suited
CnD2	Poorly suited	Suited	Well suited	Well suited	Poorly suited
Chippewa. See Norwich series.					
Cut and fill land: Cu. Too variable for reliable evaluation. Onsite investigation needed.					
Holly: Hw	Poorly suited	Suited	Suited	Well suited	Suited
Lackawanna:					
LaB2, LaC2	Suited	Well suited	Well suited	Well suited	Poorly suited
LaD2, LfB, LfC2, LfD2	Poorly suited	Suited	Well suited	Well suited	Poorly suited
LgB, LgD, LgF	Not suited	Poorly suited	Well suited	Well suited	Poorly suited
Lordstown:					
LkB2, LkC2, LkD2, LoB, LoC2, LoD2.	Poorly suited	Poorly suited	Suited	Suited	Suited
LsB, LsD, LsF	Not suited	Poorly suited	Suited	Suited	Suited
Mardin:					
McB2, McC2	Suited	Well suited	Well suited	Well suited	Poorly suited
McD2, MfB2, MfC2, MfD2.	Poorly suited	Suited	Well suited	Well suited	Poorly suited
MgB, MgD	Not suited	Poorly suited	Well suited	Well suited	Poorly suited
MgF	Not suited	Not suited	Well suited	Well suited	Poorly suited
Mixed alluvial land: Mn	Not suited	Not suited	Not suited	Not suited	Not suited
Morris:					
MoA, MrB2	Poorly suited	Poorly suited	Suited	Suited	Suited
MoB2, MrC2	Poorly suited	Poorly suited	Suited	Suited	Suited
MoC2, MrD2	Poorly suited	Poorly suited	Suited	Suited	Suited
MsB	Not suited	Poorly suited	Suited	Suited	Suited
MsD	Not suited	Poorly suited	Suited	Suited	Suited
Norwich:					
NcA	Poorly suited	Poorly suited	Suited	Suited	Suited
NcB	Poorly suited	Poorly suited	Suited	Suited	Suited
NsB	Not suited	Poorly suited	Suited	Suited	Suited
Oquaga. See Lordstown series.					
Peat: Pt	Not suited	Not suited	Not suited	Not suited	Not suited
Terrace escarpments: Te	Not suited	Not suited	Not suited	Not suited	Not suited
Unadilla: Us	Well suited	Well suited	Well suited	Well suited	Poorly suited

for wildlife

Wildlife habitat elements—Continued			Kinds of wildlife		
Wetland food and cover plants	Shallow water developments	Excavated ponds	Open land	Woodland	Wetland
Suited	Suited	Not suited	Suited	Well suited	Suited.
Poorly suited	Poorly suited	Poorly suited	Well suited	Well suited	Poorly suited.
Not suited	Not suited	Not suited	Well suited	Well suited	Not suited.
Not suited	Not suited	Not suited	Suited	Suited	Not suited.
Not suited	Not suited	Not suited	Poorly suited	Suited	Not suited.
Not suited	Not suited	Not suited	Well suited	Well suited	Not suited.
Not suited	Not suited	Not suited	Well suited	Well suited	Not suited.
Not suited	Not suited	Not suited	Suited	Suited	Not suited.
Suited	Suited	Not suited	Suited	Well suited	Suited.
Not suited	Not suited	Not suited	Well suited	Well suited	Not suited.
Not suited	Not suited	Not suited	Suited	Suited	Not suited.
Not suited	Not suited	Not suited	Poorly suited	Suited	Not suited.
Not suited	Not suited	Not suited	Poorly suited	Suited	Not suited.
Not suited	Not suited	Not suited	Poorly suited	Suited	Not suited.
Not suited	Not suited	Not suited	Well suited	Well suited	Not suited.
Not suited	Not suited	Not suited	Suited	Suited	Not suited.
Not suited	Not suited	Not suited	Poorly suited	Suited	Not suited.
Not suited	Not suited	Not suited	Poorly suited	Suited	Not suited.
Not suited	Not suited	Not suited	Not suited	Not suited	Not suited.
Suited	Suited	Suited	Poorly suited	Suited	Suited.
Poorly suited	Not suited	Not suited	Poorly suited	Suited	Not suited.
Not suited	Not suited	Not suited	Poorly suited	Suited	Not suited.
Poorly suited	Not suited	Not suited	Poorly suited	Suited	Not suited.
Not suited	Not suited	Not suited	Poorly suited	Suited	Not suited.
Well suited	Well suited	Well suited	Poorly suited	Suited	Well suited.
Poorly suited	Not suited	Not suited	Poorly suited	Suited	Not suited.
Poorly suited	Not suited	Not suited	Poorly suited	Suited	Not suited.
Well suited	Well suited	Well suited	Not suited	Not suited	Well suited.
Not suited	Not suited	Not suited	Not suited	Not suited	Not suited.
Not suited	Not suited	Not suited	Well suited	Well suited	Not suited.

TABLE 3.—*Soil suitability*

Soil series and map symbols	Wildlife habitat elements				
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants
Volusia:					
VcA	Poorly suited	Poorly suited	Suited	Suited	Suited
VcB2, VfB	Poorly suited	Poorly suited	Suited	Suited	Suited
VcC2, VcD2, VfC, VfD	Poorly suited	Poorly suited	Suited	Suited	Suited
VsB	Not suited	Poorly suited	Suited	Suited	Suited
VsD	Not suited	Poorly suited	Suited	Suited	Suited
Wellsboro:					
WeB2, WeC2	Suited	Well suited	Well suited	Well suited	Poorly suited
WeD2	Poorly suited	Suited	Well suited	Well suited	Poorly suited
WlB2, WlC2, WlD2	Poorly suited	Suited	Well suited	Well suited	Poorly suited
WsB, WsD	Not suited	Poorly suited	Well suited	Well suited	Poorly suited
WsF	Not suited	Not suited	Well suited	Well suited	Poorly suited
Wyalusing: Wy	Poorly suited	Suited	Suited	Well suited	Suited

Grain and seed crops consist of domestic grains or seed-producing annual herbaceous plants that are planted to produce food for wildlife. Examples are corn, sorghum, wheat, millet, buckwheat, soybeans, and sunflower.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted to furnish food and cover for wildlife. Examples are fescue, brome, bluegrass, timothy, redtop, orchardgrass, reed canarygrass, clover, trefoil, alfalfa, and sericea lespedeza.

Wild herbaceous upland plants are native or introduced perennial grasses or forbs that generally are established naturally and that provide food and cover mainly for upland wildlife. Examples are ragweed, wheatgrass, wildrye, oatgrass, pokeweed, strawberries, beggarweeds, goldenrod, and dandelion.

Hardwood woody plants are deciduous trees, shrubs, and woody vines that produce fruit, nuts, buds, catkins, twigs, or foliage that are used extensively as food by wildlife. They are commonly established naturally but also may be planted. Examples are oak, beech, cherry, hawthorn, dogwood, viburnums, holly, maple, birch, and poplar. Smaller plants include grape, honeysuckle, blueberry, briers, greenbrier, raspberry, and roses.

Coniferous woody plants are cone-bearing trees and shrubs that are important to wildlife primarily as cover, but they also furnish food in the form of browse, seeds, or cones. These trees and shrubs are commonly established naturally, but they also may be planted. Examples are pine, spruce, white-cedar, hemlock, fir, redcedar, juniper, and yew.

Wetland food and cover plants are annual and perennial grasses and grasslike plants on moist to wet sites. These plants do not include submerged or floating aquatic plants that produce the food and cover used mainly by wetland wildlife. Examples of wetland food plants are smartweed, wild millet, bulrushes, sedges, wildrice, switchgrass, reed canarygrass, and cattails.

Shallow water developments are areas of water that have been made by building low dikes or levees, by digging shallow excavations, or by using devices to control the water of marshy streams or channels.

Excavated ponds are dugout areas or a combination of dugout areas and low dikes that hold water of suitable quality, suitable depth, and in ample supply for the production of fish or wildlife. Such a pond should have a surface area of at least one-quarter acre and an average depth of 6 feet or more in at least a quarter of its area. Also required is a water table that is permanently high or another source of unpolluted water of low acidity. The ponds can be stocked with fish, and they are also used by migratory water fowl as resting places. If shrubs and trees are planted around these ponds, they will attract many other kinds of wildlife. Shallow impoundments are breeding grounds and feeding areas for waterfowl and shorebirds. Muskrat, mink, and other furbearers also benefit from these developments. Because many of the soils in the county are not suitable as sites for ponds, the sites should be selected with care before a pond is established.

Open land wildlife is made up of the birds and mammals commonly found in crop fields, in meadows and pastures, and on nonforested, overgrown land. Among these birds and mammals are quail, ring-necked pheasants, mourning doves, woodcock, cottontail rabbits, meadowlarks, killdeer, and field sparrows.

Woodland wildlife consists of birds and mammals commonly found in wooded areas. Examples are ruffed grouse, wild turkeys, wood thrushes, warblers, vireos, deer, squirrels, and raccoon.

Wetland wildlife consists of birds and mammals commonly found in marshes and swamps. Examples are ducks, geese, heron, snipe, rails, coots, muskrat, mink, and beaver.

Engineering Uses of the Soils [5]

This section provides information of special interest to engineers, contractors, farmers, and others who use soil as structural material or as foundation material upon

[5] Prepared in cooperation with JOHN K. ROBB, assistant State conservation engineer, Soil Conservation Service.

for wildlife—Continued

Wildlife habitat elements—Continued			Kinds of wildlife		
Wetland food and cover plants	Shallow water developments	Excavated ponds	Open land	Woodland	Wetland
Suited	Suited	Suited	Poorly suited	Suited	Suited.
Poorly suited	Not suited	Not suited	Poorly suited	Suited	Not suited.
Not suited	Not suited	Not suited	Poorly suited	Suited	Not suited.
Poorly suited	Not suited	Not suited	Poorly suited	Suited	Not suited.
Not suited	Not suited	Not suited	Poorly suited	Suited	Not suited.
Not suited	Not suited	Not suited	Well suited	Well suited	Not suited.
Not suited	Not suited	Not suited	Poorly suited	Suited	Not suited.
Not suited	Not suited	Not suited	Suited	Suited	Not suited.
Not suited	Not suited	Not suited	Poorly suited	Suited	Not suited.
Not suited	Not suited	Not suited	Poorly suited	Suited	Not suited.
Suited	Suited	Not suited	Suited	Well suited	Suited.

which structures are built. Information is given in this section about those properties of the soils that affect construction and maintenance of roads and airports, pipelines, building foundations, water storage facilities, erosion control structures, drainage systems, and sewage disposal systems. Among the soil properties most important in engineering are permeability, shear strength, density, shrink-swell potential, water-holding capacity, grain-size distribution, plasticity, and reaction. Also important are the depth to the water table and to bedrock.

Information concerning these and related soil properties is furnished in tables 4, 5, and 6. The estimates and interpretations of soil properties in these tables can be used in—

1. Planning and designing of agricultural drainage systems, farm ponds, irrigation systems, diversion terraces, and other structures for controlling water and conserving soil.
2. Selecting potential locations for highways, airports, pipelines, and underground cables.
3. Locating probable sources of sand, gravel, or rock suitable for use as construction material.
4. Selecting potential industrial, commercial, residential, and recreational areas.

With the use of the soil map for identification, the engineering interpretations in this section can be useful for many purposes. It should be emphasized that they do not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads or the excavations that are deeper than the depths of layers here reported. Even in these situations, however, the soil map is useful in planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

Some terms used in soil science, for example, sand, silt, clay, surface soil, subsoil, and horizon, have a special meaning in soil science and a different meaning in engineering. These and other terms are defined in the Glossary.

Engineering classification systems

The two systems most commonly used in classifying samples of soil horizons for engineering are the AASHO system adopted by the American Association of State Highway Officials and the Unified system used by the Soil Conservation Service engineers, Department of Defense, and others.

The AASHO system is used to classify soils according to those properties that affect use in highway construction (*2*). In this system, a soil is placed in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation), and at the other extreme, clay soils that have low strength when wet. The best soils for subgrade are therefore classified as A-1, the next best A-2, and so on to class A-7, the poorest soils for subgrade.

Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. If soil material is near a classification boundary, it is given a symbol showing both classes, for example, A–2 or A–4. Within each group, the relative 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 for the poorest. The AASHO classification for tested soils, with index numbers in parentheses, is shown in table 4; the estimated classification for all soils mapped in the survey area is given in table 5.

In the Unified system, soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter (*18*). They are grouped in 15 classes. There are 8 classes of coarse-grained soils identified as GW, GP, GM, GC, SW, SP, SM, and SC; 6 classes of fine-grained soils identified as ML, CL, OL, MH, CH, and OH; and 1 class of highly organic soils identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes, for example CH–MH.

TABLE 4.—*Engineering*

[Tests performed by the Pennsylvania Department of Transportation in accordance with standard

Soil name and location	Parent material	Pennsylvania report No.	Depth from surface	Moisture-density data [1]	
				Maximum dry density	Optimum moisture
			Inches	*Lb. per cu. ft.*	*Pct.*
Barbour fine sandy loam:					
In field S. of Route 106, 0.125 mile past its intersection with Route 57007, and 380 feet S. of road.	Alluvium.	BE-4412	12-21	117	13
		BE-4413	34-50	126	10
Basher silt loam:					
1 mile E. of Great Bend on S. roadbank of Route T749-----	Alluvium.	BE-5813	22-30	104	19
		BE-5814	40-50	107	17
Holly silt loam:					
Intersection of Route 858 and Route 57005, 150 feet S. of intersection, and 30 feet E. of road.	Alluvium.	BE-3279	10-20	95	21
		BE-5812	20-42	111	20
Lackawanna channery silt loam:					
W. of Springville on Route 57012, 0.25 mile E. of intersection with Route 57013.	Wisconsin glacial till.	BE-2420	17-26	119	14
		BE-4405	28-34	123	11
Mardin channery silt loam:					
90 feet W. of Route T768, and 1,000 feet N. of Route PA-858.	Wisconsin glacial till.	BE-2425	20-30	121	13
		BE-2426	38-50	123	12
Morris very stony silt loam:					
Lathrop Township 1 mile N. of Tarbett Pond on Route 57010, and 900 feet NE. of road.	Wisconsin glacial till.	BE-4407	17-22	121	11
		BE-4408	34-50	124	11
Norwich clay:					
2 miles NE. of Montrose on Route T593, 270 feet NW. of power pole 5B-62.	Wisconsin glacial till.	BE-3295	9-15	116	14
		BE-3296	22-30	116	14
Volusia channery silt loam:					
Choconut Township on Route T685, 0.125 mile W. of its junction with Route T772, S. of T685 in field.	Wisconsin glacial till.	BE-4416	22-33	119	13
		BE-4417	33-48	120	12
Wellsboro channery silt loam:					
On Route 57010, 1.5 miles N. of Tarbett Pond, 65 feet N. of center of road, 480 feet W. of porch of house.	Wisconsin glacial till.	BE-2423	20-30	121	12
		BE-2424	39-45	124	10
Wyalusing silt loam:					
W. of Fairdale at intersection of Route 106 and Route T318, 270 feet SW. of bridge abutment, 40 feet SE. of road embankment.	Alluvium.	BE-4406	9-17	109	16
		BE-4409	28-34	103	18

[1] Based on AASHO Designation T 99 (*2*).

[2] Mechanical analyses according to AASHO Designation T 88 (*2*). Results by this procedure differ somewhat from results 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

test data

procedures of the American Association of State Highway Officials (AASHO) (*2*)]

Mechanical analysis [2]										Liquid limit index	Plasticity	Classification	
Percentage passing sieve—						Percentage smaller than—							
3 in.	¾ in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO [3]	Unified [4]
		100	100	98	48	39	26	15	11	22	1	A–4(3)	SM
100	44	21	14	9	4	3	2	2	1	25	2	A–1–a(0)	GP
			100	99	96	92	67	34	20	33	6	A–4(8)	ML
			100	99	96	91	67	33	23	30	5	A–4(8)	ML
	100	100	100	98	90	85	67	36	22	42	11	A–7–5(9)	ML
	100	100	100	99	89	84	62	33	21	37	9	A–4(8)	ML
100	73	59	54	47	33	32	23	13	9	25	4	A–2–4(0)	GM
	87	68	61	54	40	36	25	15	10	22	3	A–4(1)	GM
100	76	63	59	56	42	38	30	19	15	25	7	A–4(1)	GM–GC
100	86	74	68	64	45	41	30	21	16	24	5	A–4(2)	SM–SC
100	83	71	65	61	43	38	26	13	8	22	2	A–4(2)	GM
100	90	75	69	63	46	42	31	18	11	22	4	A–4(2)	SM
	98	93	91	89	67	62	47	29	17	23	3	A–4(6)	ML
	85	77	76	74	60	55	42	24	15	24	4	A–4(5)	ML
	85	73	67	63	51	47	35	19	11	23	3	A–4(3)	ML
	78	66	62	56	46	42	33	17	10	24	5	A–4(2)	GM–GC
100	84	72	69	64	45	41	31	17	12	20	4	A–4(2)	GM
100	70	59	56	51	36	32	22	12	7	18	1	A–4(0)	GM
			100	100	58	49	36	21	12	29	2	A–4(5)	ML
100	85	83	83	81	35	29	18	9	6	32	1	A–2–4(0)	SM

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] Based on AASHO Designation M 145–49 (*2*).

[4] Based on MIL–STD–619B (*18*). SCS and the Bureau of Public Roads have agreed that any soil having a plasticity index within 2 points of A-line is to be given a borderline classification. GM–GC is an example of such a classification.

TABLE 5.—*Estimated soil*

[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 soil in referring to other series that appear in the first column of this

Soil series and map symbols	Depth to seasonal high water table	Depth from surface (typical profile)	Coarse fraction greater than 3 inches	Percentage passing sieve—				Engineering classification	
				No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Unified	AASHO
	Ft.	*In.*	*Pct.*						
Barbour: Ba	3+	0–30		90–100	90–100	70–100	30–75	SM, ML	A–2, A–4
		30–50	0–5	20–45	10–40	10–35	4–15	GM, GP	A–1, A–2
Basher: Bc	1½–3	0–37		90–100	90–100	70–100	55–95	ML	A–4
		37–50	0–5	50–100	50–100	45–100	25–100	GM, ML	A–2, A–4
Bath: BeB2, BeC2, BfB2, BfC2, BfD2, BsB, BsD, BsF.	3+	0–32	10–20	60–80	55–70	50–60	35–45	SM, GM, GC	A–4
		32–50	10–30	60–80	55–70	50–60	15–40	SM, SC	A–2, A–4
Chenango: CnA, CnB2, CnC2, CnD2	3+	0–20	5–15	55–90	55–70	25–70	15–45	SM, GM	A–2, A–4
		20–85	5–20	40–55	30–55	10–40	1–12	GM–GP, GP, GW	A–1, A–2
Chippewa Mapped only with Norwich soils.	0–½	0–12	0–5	70–100	65–90	65–85	60–80	OL, ML, CL	A–4, A–6
		12–50	5–15	70–90	65–90	50–80	40–65	ML–CL, GM–GC	A–4
Cut and fill land: Cu. No estimates made, because soil material is too variable. Onsite investigation required.									
Holly: Hw	0–½	0–36		95–100	95–100	85–100	75–100	ML, CL	A–4, A–7
		36–60		50–100	45–100	40–100	30–90	GM, ML, GC	A–1, A–2, A–4
Lackawanna: LaB2, LaC2, LaD2, LfB, LfC2, LfD2, LgB, LgD, LgF.	3+	0–20	0–20	40–80	40–75	35–60	20–55	GM, ML, GC	A–2, A–4
		20–38	0–20	50–75	40–65	35–55	20–40	SM, GM, GC	A–2, A–4
		38–50	0–20	60–80	45–65	40–55	25–40	GM, GC, SM–SC	A–2, A–4
*Lordstown: LkB2, LkC2, LkD2, LoB, LoC2, LoD2, LsB, LsD, LsF. For Oquaga part, see Oquaga series.	3+	0–28	0–30	45–70	40–60	35–55	25–45	GM	A–2, A–4
		28							
Mardin: McB2, McC2, McD2, MfB2, MfC2, MfD2, MgB, MgD, MgF.	1½–2½	0–20	0–15	60–80	50–75	45–70	30–55	ML–CL, GM–GC	A–2, A–4
		20–50	0–15	55–90	45–80	40–75	25–55	ML–CL, SM, SM–SC, GM–GC	A–2, A–4

See footnote at end of table.

properties significant to engineering

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for table. The sign > means more than and the sign < means less than]

USDA texture	Permeability	Available moisture capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential	Corrosion potential for—	
							Steel	Concrete
	In. per hr.	*In. per in. of soil*	*pH*	*Pct.*	*Lb. per cu. ft.*			
Fine sandy loam to silt loam	0. 63–2. 0	0. 12–0. 16	5. 1–7. 0	12–19	104–114	Low	Low	Moderate.
Gravelly loamy sand to very gravelly loamy sand.	2. 0–6. 3+	0. 01–0. 10	5. 1–6. 0	10–16	115–126	Low	Low	Moderate.
Silt loam, gravelly fine sandy loam.	0. 63–2. 0	0. 12–0. 16	5. 6–6. 5	12–19	104–114	Low	Moderate	Moderate.
Fine sandy loam, gravelly silt loam.	0. 63–6. 3+	0. 04–0. 10	5. 6–6. 0	10–17	107–115	Low	Moderate	Moderate.
Flaggy loam to channery silt loam.	0. 63–2. 0	0. 08–0. 12	5. 1–6. 0	12–16	116–124	Low	Moderate	Moderate.
Flaggy fine sandy loam to flaggy sandy loam (fragipan).	<0. 20	0. 06–0. 10	5. 1–6. 0	10–14	120–126	Low	Low	Moderate.
Gravelly silt loam	0. 63–2. 0	0. 10–0. 14	5. 1–6. 0	10–14	118–124	Low	Low	Moderate.
Very gravelly loam, very gravelly sandy loam.	>6. 3	0. 02–0. 06	5. 1–6. 0	8–12	122–128	Low	Low	Moderate.
Silt loam, silty clay loam	0. 20–2. 0	0. 12–0. 16	5. 1–6. 0	15–20	95–110	Moderate.	High	Moderate.
Channery silt loam, channery silty clay loam.	0. 20	0. 08–0. 12	5. 6–6. 5	12–16	114–118	Moderate.	High	Moderate.
Silt loam, silty clay loam, clay loam.	0. 63–2. 0	0. 16–0. 20	5. 1–6. 0	15–20	95–110	Moderate.	High	Moderate
Gravelly loam	0. 63–6. 3	0. 06–0. 10	5. 1–6. 0	12–19	103–117	Low	High	Moderate.
Channery silt loam, channery loam.	0. 63–2. 0	0. 08–0. 12	4. 5–6. 0	12–18	118–124	Low	Low	High.
Channery loam, gravelly loam (fragipan).	<0. 20	0. 04–0. 08	4. 6–5. 5	10–18	109–126	Low	Low	High.
Channery loam, channery fine sandy loam.	0. 20–0. 63	0. 06–0. 10	4. 1–5. 5	8–14	122–128	Low	Low	High.
Channery silt loam to flaggy loam. Gray sandstone bedrock.	0. 63–2. 0	0. 06–0. 10	4. 6–6. 0	11–14	118–124	Low	Low	High
Channery silt loam, channery loam.	0. 63–2. 0	0. 10–0. 14	4. 5–5. 5	10–14	118–124	Low	Moderate.	Moderate
Channery loam (fragipan)	<0. 20	0. 06–0. 10	4. 5–6. 5	10–12	120–126	Low	Moderate.	Moderate.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface (typical profile)	Coarse fraction greater than 3 inches	Percentage passing sieve—				Engineering classification	
				No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Unified	AASHO
	Ft.	*In.*	*Pct.*						
Mixed alluvial land: Mn. No estimates made, because soil material is too variable. Onsite investigation required.									
Morris: MoA, MoB2, MoC2, MrB2, MrC2, MrD2, MsB, MsD.	½–1½	0–17	0–20	60–95	55–90	40–85	35–60	ML, CL, GM	A–4, A–6
		17–50	0–20	60–90	55–80	40–75	25–55	ML, CL, GM–GC, ML–CL	A–2, A–4, A–6
*Norwich: NcA, NcB, NsB. For Chippewa part, see Chippewa series.	0	0–10	0–10	85–100	80–95	70–90	45–70	ML, CL, SM, SC	A–4, A–6, A–7
		10–50	0–20	70–85	60–80	55–75	30–65	ML, CL, SM, SC	A–2, A–4, A–6
Oquaga. Mapped only with Lordstown soils.	3+	0–33	0–10	40–70	30–65	20–60	15–55	ML, GM	A–1, A–2, A–4
		33							
Peat: Pt	0	0–96						Pt	
		96–120		90–100	90–100	85–100	65–95	ML,CL	A–4, A–6, A–7
Terrace escarpments: Te. No estimates made, because soil material is too variable. Onsite investigation required.									
Unadilla: Us	3+	0–45		80–100	75–100	70–100	55–95	ML, ML–CL	A–4
		45–60	0–10	35–80	25–60	10–45	2–30	SM, GM, SW, SP, GW, GP	A–1, A–2
Volusia: VcA, VcB2, VcC2, VcD2, VfB, VfC, VfD, VsB, VsD.	½–1½	0–13	0–20	70–95	65–80	60–75	45–60	ML, CL, GM	A–4
		13–60	0–20	65–80	55–75	50–70	40–65	ML, CL, GM–GC	A–4
Wellsboro: WeB2, WeC2, WeD2, WlB2, WlC2, WlD2, WsB, WsD, WsF.	1½–2½	0–21	0–15	70–90	65–85	60–85	30–55	SM–SC, SM, ML–CL	A–2, A–4
		21–52	0–15	60–90	55–85	50–75	30–60	SM, GM, ML–CL	A–,2 A–4
Wyalusing: Wy	0–½	0–34		90–100	90–100	85–100	50–90	ML, SM	A–4
		34–50		40–100	25–100	20–100	15–70	GM, SM	A–1, A–2, A–4

[1] Not compactible.

significant to engineering—Continued

USDA texture	Permeability	Available moisture capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential	Corrosion potential for—	
							Steel	Concrete
	In. per hr.	*In. per in. of soil*	*pH*	*Pct.*	*Lb. per cu. ft.*			
Channery silt loam, channery loam.	0.63–2.0	0.08–0.14	5.1–6.0	10–14	116–125	Low	High	Moderate.
Channery loam (fragipan)	<0.20	0.04–0.08	5.9–6.6	10–13	120–126	Low	High	Moderate.
Clay, channery loam, channery clay loam.	0.63–2.0	0.14–0.18	5.0–6.5	12–15	114–118	Moderate.	High	Moderate.
Channery loam, channery clay loam (fragipan).	<0.20	0.08–0.12	5.1–6.5	12–14	114–120	Low	High	Moderate.
Channery silt loam to very channery loam. Red and gray sandstone bedrock.	2.0–6.3	0.06–0.10	4.6–5.5	11–14	118–124	Low	Low	High.
Peat			4.5–5.5	(1)	(1)	Variable	Moderate	High.
Stratified sand, silt, and clay	<0.20	0.08–0.14	5.0–6.0	10–14	114–120	Moderate.	Moderate	High.
Silt loam, very fine sandy loam.	0.63–2.0	0.14–0.18	5.1–6.5	12–15	112–116	Low	Low	Moderate.
Fine sandy loam, loamy fine sand.	0.63–2.0	0.03–0.08	5.1–6.0	10–14	118–122	Low	Low	Moderate.
Silt loam, channery loam	0.63–2.0	0.15–0.18	5.1–6.5	12–15	112–116	Low	High	Moderate.
Channery loam, channery silt loam (fragipan).	<0.20	0.08–0.12	5.1–6.5	12–15	118–124	Low	High	Moderate.
Channery silt loam	0.63–2.0	0.10–0.14	5.6–6.5	10–13	118–125	Low	Moderate	Moderate.
Flaggy loam to channery silt loam (fragipan).	<0.20	0.06–0.10	4.6–6.0	9–12	123–126	Low	Moderate	High.
Silt loam, loam, fine sandy loam.	0.63–2.0	0.16–0.20	5.1–6.0	15–25	100–115	Low	High	Moderate.
Very gravelly loamy sand	0.63–6.3	0.04–0.13	5.1–6.0	14–21	110–124	Low	High	Moderate.

TABLE 6.—*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 soil in referring to other series that appear

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of—			Soil features affecting—
			Topsoil	Sand and gravel	Road fill	Highway location
Barbour: Ba	Fair	Moderate	Good	Poor in most places. Good in substratum locally.	Good	Subject to flooding.
Basher: Bc	Poor	High	Good	Poor in most places. Good in substratum locally.	Fair: seasonal high water table.	Seasonal high water table; subject to flooding.
Bath: BeB2, BeC2, BfB2, BfC2, BfD2, BsB, BsD, BsF.	Good	Moderate	Poor: channery, flaggy, or stony soil.	Unsuitable: too many fines.	Good	Sloughing in deep cuts; stony soil in many places; seepage above fragipan.
Chenango: CnA, CnB2, CnC2, CnD2.	Good	Low	Poor: gravelly soil.	Good	Good	Cut slopes are droughty.
Chippewa Mapped only with Norwich soils.	Poor	High	Poor: high water table; many stony areas.	Unsuitable: too many fines.	Fair: high water table.	High water table
Cut and fill land: Cu. No estimates made because soil material is too variable. Onsite investigation required.						
Holly: Hw	Poor	High	Fair: high water table.	Unsuitable: high water table; too many fines.	Fair to a depth of 36 inches: A–4, A–7 material. Good at a depth below 36 inches: A–2, A–4 material.	High water table; subject to flooding.
Lackawanna: LaB2, LaC2, LaD2, LfB, LfC2, LfD2, LgB, LgD, LgF.	Good	Moderate	Poor: channery, flaggy, or stony soil.	Unsuitable: too many fines.	Good	Sloughing in deep cuts; seepage above fragipan; stony soil in many places.
*Lordstown: LkB2, LkC2, LkD2, LoB, LoC2, LoD2, LsB, LsD, LsF. For Oquaga part, see Oquaga series.	Good	Low	Poor: channery or stony soil.	Unsuitable: too many fines.	Good	Depth to sandstone bedrock is 1½ to 3½ feet; erodible on steep slopes; stony soil in many places.
Mardin: McB2, McC2, McD2, MfB2, MfC2, MfD2, MgB, MgD, MgF.	Fair	Moderate	Poor: channery, flaggy, or stony soil.	Unsuitable: too many fines.	Good	Seasonal high water table; seepage along fragipan.

interpretations

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for in the first column of this table]

Soil features affecting—Continued					
Pipeline construction and maintenance	Impoundments		Agricultural drainage	Sprinkler irrigation	Terraces, diversions, and waterways
	Reservoir area	Embankment			
Subject to flooding and to caving.	Subject to flooding; pervious material in substratum.	Pervious material in substratum; poor resistance to piping.	Well drained	Subject to flooding	Nearly level.
Seasonal high water table; subject to flooding; unstable banks.	Subject to flooding; pervious material in substratum.	Fair stability; pervious material in substratum.	Subject to flooding; seasonal high water table.	Seasonal high water table; subject to flooding.	Nearly level.
Stony soil in many places.	Features are generally favorable.	Stony soil in many places.	Well drained	Slow permeability; moderate available moisture capacity.	Slow permeability in fragipan.
Subject to caving	Pervious material	Good stability; permeable when compacted.	Well drained	Low available moisture capacity.	Irregular topography
High water table	Features generally favorable.	Fair stability	High water table; slow permeability.	High water table; slow permeability.	High water table; seepage along fragipan.
High water table; subject to flooding and to caving.	Subject to flooding; possible pervious layers in substratum.	Fair stability; piping hazard.	Subject to flooding; high water table; lower than available outlets in many places.	High water table; subject to flooding.	High water table; subject to flooding; seepage areas at edge of flood plain.
Stony soil in many places.	Features generally favorable.	Stony soil in many places.	Well drained	Slow permeability; moderate available moisture capacity.	Slow permeability in fragipan.
Depth to sandstone bedrock is 1½ to 3½ feet.	Depth to bedrock is 1½ to 3½ feet; pervious substratum and bedrock.	Limited amount of material; stony soil in many places.	Well drained	Low available moisture capacity.	Depth to bedrock is 1½ to 3½ feet; erodible on steep slopes; stony soil in many places.
Seasonal high water table; stony soil in many places.	Features generally favorable.	Stony soil in many places.	Seasonal high water table; slow permeability.	Seasonal high water table; slow permeability.	Seepage along fragipan; seasonal high water table; slow permeability.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of—			Soil features affecting—
			Topsoil	Sand and gravel	Road fill	Highway location
Mixed alluvial land: Mn.	Poor	Low	Poor: gravelly and cobbly soil.	Poor: subject to flooding; highly variable.	Good	Subject to flooding.
Morris: MoA, MoB2, MoC2, MrB2, MrC2, MrD2, MsB, MsD.	Poor	High	Poor: channery, flaggy, or stony soil.	Unsuitable: too many fines.	Fair: A–4 and A–6 material; seasonal high water table.	Seasonal high water table; seepage along fragipan.
*Norwich: NcA, NcB, NsB. For Chippewa part, see Chippewa series.	Poor	High	Poor: high water table; many stony areas.	Unsuitable: too many fines.	Fair: high water table.	High water table.
Oquaga. Mapped only with Lordstown soils.	Good	Low	Poor: channery or stony soil.	Unsuitable: too many fines.	Good	Depth to sandstone bedrock is 1½ to 3½ feet; erodible on steep slopes; stony soil in many places.
Peat: Pt	Unsuitable	High	Poor, but good for mulch or organic material.	Unsuitable: too many fines.	Unsuitable; high water table; organic material.	High water table; subsidence; unstable.
Terrace escarpments: Te.	Good	Low	Poor: gravelly, cobbly, or stony soil.	Good	Good	Steep slopes; cut slopes are droughty.
Unadilla: Us	Fair	Moderate	Good	Fair for sand. Poor for gravel.	Fair: erodible	Erodible material.
Volusia: VcA, VcB2, VcC2, VcD2, VfB, VfC, VfD, VsB, VsD.	Poor	High	Poor: channery, flaggy, or stony soil.	Unsuitable: too many fines.	Fair: seasonal high water table.	Seasonal high water table; seepages along fragipan.
Wellsboro: WeB2, WeC2, WeD2, WlB2, WlC2, WlD2, WsB, WsD, WsF.	Fair	Moderate	Poor: channery, flaggy, or stony soil.	Unsuitable: too many fines.	Good	Seasonal high water table; seepage along fragipan.
Wyalusing: Wy	Poor	High	Fair: high water table.	Unsuitable: high water table; too many fines.	Fair to a depth of 34 inches: A–4 material. Good at depths below 34 inches: A–1, A–2, A–4 material.	High water table; subject to flooding.

interpretations—Continued

Soil features affecting—Continued					
Pipeline construction and maintenance	Impoundments		Agricultural drainage	Sprinkler irrigation	Terraces, diversions, and waterways
	Reservoir area	Embankment			
Subject to flooding; high water table in some areas.	Subject to flooding; pervious material.	Stony and cobbly soil; pervious material.	Subject to flooding; high water table in some areas.	Subject to flooding; stony and cobbly soil.	Subject to flooding; stony and cobbly soil; high water table in some areas.
Seasonal high water table; stony soil in many places.	Features generally favorable.	Stony soil in many places.	Seasonal high water table; slow permeability.	High water table; slow permeability.	Seepage along fragipan; slow permeability; seasonal high water table.
High water table----	Features generally favorable.	Fair stability-------	High water table; slow permeability.	High water table; slow permeability.	High water table; seepage along fragipan.
Depth to sandstone bedrock is 1½ to 3½ feet.	Depth to bedrock is 1½ to 3½ feet; pervious substratum and bedrock.	Limited amount of material; stony soil in many places.	Well drained--------	Low available moisture capacity.	Depth to bedrock is 1½ to 3½ feet; erodible on steep slopes; stony soil in many places.
High water table; subsidence; unstable.	High water table; variable stability below water table.	Poor stability; subsidence.	High water table; subsidence; lower than available outlets in many places.	High water table----	High water table; lower than available outlets.
Unstable banks-----	Permeable material--	Fair stability; permeable material.	Well drained--------	Low available moisture capacity; steep slopes.	Irregular topography; steep slopes.
Unstable banks-----	Pervious layers in substratum.	Fair stability; permeable material.	Well drained--------	High available moisture capacity.	Erodible; nearly level.
Seasonal high water table; stony soil in many places.	Features generally favorable.	Stony soil in many places.	Seasonal high water table; slow permeability.	Seasonal high water table; slow permeability.	Seepage along fragipan; slow permeability; seasonal high water table.
Seasonal high water table; stony soil in many places.	Features generally favorable.	Stony soil in many places.	Seasonal high water table; slow permeability.	Seasonal high water table; slow permeability.	Seepage along fragipan; seasonal high water table.
High water table; subject to flooding.	Subject to flooding; pervious layers in underlying material.	Fair stability; piping hazard.	Subject to flooding; high water table, lower than available outlets in many places.	High water table; flooding.	High water table; subject to flooding; seepage areas at edge of flood plain.

Engineering test data

Table 4 shows the results of engineering tests performed by the Pennsylvania Department of Transportation on several important soils in Susquehanna County. The table shows the specific location where samples were taken, the depth to which sampling was done, and the results of tests to determine particle-size distribution, and other properties significant in soil engineering.

If a soil material is compacted at successively higher moisture content, assuming that the comparative effort remains constant, the density of the compacted material increases until the optimum moisture content is reached. After that the density decreases with the increase in moisture content. The highest dry density obtained in the compaction test is termed *maximum dry density*. Data that give moisture density are important in earthwork, for as a rule, optimum stability is obtained if the soil is compacted to about the maximum dry density when it is at approximately the optimum moisture content.

Mechanical analyses show the percentages, by weight, of soil particles that pass sieves of specified sizes. Sand and other coarser materials do not pass through the No. 200 sieve. Silt and clay pass through the No. 200 sieve. Silt is the material larger than 0.002 millimeter in diameter that passes through the No. 200 sieve, and clay is that fraction passing through the No. 200 sieve that is smaller than 0.002 millimeter in diameter. The clay fraction was determined by the hydrometer method rather than the pipette method that most soil scientists use in determining the clay in soil samples.

The tests to determine liquid limit and plastic limit measure the effect of water on the consistence of soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a semisolid to a plastic. As the moisture content is further increased, the material changes from a plastic to a liquid. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state. The liquid limit is the moisture content at which the material passes 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 soil material is in a plastic condition.

Estimated engineering properties

Table 5 provides estimates of soil properties important to engineering. The estimates are based on field classification and descriptions, physical and chemical tests of selected representative samples, test data from comparable soils in adjacent areas, and from detailed experience in working with the individual kind of soil in the survey area.

The depth to bedrock is not given; in nearly all the soils, the depth is more than 40 inches and does not significantly interfere with engineering use. The exceptions are Lordstown and Oquaga soils where bedrock is at a depth of 20 to 40 inches.

Permeability relates only to movement of water downward through undisturbed and uncompacted soil. It does not include lateral seepage. The estimates are based on structure and porosity of the soil. Plowpans, surface crusts, and other properties resulting from use of the soils are not considered.

Available moisture capacity is 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 per inch of soil.

Reaction is the degree of acidity or alkalinity of a soil expressed as a pH value. The pH value and relative terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is an indication of the volume change to be expected of the soil material with changes in moisture content. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates hazards to the maintenance of structures constructed in, on, or with such materials.

Corrosion potential indicates the potential risk to uncoated metal or concrete structures through chemical action that dissolves or weakens the structural material. Structural materials may corrode when buried in soil, and a given material corrodes in some kinds of soil more rapidly than in others. Extensive installations that intersect soil boundaries or soil horizons are more likely to be damaged by corrosion than are installations entirely in one kind of soil or soil horizon.

Engineering interpretations

Table 6 contains selected information useful to engineers and others who plan to use soil material in construction of highways, farm facilities, buildings, and sewage disposal systems. Detrimental or undesirable features are emphasized, but very important desirable features also may be listed. The ratings and other interpretations in this table are based on estimated engineering properties of the soils in table 5; on available test data, including those in table 4; and on field experience. The information applies only to soil depths indicated in table 5, but it is reasonably reliable to a depth of about 5 feet for most soils and to a depth of several more feet for some. It should be remembered that small areas of other soils have been included with each listed soil in mapping.

Winter grading is affected chiefly by soil features, especially unfavorable ones, that are relevant to moving, mixing, and compacting soil in road building when temperatures are below freezing.

Susceptibility to frost rating is affected chiefly by the height and duration of the water table and by the content of fines (silt and clay) in the soil.

Topsoil is a term used to designate a fertile soil or soil material, ordinarily rich in organic matter, used as a topdressing for lawns, gardens, roadbanks, and the like. The ratings indicate suitability for such use.

Suitability as a source of sand and gravel is rated on the probability that delineated areas of the soil contain deposits of sand and gravel. The ratings do not indicate quality or size of the deposits.

Road fill is material used to build embankments. The ratings indicate performance of soil material moved from borrow areas for these purposes.

Highway location is influenced by features of the undisturbed soil that affect construction and maintenance of highways. The soil features listed, favorable as well as unfavorable, are the principal ones that affect geographic location of highways.

Pipeline construction is influenced by features of the undisturbed soil, such as slope, depth of bedrock, height and duration of the water table, stoniness or rockiness, flooding, and corrosion potential.

Reservoir areas are affected mainly by losses of water through seepage, and the soil features listed are those that influence such seepage.

Embankments serve as dams. The soil features, of both subsoil and substratum, are those important to the use of soils for constructing embankments.

Agricultural drainage is influenced by features of the undisturbed soils, such as permeability, height of water table, and seepage.

Irrigation is influenced by features such as soil depth, available moisture capacity, permeability, and stoniness. Only sprinkler type systems are considered.

Terraces, diversions, and waterways are influenced by depth to bedrock, stoniness, seepage, and ease of obtaining vegetative cover.

Use of the Soils for Town and Country Planning

This section provides information of special interest to those persons or organizations who plan to develop recreational enterprises (fig. 7) or community development (fig. 8) activities that rely on selective soil use for their success. In addition to providing basic information about soils that should be useful in planning outdoor recreational activities, it will also provide a sound factual basis for developing wise land-use plans for Susquehanna County or its political subdivisions. Interpretive maps can be made from the soil maps and the information in table 7 to assist in determining the degree and kind of limitations of the soils of any given area.

Figure 7.—**Typical peat bog near South Montrose. Such an area is suitable for flooding with water deep enough to form a lake.**

The information in this section is presented also for guidance of individuals, officials, and developers who are concerned with selecting suitable uses for soils and with avoiding mistakes and costly changes in plans resulting from improper use.

While this information and the soil maps give general guidance, it is emphasized that the mapping and written

Figure 8.—**This 15-acre lake was constructed on marsh land that was formerly idle but now provides water frontage for approximately 40 lots in a subdivision.**

information are restricted in detail by the map scale and should be used only in planning more detailed field investigations to determine the onsite condition of the soil at any specific site.

Only soil features are evaluated in this section, since the ease or difficulty of making improvements is largely controlled by the characteristics of the soils. However, it is recognized that such economic factors as location are often decisive in the ultimate use of an area, regardless of soil limitations involved.

Table 7 lists all the soils in the county and shows the kinds and estimated degree of limitation for specific uses. Soil features that have an important effect on recreational and community development uses are depth to bedrock, permeability, flooding, depth to seasonal water table, soil texture, slope, and stoniness. Relative degrees of limitations used are slight, moderate, and severe. Slight indicates that the soil area in question generally has few limitations for the specified use. Moderate indicates that the soil has limitations that require special practices to

TABLE 7.—*Estimated degree and kind of limita-*

Soil series and map symbols	Onsite disposal of sewage effluent	Sewage lagoons	Locations for buildings of three stories or less	Landscaping and lawns at homesites	Streets and parking lots for subdivisions	Sanitary land fills [1] (trench method)	Cemeteries
Barbour: Ba	Severe: subject to flooding.	Severe: subject to flooding; moderately rapid permeability in substratum.	Severe: subject to flooding; moderately rapid permeability in substratum.	Moderate: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Basher: Bc	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Bath:							
BeB2	Severe: slow permeability.	Moderate: slope.	Slight	Slight	Moderate: slope.	Slight	Slight
BeC2	Severe: slow permeability.	Severe: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
BfB2	Severe: slow permeability.	Moderate: slope.	Slight	Severe: flaggy soil.	Moderate: slope.	Slight	Severe: flaggy soil.
BfC2	Severe: slow permeability.	Severe: slope.	Moderate: slope.	Severe: flaggy soil.	Severe: slope.	Moderate: slope.	Severe: flaggy soil.
BfD2	Severe: slope; slow permeability.	Severe: slope.	Severe: slope.	Severe: slope; flaggy soil.	Severe: slope.	Severe: slope.	Severe: slope; flaggy soil.
BsB	Severe: slow permeability.	Moderate: slope.	Moderate: stony soil.	Severe: flaggy soil.	Moderate: slope.	Moderate: stony soil.	Severe: stony soil.
BsD	Severe: slope; slow permeability.	Severe: slope.	Severe: slope.	Severe: slope; flaggy soil.	Severe: slope.	Severe: slope.	Severe: slope; stony soil.
BsF	Severe: slope; slow permeability.	Severe: slope.	Severe: slope.	Severe: slope; flaggy soil.	Severe: slope.	Severe: slope.	Severe: slope; stony soil.

See footnote at end of table.

overcome or correct. Severe indicates that the soil has limitations that are very difficult or expensive to overcome or correct.

The various soil uses involved in the development of recreational and community facilities are evaluated in table 7. The column heads are discussed in the following paragraphs.

ONSITE DISPOSAL OF SEWAGE EFFLUENT.—The main features affecting use of soils for sewage effluent disposal systems are permeability, slope, depth to bedrock, and the depth to any water table that may be present. In soils underlain by cavernous limestone, underground water may be contaminated by seepage of effluent through rock crevices or solution channels. Ground water may also be contaminated by rapid percolation through loose material underlying some kinds of soil. Size of drainage field and type of disposal system used are often affected by the degree and kind of limitation. Soils with a severe rating should be carefully investigated before decisions are made concerning installation of disposal systems. For

tions for town and country planning

Campsites for—		Buildings without basements	Paths and trails in camping areas	Picnic and play areas (extensive use)	Athletic fields (intensive use)	Golf fairways
Tents and small campers	Large camper trailers					
Moderate: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Slight	Moderate: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.
Moderate subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Slight	Moderate: subject to flooding.	Moderate: subject to flooding; seasonal high water table.	Moderate: subject to flooding.
Moderate: slow permeability; channery soil.	Moderate: slope; slow permeability; channery soil.	Slight	Moderate: channery soil.	Moderate: channery soil.	Severe: channery soil.	Moderate: channery soil.
Moderate: slow permeability; slope; channery soil.	Severe: slope	Moderate: slope.	Moderate: channery soil.	Moderate: slope; channery soil.	Severe: slope; channery soil.	Moderate: slope; channery soil.
Moderate: flaggy soil; slow permeability.	Moderate: flaggy soil; slope; slow permeability.	Slight	Moderate: flaggy soil.	Moderate: flaggy soil.	Severe: flaggy soil.	Severe: flaggy soil.
Moderate: slope; slow permeability; flaggy soil.	Severe: slope	Moderate: slope.	Moderate: flaggy soil.	Moderate: flaggy soil; slope.	Severe: flaggy soil; slope.	Severe: flaggy soil.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope; flaggy soil.	Severe: slope	Severe: slope; flaggy soil.	Severe: slope; flaggy soil.
Moderate: stony or channery soil; slow permeability.	Moderate: slope; slow permeability; channery or stony soil.	Slight	Moderate: stony or channery soil.	Moderate: channery soil.	Severe: channery soil.	Moderate: channery or stony soil.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope; stony or channery soil.	Severe: slope	Severe: slope; channery soil.	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope; channery soil.	Severe: slope.

TABLE 7.—*Estimated degree and kind of limitations for*

Soil series and map symbols	Onsite disposal of sewage effluent	Sewage lagoons	Locations for buildings of three stories or less	Landscaping and lawns at homesites	Streets and parking lots for subdivisions	Sanitary land fills [1] (trench method)	Cemeteries
Chenango:							
CnA	Slight: possible contamination of ground water.	Severe: rapid permeability in substratum.	Slight	Slight	Slight	Severe: rapid permeability in substratum.	Slight
CnB2	Slight: possible contamination of ground water.	Severe: rapid permeability in substratum.	Slight	Slight	Moderate slope.	Severe: rapid permeability in substratum.	Slight
CnC2	Moderate: slope; possible contamination of ground water.	Severe: slope; rapid permeability in substratum.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: rapid permeability in substratum.	Moderate: slope.
CnD2	Severe: slope; possible contamination of ground water.	Severe: slope; rapid permeability in substratum.	Severe: slope.	Severe: slope.	Severe: slope.	Severe; slope; rapid permeability in substratum.	Severe: slope.
Chippewa. Mapped only with Norwich series.							
Cut and fill land: Cu. No estimates made, because soil material is too variable. Onsite investigation required.							
Holly: Hw	Severe: subject to flooding; high water table.	Severe: subject to flooding.	Severe: subject to flooding; high water table.	Severe: subject to flooding; high water table.	Severe: subject to flooding; high water table.	Severe: subject to flooding; high water table.	Severe: subject to flooding; high water table.
Lackawanna:							
LaB2	Severe: slow permeability.	Moderate: slope.	Slight	Slight	Moderate: slope.	Slight	Slight
LaC2	Severe: slow permeability.	Severe: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
LaD2	Severe: slope; slow permeability.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

town and country planning—Continued

Campsites for—		Buildings without basements	Paths and trails in camping areas	Picnic and play areas (extensive use)	Athletic fields (intensive use)	Golf fairways
Tents and small campers	Large camper trailers					
Moderate: gravelly soil.	Moderate: gravelly soil.	Slight	Moderate gravelly soil.	Moderate: gravelly soil.	Severe: gravelly soil.	Moderate: gravelly soil.
Moderate: gravelly soil.	Moderate: slope; gravelly soil.	Slight	Moderate gravelly soil.	Moderate: gravelly soil.	Severe: gravelly soil.	Moderate: gravelly soil.
Moderate: slope; gravelly soil.	Severe: slope	Moderate: slope.	Moderate: gravelly soil.	Moderate: slope; gravelly soil.	Severe: slope; gravelly soil.	Moderate: slope; gravelly soil.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope; gravelly soil.	Severe: slope	Severe: slope; gravelly soil.	Severe: slope.
Severe: high water table.	Severe: high water table.	Severe: subject to flooding; high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Moderate: slow permeability; channery soil.	Moderate: slow permeability; slope; channery soil.	Slight	Moderate: channery soil.	Moderate: channery soil.	Severe: channery soil.	Moderate: channery soil.
Moderate: slow permeability; slope; channery soil.	Severe: slope	Moderate: slope.	Moderate: channery soil.	Moderate: slope; channery soil.	Severe: slope; channery soil.	Moderate: slope; channery soil.
Severe: slope	Severe: slope	Severe: slope.	Moderate: slope; channery soil.	Severe: slope	Severe: slope; channery soil.	Severe: slope.

TABLE 7.—*Estimated degree and kind of limitations for*

Soil series and map symbols	Onsite disposal of sewage effluent	Sewage lagoons	Locations for buildings of three stories or less	Landscaping and lawns at homesites	Streets and parking lots for subdivisions	Sanitary land fills [1] (trench method)	Cemeteries
Lackawanna—Con.							
LfB	Severe: slow permeability.	Moderate: slope.	Slight	Severe: flaggy soil.	Moderate: slope.	Slight	Severe: flaggy soil.
LfC2	Severe: slow permeability.	Severe: slope.	Moderate: slope.	Severe: flaggy soil.	Severe: slope.	Moderate: slope.	Severe: flaggy soil.
LfD2	Severe: slow permeability; slope.	Severe: slope.	Severe: slope.	Severe: slope; flaggy soil.	Severe: slope.	Severe: slope.	Severe: slope; flaggy soil.
LgB	Severe: slow permeability.	Moderate: slope.	Moderate: stony.	Severe: flaggy soil.	Moderate: slope; stony soil.	Moderate: stony soil.	Severe: stony soil.
LgD	Severe: slope; slow permeability.	Severe: slope.	Severe: slope.	Severe: slope; flaggy soil.	Severe: slope.	Severe: slope.	Severe: slope; stony soil.
LgF	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope; flaggy soil.	Severe: slope.	Severe: slope.	Severe: slope; stony soil.
Lordstown:							
LkB2	Severe: depth to bedrock is 1½ to 3½ feet.	Severe: depth to bedrock is 1½ to 3½ feet.	Severe: depth to bedrock is 1½ to 3½ feet.	Moderate: depth to bedrock is 1½ to 3½ feet.	Severe: depth to bedrock is 1½ to 3½ feet.	Severe: depth to bedrock is 1½ to 3½ feet.	Severe: depth to bedrock is 1½ to 3½ feet.
LkC2	Severe: depth to bedrock is 1½ to 3½ feet.	Severe: depth to bedrock is 1½ to 3½ feet; slope.	Severe: depth to bedrock is 1½ to 3½ feet.	Moderate: depth to bedrock is 1½ to 3½ feet; slope.	Severe: depth to bedrock is 1½ to 3½ feet; slope.	Severe: depth to bedrock is 1½ to 3½ feet.	Severe: depth to bedrock is 1½ to 3½ feet.
LkD2	Severe: depth to bedrock is 1½ to 3½ feet; slope.	Severe: depth to bedrock is 1½ to 3½ feet; slope.	Severe: depth to bedrock is 1½ to 3½ feet; slope.	Severe: slope.	Severe: depth to bedrock is 1½ to 3½ feet; slope.	Severe: depth to bedrock is 1½ to 3½ feet; slope.	Severe: depth to bedrock is 1½ to 3½ feet; slope.
LoB	Severe: depth to bedrock is 1½ to 3½ feet.	Severe: depth to bedrock is 1½ to 3½ feet.	Severe: depth to bedrock is 1½ to 3½ feet.	Severe: flaggy soil.	Severe: depth to bedrock is 1½ to 3½ feet.	Severe: depth to bedrock is 1½ to 3½ feet.	Severe: depth to bedrock is 1½ to 3½ feet; flaggy soil.
LoC2	Severe: depth to bedrock is 1½ to 3½ feet.	Severe: depth to bedrock is 1½ to 3½ feet; slope.	Severe: depth to bedrock is 1½ to 3½ feet.	Severe: flaggy soil.	Severe: depth to bedrock is 1½ to 3½ feet; slope.	Severe: depth to bedrock is 1½ to 3½ feet.	Severe: depth to bedrock is 1½ to 3½ feet; flaggy soil.
LoD2	Severe: depth to bedrock is 1½ to 3½ feet; slope.	Severe: depth to bedrock is 1½ to 3½ feet; slope.	Severe: depth to bedrock is 1½ to 3½ feet; slope.	Severe: slope; flaggy soil.	Severe: depth to bedrock is 1½ to 3½ feet; slope.	Severe: depth to bedrock is 1½ to 3½ feet; slope.	Severe: depth to bedrock is 1½ to 3½ feet; flaggy soil; slope.

See footnote at end of table.

town and country planning—Continued

Campsites for—		Buildings without basements	Paths and trails in camping areas	Picnic and play areas (extensive use)	Athletic fields (intensive use)	Golf fairways
Tents and small campers	Large camper trailers					
Moderate: flaggy soil; slow permeability.	Moderate: flaggy soil; slow permeability; slope.	Slight	Moderate: flaggy soil.	Moderate: flaggy soil.	Severe: flaggy soil.	Severe: flaggy soil.
Moderate: flaggy soil; slow permeability; slope.	Severe: slope	Moderate: slope.	Moderate: flaggy soil.	Moderate: flaggy soil; slope.	Severe: slope; flaggy soil.	Severe: flaggy soil.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope; flaggy soil.	Severe: slope.	Severe: slope; flaggy soil.	Severe: slope; flaggy soil.
Moderate: channery or stony soil; slow permeability.	Moderate: channery or stony soil; slow permeability; slope.	Slight	Moderate: stony or channery soil.	Moderate: channery soil.	Severe: channery soil.	Moderate: channery or stony soil.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope; stony or channery soil.	Severe: slope.	Severe: slope; channery soil.	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope.	Severe: slope.	Severe: slope; channery soil.	Severe: slope.
Moderate: channery soil.	Moderate: slope; channery soil.	Slight	Moderate: channery soil.	Moderate: channery soil.	Severe: channery soil.	Moderate: depth to bedrock is 1½ to 3½ feet; channery soil.
Moderate: channery soil; slope.	Severe: slope	Moderate: slope.	Moderate: channery soil.	Moderate: slope; channery soil.	Severe: slope; channery soil.	Moderate: depth to bedrock is 1½ to 3½ feet; slope; channery soil.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope; channery soil.	Severe: slope	Severe: slope; channery soil.	Severe: slope.
Moderate: flaggy soil.	Moderate: flaggy soil; slope.	Slight	Moderate: flaggy soil.	Moderate: flaggy soil.	Severe: flaggy soil.	Severe: flaggy soil.
Moderate: flaggy soil; slope.	Severe: slope	Moderate: slope.	Moderate: flaggy soil.	Moderate: flaggy soil; slope.	Severe: slope; flaggy soil.	Severe: flaggy soil.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope; flaggy soil.	Severe: slope	Severe: slope; flaggy soil.	Severe: slope; flaggy soil.

TABLE 7.—*Estimated degree and kind of limitations for*

Soil series and map symbols	Onsite disposal of sewage effluent	Sewage lagoons	Locations for buildings of three stories or less	Landscaping and lawns at homesites	Streets and parking lots for subdivisions	Sanitary land fills [1] (trench method)	Cemeteries
Lordstown—Con.							
LsB	Severe: depth to bedrock is 1½ to 3½ feet.	Severe: depth to bedrock is 1½ to 3½ feet.	Severe: depth to bedrock is 1½ to 3½ feet.	Severe: flaggy soil.	Severe: depth to bedrock is 1½ to 3½ feet.	Severe: depth to bedrock is 1½ to 3½ feet.	Severe: depth to bedrock is 1½ to 3½ feet; stony soil.
LsD	Severe: depth to bedrock is 1½ to 3½ feet; slope.	Severe: depth to bedrock is 1½ to 3½ feet; slope	Severe: depth to bedrock is 1½ to 3½ feet; slope.	Severe: slope; flaggy soil.	Severe: slope; depth to bedrock is 1½ to 3½ feet.	Severe: depth to bedrock is 1½ to 3½ feet; slope.	Severe: depth to bedrock is 1½ to 3½ feet; slope; stony soil.
LsF	Severe: depth to bedrock is 1½ to 3½ feet; slope.	Severe: depth to bedrock is 1½ to 3½ feet; slope.	Severe: depth to bedrock is 1½ to 3½ feet; slope.	Severe: slope; flaggy soil.	Severe: depth to bedrock is 1½ to 3½ feet; slope.	Severe: depth to bedrock is 1½ to 3½ feet; slope.	Severe: depth to bedrock is 1½ to 3½ feet; slope; stony soil.
Mardin:							
McB2	Severe: slow permeability.	Moderate: slope.	Moderate: seasonal high water table.	Slight	Moderate: slope; seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.
McC2	Severe: slow permeability.	Severe: slope.	Moderate: seasonal high water table; slope.	Moderate: slope.	Severe: slope.	Moderate: seasonal high water table; slope.	Moderate: seasonal water high table; slope.
McD2	Severe: slope; slow permeability.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
MfB2	Severe: slow permeability.	Moderate: slope.	Moderate: seasonal high water table.	Severe: flaggy soil.	Moderate: seasonal high water table; slope.	Moderate: seasonal high water table.	Severe: flaggy soil.
MfC2	Severe: slow permeability.	Severe: slope.	Moderate: seasonal high water table; slope.	Severe: flaggy soil.	Severe: slope.	Moderate: seasonal high water table; slope.	Severe: flaggy soil.
MfD2	Severe: slope; slow permeability.	Severe: slope.	Severe: slope.	Severe: slope; flaggy soil.	Severe: slope.	Severe: slope.	Severe: slope; flaggy soil.
MgB	Severe: slow permeability.	Moderate: slope.	Moderate: seasonal high water table; stony soil.	Severe: flaggy soil.	Moderate: seasonal high water table; slope.	Moderate: seasonal high water table; stony soil.	Severe: stony soil.
MgD	Severe: slope; slow permeability.	Severe: slope.	Severe: slope.	Severe: slope; flaggy soil.	Severe: slope.	Severe: slope.	Severe: slope; stony soil.

See footnote at end of table.

town and country planning—Continued

Campsites for—		Buildings without basements	Paths and trails in camping areas	Picnic and play areas (extensive use)	Athletic fields (intensive use)	Golf fairways
Tents and small campers	Large camper trailers					
Moderate: stony soil; channery soil.	Moderate: stony or channery soil; slope.	Slight	Moderate: stony or channery soil.	Moderate: channery soil.	Severe: channery soil.	Moderate: depth to bedrock is 1½ to 3½ feet; channery or stony soil.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope; stony or channery soil.	Severe: slope	Severe: slope; channery soil.	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope; channery soil.	Severe: slope.
Moderate: slow permeability; slope; channery soil.	Moderate: slow permeability; channery soil; slope.	Slight	Moderate: channery soil.	Moderate: channery soil.	Severe: channery soil.	Moderate: channery soil.
Moderate: slow permeability; channery soil; slope.	Severe: slope	Moderate: slope.	Moderate: channery soil.	Moderate: slope; channery soil.	Severe: slope; channery soil.	Moderate: slope; channery soil.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope; channery soil.	Severe: slope	Severe: slope; channery soil.	Severe: slope.
Moderate: slow permeability; flaggy soil.	Moderate: slow permeability; slope; flaggy soil.	Slight	Moderate: flaggy soil.	Moderate: flaggy soil.	Severe: flaggy soil.	Severe: flaggy soil.
Moderate: slow permeability; flaggy soil; slope.	Severe: slope	Moderate: slope.	Moderate: flaggy soil.	Moderate: flaggy soil; slope.	Severe: slope; flaggy soil.	Severe: flaggy soil.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope; flaggy soil.	Severe: slope	Severe: slope; flaggy soil.	Severe: slope; flaggy soil.
Moderate: slow permeability; stony or channery soil.	Moderate: slow permeability; slope; channery or stony soil.	Slight	Moderate: stony or channery soil.	Moderate: channery soil.	Severe: channery soil.	Moderate: stony or channery soil.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope stony or channery soil.	Severe: slope	Severe: slope; channery soil.	Severe: slope.

TABLE 7.—*Estimated degree and kind of limitations for*

Soil series and map symbol	Onsite disposal of sewage effluent	Sewage lagoons	Locations for buildings of three stories or less	Landscaping and lawns at homesites	Streets and parking lots for subdivisions	Sanitary land fills [1] (trench method)	Cemeteries
Mardin—Con. MgF	Severe: slope; slow permeability.	Severe: slope.	Severe: slope.	Severe: slope; flaggy soil.	Severe: slope.	Severe: slope.	Severe: slope; stony soil.
Mixed alluvial land: Mn.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Morris: MoA	Severe: seasonal high water table; slow permeability.	Slight	Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.
MoB2	Severe: seasonal high water table; slow permeability.	Moderate: slope.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table; slope.	Severe: seasonal high water table.	Severe: seasonal high water table.
MoC2	Severe: seasonal high water table; slow permeability.	Severe: slope.	Severe: seasonal high water table.	Moderate: seasonal high water table; slope.	Severe: slope.	Severe: seasonal high water table.	Severe: seasonal high water table.
MrB2	Severe: seasonal high water table; slow permeability.	Moderate: slope.	Severe: seasonal high water table.	Severe: flaggy soil.	Moderate: seasonal high water table; slope.	Severe: seasonal high water table.	Severe: seasonal high water table; flaggy soil.
MrC2	Severe: seasonal high water table; slow permeability.	Severe: slope.	Severe: seasonal high water table.	Severe: flaggy soil.	Severe: slope.	Severe: seasonal high water table.	Severe: seasonal high water table; flaggy soil.
MrD2	Severe: slope; seasonal high water table; slow permeability.	Severe: slope.	Severe: slope; seasonal high water table.	Severe: slope; flaggy soil.	Severe: slope.	Severe: slope; seasonal high water table.	Severe: slope; seasonal high water table; flaggy soil.
MsB	Severe: seasonal high water table; slow permeability.	Moderate: slope.	Severe: seasonal high water table.	Severe: flaggy soil.	Moderate: slope; seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table; stony soil.
MsD	Severe: seasonal high water table; slope; slow permeability.	Severe: slope.	Severe: seasonal high water table; slope.	Severe: slope; flaggy soil.	Severe: slope.	Severe: seasonal high water table; slope.	Severe: seasonal high water table; stony soil; slope.

See footnote at end of table.

town and country planning—Continued

Campsites for—		Buildings without basements	Paths and trails in camping areas	Picnic and play areas (extensive use)	Athletic fields (intensive use)	Golf fairways
Tents and small campers	Large camper trailers					
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope; channery soil.	Severe: slope.
Moderate: subject to flooding; gravelly soil.	Moderate: subject to flooding; gravelly soil.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding; gravelly soil.	Severe: gravelly soil.	Moderate: subject to flooding; gravelly soil.
Moderate: seasonal high water table; slow permeability.	Moderate: seasonal high water table; slow permeability.	Moderate: seasonal high water table.	Moderate: seasonal high water table; channery soil.	Moderate: seasonal high water table; channery soil.	Severe: seasonal high water table; channery soil.	Moderate: seasonal high water table; channery soil.
Moderate: seasonal high water table; slow permeability.	Moderate: seasonal high water table; slow permeability; slope.	Moderate: seasonal high water table.	Moderate: seasonal high water table; channery soil.	Moderate: seasonal high water table; channery soil.	Severe: seasonal high water table; channery soil.	Moderate: seasonal high water table; channery soil.
Moderate: seasonal high water table; slow permeability; slope.	Severe: slope	Moderate: slope; seasonal high water table.	Moderate: seasonal high water table; channery soil.	Moderate: seasonal high water table; slope; channery soil.	Severe: seasonal high water table; slope; channery soil.	Moderate: seasonal high water table; slope; channery soil.
Moderate: seasonal high water table; flaggy soil; slow permeability.	Moderate: seasonal high water table; flaggy soil; slow permability; slope.	Moderate: seasonal high water table.	Moderate: flaggy soil; seasonal high water table.	Moderate: flaggy soil; seasonal high water table.	Severe: seasonal high water table; flaggy soil.	Severe: flaggy soil.
Moderate: seasonal high water table; flaggy soil; slow permeability; slope.	Severe: slope	Moderate: slope; seasonal high water table.	Moderate: flaggy soil; seasonal high water table; slope.	Moderate: flaggy soil; slope; seasonal high water table.	Severe: seasonal high water table; flaggy soil; slope.	Severe: flaggy soil.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope; seasonal high water table; flaggy soil.	Severe: slope	Severe: seasonal high water table; flaggy soil; slope.	Severe: slope; flaggy soil.
Moderate: seasonal high water table; slow permeability; stony or channery soil.	Moderate: seasonal high water table; slow permeability; slope; stony or channery soil.	Moderate: seasonal high water table.	Moderate: seasonal high water table; channery or stony soil.	Moderate: seasonal high water table; channery soil.	Severe: seasonal high water table; channery soil.	Moderate: stony or channery soil.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope; seasonal high water table; stony or channery soil.	Severe: slope	Severe: seasonal high water table; slope; channery soil.	Severe: slope.

TABLE 7.—*Estimated degree and kind of limitations for*

Soil series and map symbols	Onsite disposal of sewage effluent	Sewage lagoons	Locations for buildings of three stories or less	Landscaping and lawns at homesites	Streets and parking lots for subdivisions	Sanitary land fills [1] (trench method)	Cemeteries
Norwich:							
NcA	Severe: high water table; slow permeability.	Slight	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
NcB	Severe: high water table; slow permeability.	Moderate: slope.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
NsB	Severe: high water table; slow permeability.	Moderate: slope.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table; stony soil.
Oquaga. Mapped only with Lordstown series.							
Peat: Pt	Severe: high water table; subject to flooding.	Severe: organic material; subject to flooding.	Severe: high water table; subject to flooding; unstable material.	Severe: high water table; organic material.	Severe: high water table.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.
Terrace escarpments: Te.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Unadilla: Us	Slight	Moderate: moderate permeability.	Slight	Slight	Slight	Slight	Slight
Volusia:							
VcA	Severe: seasonal high water table; slow permeability.	Slight	Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.
VcB2	Severe: seasonal high water table; slow permeability.	Moderate: slope.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table; slope.	Severe: seasonal high water table.	Severe: seasonal high water table.
VcC2	Severe: seasonal high water table; slow permeability.	Severe: slope.	Severe: seasonal high water table.	Moderate: seasonal high water table; slope.	Severe: slope.	Severe: seasonal high water table.	Severe: seasonal high water table.
VcD2	Severe: seasonal high water table; slope; slow permeability.	Severe: slope.	Severe: seasonal high water table; slope.	Severe: slope.	Severe: slope.	Severe: seasonal high water table; slope.	Severe: seasonal high water table; slope.

See footnote at end of table.

town and country planning—Continued

Campsites for—		Buildings without basements	Paths and trails in camping areas	Picnic and play areas (extensive use)	Athletic fields (intensive use)	Golf fairways
Tents and small campers	Large camper trailers					
Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Severe: high water table; subject to flooding; organic soil.	Severe: high water table; subject to flooding; organic soil.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding; organic soil.	Severe: high water table; organic soil.	Severe: high water table; organic soil.	Severe: high water table; organic soil.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Slight	Slight	Slight	Slight	Slight	Slight	Slight.
Moderate: seasonal high water table; slow permeability; channery soil.	Moderate: seasonal high water table; slow permeability; channery soil.	Moderate: seasonal high water table.	Moderate: seasonal high water table; channery soil.	Moderate: seasonal high water table; channery soil.	Severe: seasonal high water table; channery soil.	Moderate: seasonal high water table; channery soil.
Moderate: seasonal high water table; slow permeability; channery soil.	Moderate: seasonal high water table; slow permeability; slope; channery soil.	Moderate: seasonal high water table.	Moderate: seasonal high water table; channery soil.	Moderate: seasonal high water table; channery soil.	Severe: seasonal high water table; channery soil.	Moderate: seasonal high water table; channery soil.
Moderate: seasonal high water table; slow permeability; slope; channery soil.	Severe: slope	Moderate: slope; seasonal high water table.	Moderate: seasonal high water table; channery soil.	Moderate: seasonal high water table; slope; channery soil.	Severe: seasonal high water table; slope; channery soil.	Moderate: seasonal high water table; slope; channery soil.
Severe: slope	Severe: slope	Severe: slope.	Moderate: slope; seasonal high water table; channery soil.	Severe: slope.	Severe: slope; seasonal high water table; channery soil.	Severe: slope.

TABLE 7.—*Estimated degree and kinds of limita-*

Soil series and map symbols	Onsite disposal of sewage effluent	Sewage lagoons	Locations for buildings of three stories or less	Landscaping and lawns at homesites	Streets and parking lots for subdivisions	Sanitary land fills [1] (trench method)	Cemeteries
Volusia—Con.							
VfB	Severe: seasonal high water table; slow permeability.	Moderate: slope.	Severe: seasonal high water table.	Severe: flaggy soil.	Moderate: seasonal high water table; slope.	Severe: seasonal high water table.	Severe: seasonal high water table; flaggy soil.
VfC	Severe: seasonal high water table; slow permeability.	Severe: slope.	Severe: seasonal high water table.	Severe: flaggy soil.	Severe: slope.	Severe: seasonal high water table.	Severe: seasonal high water table; flaggy soil.
VfD	Severe: slope; seasonal high water table; slow permeability.	Severe: slope.	Severe: slope; seasonal high water table.	Severe: slope; flaggy soil.	Severe: slope.	Severe: slope; seasonal high water table.	Severe: slope; seasonal high water table; flaggy soil.
VsB	Severe: seasonal high water table; slow permeability.	Moderate: slope.	Severe: seasonal high water table.	Severe: flaggy soil.	Moderate: seasonal high water table; slope.	Severe: seasonal high water table.	Severe: seasonal high water table; stony soil.
VsD	Severe: slope; seasonal high water table; slow permeability.	Severe: slope.	Severe: slope; seasonal high water table.	Severe: slope; flaggy soil.	Severe: slope.	Severe: slope; seasonal high water table.	Severe: slope; seasonal high water table; stony soil.
Wellsboro:							
WeB2	Severe: slow permeability.	Moderate: slope.	Moderate: seasonal high water table.	Slight	Moderate: seasonal high water table; slope.	Moderate: seasonal high water table.	Moderate: seasonal high water table.
WeC2	Severe: slow permeability.	Severe: slope.	Moderate: seasonal high water table; slope.	Moderate: slope.	Severe: slope.	Moderate: seasonal high water table; slope.	Moderate: seasonal high water table; slope.
WeD2	Severe: slope; slow permeability.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
WlB2	Severe: slow permeability.	Moderate: slope.	Moderate: seasonal high water table.	Severe: flaggy soil.	Moderate: seasonal high water table; slope.	Moderate: seasonal high water table.	Severe: flaggy soil.
WlC2	Severe: slow permeability.	Severe: slope.	Moderate: seasonal high water table; slope.	Severe: flaggy soil.	Severe: slope.	Moderate: seasonal high water table; slope.	Severe: flaggy soil.

See footnote at end of table.

tions for town and country planning—Continued

Campsites for—		Buildings without basements	Paths and trails in camping areas	Picnic and play areas (extensive use)	Athletic fields (intensive use)	Golf fairways
Tents and small campers	Large camper trailers					
Moderate: seasonal high water table.	Moderate: seasonal high water table; flaggy soil; slow permeability; slope.	Moderate: seasonal high water table.	Moderate: flaggy soil; seasonal high water table.	Moderate: flaggy soil; seasonal high water table.	Severe: seasonal high water table; flaggy soil.	Severe: flaggy soil.
Moderate: seasonal high water table; flaggy soil; slow permeability; slope.	Severe: slope	Moderate: slope; seasonal high water table.	Moderate: flaggy soil; seasonal high water table.	Moderate: flaggy soil; seasonal high water table; slope.	Severe: seasonal high water table; flaggy soil; slope.	Severe: flaggy soil.
Severe: slope	Severe: slope	Severe: slope.	Moderate: slope; seasonal high water table; flaggy soil.	Severe: slope.	Severe: seasonal high water table; flaggy soil; slope.	Severe: slope; flaggy soil.
Moderate: seasonal high water table; slow permeability; stony or channery soil.	Moderate: seasonal high water table; slow permeability; slope; stony or channery soil.	Moderate: seasonal high water table.	Moderate: seasonal high water table; stony soil; channery soil.	Moderate: channery soil; seasonal high water table.	Severe: seasonal high water table; channery soil.	Moderate: channery or stony soil.
Severe: slope	Severe: slope	Severe: slope.	Moderate: slope; stony soil; seasonal high water table; channery soil.	Severe: slope.	Severe: seasonal high water table; slope; channery soil.	Severe: slope.
Moderate: slow permeability; channery soil.	Moderate: slow permeability; slope; channery soil.	Slight	Moderate: channery soil.	Moderate: channery soil.	Severe: channery soil.	Moderate: channery soil.
Moderate: slow permeability; slope; channery soil.	Severe: slope	Moderate: slope.	Moderate: channery soil	Moderate: slope; channery soil.	Severe: slope; channery soil.	Moderate: slope; channery soil.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope; channery soil.	Severe: slope	Severe: slope; channery soil.	Severe: slope.
Moderate: slow permeability; flaggy soil.	Moderate: slow permeability; slope; flaggy soil.	Slight	Moderate: flaggy soil.	Moderate: flaggy soil.	Severe: flaggy soil.	Severe: flaggy soil.
Moderate: slow permeability; slope; flaggy soil.	Severe: slope	Moderate: slope.	Moderate: flaggy soil.	Moderate: flaggy soil; slope.	Severe: slope; flaggy soil.	Severe: flaggy soil.

TABLE 7.—*Estimated degree and kinds of limita-*

Soil series and map symbols	Onsite disposal of sewage effluent	Sewage lagoons	Locations for buildings of three stories or less	Landscaping and lawns at homesites	Streets and parking lots for subdivisions	Sanitary land fills [1] (trench method)	Cemeteries
Wellsboro—Con.							
WlD2	Severe: slope; slow permeability.	Severe: slope.	Severe: slope.	Severe: slope; flaggy soil.	Severe: slope.	Severe: slope.	Severe: slope; flaggy soil.
WsB	Severe: slow permeability.	Moderate: slope.	Moderate: seasonal high water table; stony soil.	Severe: flaggy soil.	Moderate: seasonal high water table; slope.	Moderate: seasonal high water table; stony soil.	Severe: stony soil.
WsD	Severe: slope; slow permeability.	Severe: slope.	Severe: slope.	Severe: slope; flaggy soil.	Severe: slope.	Severe: slope.	Severe: slope; stony soil.
WsF	Severe: slope; slow permeability.	Severe: slope.	Severe: slope.	Severe: slope; flaggy soil.	Severe: slope.	Severe: slope.	Severe: slope; stony soil.
Wyalusing: Wy	Severe: subject to flooding; high water table.	Severe: subject to flooding.	Severe: subject to flooding; high water table.	Severe: subject to flooding; high water table.	Severe: subject to flooding; high water table.	Severe: subject to flooding; high water table.	Severe: subject to flooding; high water table.

[1] Onsite investigation of the deep underlying strata, water table, and hazards of aquifer pollution and drainage into ground water is needed for land fills deeper than 5 or 6 feet.

tions for town and country planning—Continued

Campsites for—		Buildings without basements	Paths and trails in camping areas	Picnic and play areas (extensive use)	Athletic fields (intensive use)	Golf fairways
Tents and small campers	Large camper trailers					
Severe: slope	Severe: slope	Severe: slope	Moderate: slope; flaggy soil.	Severe: slope	Severe: slope; flaggy soil.	Severe: slope; flaggy soil.
Moderate: slow permeability; stony or channery soil.	Moderate: slow permeability; slope; stony or channery soil.	Slight	Moderate: channery or stony soil.	Moderate: channery soil.	Severe: channery soil.	Moderate: channery or stony soil.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope; stony or channery soil.	Severe: slope	Severe: slope; channery soil.	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope; channery soil.	Severe: slope.
Severe: high water table.	Severe: high water table.	Severe: high water table; subject to flooding.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.

systems used only for short periods, such as for summer camps, limitations may be less severe than indicated in the table.

SEWAGE LAGOONS.—The main features affecting use of soils for sewage lagoons are permeability of the substratum, slope, depth of bedrock, and flood hazard.

LOCATIONS FOR HOMES AND OTHER BUILDINGS OF THREE STORIES OR LESS.—Considered here are locations for buildings that are three stories or less in height and for which less than an 8-foot excavation is needed for basements. The main features affecting soil use for this purpose are depth to water table, depth to and kind of bedrock, degree of slope, and flood hazard. Depth to bedrock and presence of a high water table are less severe limitations if the buildings are constructed without basements.

LANDSCAPING AND LAWNS AT HOMESITES.—In these ratings the needs for lime and fertilizer are not considered. Suitable soil material is needed in amounts sufficient for desirable trees and other plants to survive and grow. Among the factors considered are depth to water table, soil depth, depth to bedrock, soil texture, presence of stones or rocks, and flood hazard.

STREETS AND PARKING LOTS FOR SUBDIVISIONS.—The main features affecting use of soils for streets and parking lots in subdivisions are depth to water table, slope, depth to and kind of bedrock, and flood hazard. For roads outside the subdivisions, slope limitations are generally less severe than those shown in table 7.

SANITARY LAND FILLS.—These are areas used for the disposal of trash and garbage by the trench method. The main requirement is for enough soil material to cover the refuse and garbage, but no transporting of fill or cover material is considered in the ratings. The main features considered are depth to and kind of bedrock, flood hazard, depth to water table, and presence of stones or rocks. Sinkholes in limestone should not be used for refuse disposal because of the risk of contaminating ground-water supplies. Esthetic, economic, and sociological factors, while important, are not considered in the ratings in table 7.

CEMETERIES.—The main features affecting use of soils for cemeteries are depth to water table, depth to and kind of bedrock, flood hazard, rockiness, stoniness, and soil texture.

TENTS AND SMALL CAMPERS AND LARGE CAMPER TRAILERS.—These are areas used for tents, small campers, and large camper trailers, and for the accompanying activities for outdoor living. These areas are used frequently during the camping season that normally extends from May 30 until Labor Day. The soils are rated on the assumption that little site preparation other than shaping and leveling tent and parking areas is done. The soil should be suitable for heavy foot traffic by humans and horses, and for limited vehicular traffic. Suitability of soil for supporting vegetation is a separate item to be considered in the final evaluation of sites for these uses.

BUILDINGS WITHOUT BASEMENTS.—These soil limitations are for building sites for seasonal and year-round cottages, washrooms and bathhouses, picnic shelters, service buildings, and other low buildings of three stories or less and without basements. Problems of sewage disposal, water supply, and road building are considered separate items.

PATHS AND TRAILS IN CAMPING AREAS.—These are areas that are to be used for trails, cross-country hiking, bridle paths, and other nonintensive uses that allow for the movement of people. It is assumed that these areas are to be used as they occur in nature and that little soil material is moved (excavated) for the planned recreational use. Areas, such as swamps, marshes, peat bogs, and sand dunes are considered as having severe soil limitations.

PICNIC AND PLAY AREAS.—These are areas used extensively for walking or running, in contrast to areas intensively used for athletic fields, and for group picnic areas. Problems of water supply and sewage disposal are not considered in the ratings. The main features considered are depth to water table, slope, depth to bedrock, flood hazard, and the presence of rocks and stones.

ATHLETIC FIELDS.—These are areas used for football, baseball, tennis, and other sports that require nearly level areas for heavy foot traffic. Considerable shaping may be needed, but the transporting of fill material or topsoil is not considered in the ratings. The main features considered are soil texture, depth to water table, permeability, slope, depth to bedrock, and flood hazard.

GOLF FAIRWAYS.—It is assumed that these areas will be used for turf, shrubs, and trees without adding topsoil. Traps, roughs, and greens are specialized features not considered in ratings for golf fairways. The main features considered are soil texture, depth to water table, permeability, slope, and flood hazard.

Descriptions of the Soils

In this section the soils of Susquehanna County are described in detail. The soil series is first described; then the mapping units in that series are described. Thus, to get full information on any one mapping unit, it is necessary to read both the description of that unit and the description of the soil series to which it belongs.

Each series description contains a short narrative description of a soil profile considered representative for the series and a much more detailed description of the same profile that scientists, engineers, and others can use in making highly technical interpretations. The colors described are for moist soils unless otherwise noted. Many of the terms used in describing soil series and mapping units are defined in the Glossary, and others are defined in the section "How This Survey Was Made."

The approximate acreage and proportionate extent of the soils are shown in table 8. The "Guide to Mapping Units" lists the mapping units of the county, the capability unit to which each belongs, and the page where each of these is described.

Barbour Series

The Barbour series consists of deep, well-drained soils that developed in medium, moderately coarse, and coarse textured flood-plain deposits along many streams throughout the county. The native vegetation consisted dominantly of maples and oaks.

In a representative profile, Barbour soils have a dark-brown fine sandy loam plow layer about 9 inches thick.

TABLE 8.—*Approximate acreage and proportionate extent of the soils*

Mapping unit	Area	Extent	Mapping unit	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Barbour fine sandy loam	2,040	0.4	Mardin flaggy silt loam, 15 to 25 percent slopes, moderately eroded	7,100	1.3
Basher silt loam	2,470	.5	Mardin very stony silt loam, 0 to 8 percent slopes	4,520	.8
Bath channery loam, 3 to 12 percent slopes, moderately eroded	1,190	.2	Mardin very stony silt loam, 8 to 25 percent slopes	16,710	3.1
Bath channery loam, 12 to 20 percent slopes, moderately eroded	1,650	.3	Mardin very stony silt loam, 25 to 50 percent slopes	5,280	1.0
Bath flaggy loam, 3 to 12 percent slopes, moderately eroded	720	.1	Mixed alluvial land	4,870	.9
Bath flaggy loam, 12 to 20 percent slopes, moderately eroded	1,340	.3	Morris channery silt loam, 0 to 3 percent slopes	2,300	.4
Bath flaggy loam, 20 to 30 percent slopes, moderately eroded	2,170	.4	Morris channery silt loam, 3 to 8 percent slopes, moderately eroded	22,680	4.3
Bath very stony loam, 0 to 12 percent slopes	1,060	.2	Morris channery silt loam, 8 to 15 percent slopes moderately eroded	12,260	2.3
Bath very stony loam, 12 to 30 percent slopes	6,420	1.2	Morris flaggy silt loam, 3 to 8 percent slopes, moderately eroded	14,010	2.6
Bath very stony loam, 30 to 60 percent slopes	4,650	.9	Morris flaggy silt loam, 8 to 15 percent slopes, moderately eroded	7,990	1.5
Chenango gravelly silt loam, 0 to 3 percent slopes	1,620	.3	Morris flaggy silt loam, 15 to 25 percent slopes, moderately eroded	810	.2
Chenango gravelly silt loam, 3 to 12 percent slopes, moderately eroded	5,690	1.1	Morris very stony silt loam, 0 to 8 percent slopes	8,530	1.6
Chenango gravelly silt loam, 12 to 20 percent slopes, moderately eroded	1,260	.2	Morris very stony silt loam, 8 to 25 percent slopes	4,960	.9
Chenango gravelly silt loam, 20 to 30 percent slopes, moderately eroded	590	.1	Norwich and Chippewa soils, 0 to 3 percent slopes	2,990	.6
Cut and fill land	1,810	.3	Norwich and Chippewa soils, 3 to 8 percent slopes	1,540	.3
Holly silt loam	2,770	.5	Norwich and Chippewa very stony soils, 0 to 8 percent slopes	720	.1
Lackawanna channery silt loam, 3 to 12 percent slopes, moderately eroded	2,320	.4	Peat	1,330	.2
Lackawanna channery silt loam, 12 to 20 percent slopes, moderately eroded	2,570	.5	Terrace escarpments	500	.1
Lackawanna channery silt loam, 20 to 30 percent slopes, moderately eroded	950	.2	Unadilla silt loam	1,530	.3
Lackawanna flaggy silt loam, 3 to 12 percent slopes	900	.2	Volusia channery silt loam, 0 to 3 percent slopes	2,480	.5
Lackawanna flaggy silt loam, 12 to 20 percent slopes, moderately eroded	1,650	.3	Volusia channery silt loam, 3 to 8 percent slopes, moderately eroded	20,370	3.8
Lackawanna flaggy silt loam, 20 to 30 percent slopes, moderately eroded	1,630	.3	Volusia channery silt loam, 8 to 15 percent slopes, moderately eroded	17,290	3.2
Lackawanna very stony silt loam, 0 to 12 percent slopes	1,130	.2	Volusia channery silt loam, 15 to 25 percent slopes, moderately eroded	870	.2
Lackawanna very stony silt loam, 12 to 30 percent slopes	6,610	1.2	Volusia flaggy silt loam, 3 to 8 percent slopes	14,500	2.7
Lackawanna very stony silt loam, 30 to 50 percent slopes	3,910	.7	Volusia flaggy silt loam, 8 to 15 percent slopes	13,880	2.6
Lordstown and Oquaga channery silt loams, 3 to 12 percent slopes, moderately eroded	8,800	1.6	Volusia flaggy silt loam, 15 to 25 percent slopes	1,400	.3
Lordstown and Oquaga channery silt loams, 12 to 20 percent slopes, moderately eroded	5,490	1.1	Volusia very stony silt loam, 0 to 8 percent slopes	7,740	1.4
Lordstown and Oquaga channery silt loams, 20 to 30 percent slopes, moderately eroded	1,730	.3	Volusia very stony silt loam, 8 to 25 percent slopes	7,760	1.5
Lordstown and Oquaga flaggy silt loams, 3 to 12 percent slopes	10,850	2.0	Wellsboro channery silt loam, 3 to 8 percent slopes, moderately eroded	12,200	2.3
Lordstown and Oquaga flaggy silt loams, 12 to 20 percent slopes, moderately eroded	9,510	1.8	Wellsboro channery silt loam, 8 to 15 percent slopes, moderately eroded	17,690	3.3
Lordstown and Oquaga flaggy silt loams, 20 to 30 percent slopes, moderately eroded	6,300	1.2	Wellsboro channery silt loam, 15 to 25 percent slopes, moderately eroded	2,940	.5
Lordstown and Oquaga very stony silt loams, 0 to 12 percent slopes	20,860	3.9	Wellsboro flaggy silt loam, 3 to 8 percent slopes, moderately eroded	4,430	.8
Lordstown and Oquaga very stony silt loams, 12 to 30 percent slopes	46,650	8.7	Wellsboro flaggy silt loam, 8 to 15 percent slopes, moderately eroded	9,470	1.8
Lordstown and Oquaga very stony silt loams, 30 to 70 percent slopes	37,130	7.0	Wellsboro flaggy silt loam, 15 to 25 percent slopes, moderately eroded	3,940	.7
Mardin channery silt loam, 3 to 8 percent slopes, moderately eroded	7,490	1.4	Wellsboro very stony silt loam, 0 to 8 percent slopes	5,810	1.1
Mardin channery silt loam, 8 to 15 percent slopes, moderately eroded	13,790	2.6	Wellsboro very stony silt loam, 8 to 25 percent slopes	14,960	2.8
Mardin channery silt loam, 15 to 25 percent slopes, moderately eroded	4,450	.8	Wellsboro very stony silt loam, 25 to 50 percent slopes	2,630	.5
Mardin flaggy silt loam, 3 to 8 percent slopes, moderately eroded	4,500	.8	Wyalusing silt loam	6,850	1.3
Mardin flaggy silt loam, 8 to 15 percent slopes, moderately eroded	10,530	2.0	Total	535,040	100.0

The subsoil is dark-brown fine sandy loam about 25 inches thick and is medium acid to strongly acid. The underlying material, at a depth of about 34 inches, is very gravelly loamy coarse sand. Bedrock is at a depth of more than 6 feet.

Barbour soils have a low to moderate available moisture capacity but, in many places, receive a moisture supply from ground water where the water table is in the substratum. They have moderate permeability and are subject to flooding.

Representative profile of Barbour fine sandy loam in a cultivated field, 3 miles east of Lawton [sample No. S58–Pa–57–8(1–6) for laboratory characterization]:

Ap—0 to 9 inches, dark-brown (7.5YR 3/2) fine sandy loam; moderate, medium to coarse, granular structure grading to platy; friable; abundant roots; 3 percent coarse fragments; neutral; abrupt, smooth boundary.

B1—9 to 12 inches, dark-brown (7.5YR 4/4) fine sandy loam; weak, medium, prismatic structure; firm in place, friable when removed; plentiful roots; less than 1 percent coarse fragments; medium acid; abrupt, wavy boundary.

B21—12 to 21 inches, dark-brown (7.5YR 4/4) fine sandy loam; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; friable; plentiful roots; less than 1 percent coarse fragments; medium acid; gradual, wavy boundary.

B22—21 to 30 inches, dark-brown (7.5YR) fine sandy loam; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; friable; thin, discontinuous silt and clay films on ped faces; plentiful roots; less than 1 percent coarse fragments; strongly acid; clear, wavy boundary.

IIB3—30 to 34 inches, dark-brown (7.5YR 4/4) gravelly loamy sand; weak, fine, prismatic structure parting to moderate, fine and medium, subangular blocky; friable; very thin, discontinuous silt and clay films on ped faces; plentiful roots; 48 percent coarse fragments; strongly acid; abrupt, wavy boundary.

IIC—34 to 50 inches, dark-brown (7.5YR 4/4) very gravelly loamy coarse sand; single grain; loose; very thin silt and clay films on pebbles; 75 percent coarse fragments; medium acid.

The solum ranges from 24 to 40 inches in thickness. The depth to bedrock is more than 6 feet. The color throughout the profile ranges from brown (7.5YR 5/4) to dark reddish brown (5YR 3/2). Reaction of the Ap horizon ranges from neutral to strongly acid depending on the amount of lime added. The texture of the B21 and B22 horizons ranges from fine sandy loam to silt loam. The IIC horizon is 20 to 75 percent coarse fragments and is slightly acid to strongly acid. At a depth below 50 inches in many places, the IIC horizon contains lenses of finer textured material.

Barbour soils are adjacent to Basher, Holly, and Wyalusing soils, all of which have a mottled subsoil, and to areas of Peat.

Barbour fine sandy loam (0 to 3 percent slopes) (Ba).—Most areas of this soil are not larger than 15 acres in size.

Included in mapping were small areas of Barbour silt loam and Unadilla silt loam. Some lower lying areas are flooded more frequently than typical Barbour soils.

This soil is subject to excessive loss of plant nutrients through leaching because of the sandy and gravelly subsoil. It is subject to flooding.

Flooding is a limitation for some uses of this soil. Most of it is used as cropland and is well suited to most crops commonly grown in the county. (Capability unit I-1)

Basher Series

The Basher series consists of deep, moderately well drained soils that developed in medium-textured and moderately coarse textured alluvium. These soils are along many streams throughout the county. The native vegetation consisted mainly of elm, maple, black oak, and red oak.

In a representative profile, Basher soils have a dark-brown silt loam plow layer 10 inches thick. The upper part of the subsoil is dark brown and is 7 inches thick. The subsoil, between depths of 17 and 37 inches, consists of alternating layers of reddish-brown silt loam and gravelly fine sandy loam; it is mottled with yellowish red and pinkish gray below a depth of 23 inches. The subsoil, at a depth below 37 inches, consists of loose, mottled, yellowish-red and gray fine sandy loam. Bedrock is at a depth of more than 6 feet.

Basher soils are subject to flooding and have a high water table during and after periods of high streamflow, usually early in spring, late in fall, and in winter. The water table is typically at a depth of 18 to 36 inches in winter and early in spring, but it is at depths of 40 inches or more late in spring and early in summer. The available moisture capacity is high, and permeability is moderate.

Representative profile of Basher silt loam in a cultivated field 2 miles west of Lynn [sample No. S58–Pa–57–18(1–5) for laboratory characterization]:

Ap—0 to 10 inches, dark-brown (7.5YR 3/2) silt loam; weak, fine, granular structure; friable; abundant roots; 7 percent coarse fragments; neutral; clear, wavy boundary.

B1—10 to 17 inches, dark-brown (7.5YR 4/4) silt loam; weak, medium, granular structure; friable; abundant roots; thin, patchy silt and clay films on ped faces; 8 percent coarse fragments; medium acid; clear, wavy boundary.

IIB21—17 to 23 inches, dark reddish-brown (5YR 3/3) gravelly fine sandy loam; single grain; very friable; abundant roots; thin, patchy silt and clay films on ped faces; 43 percent coarse fragments; medium acid; gradual, wavy boundary.

IIIB22—23 to 37 inches, dark reddish-brown (5YR 3/4) silt loam; many, fine, distinct mottles of yellowish red (5YR 4/6) and pinkish gray (5YR 6/2); weak, fine and medium, blocky structure; friable to firm; few roots; thin, patchy silt and clay films on ped faces; 1 percent coarse fragments; medium acid; clear, wavy boundary.

IVB3—37 to 50 inches, weak-red (2.5YR 4/2) fine sandy loam; common, medium, distinct mottles of yellowish red (5YR 5/6) and gray (5YR 6/1); weak, medium, platy structure; friable; less than 1 percent coarse fragments; medium acid.

The solum ranges from 35 to 55 inches in thickness. The depth to bedrock is more than 6 feet. The depth to low chroma mottling ranges from 18 to 36 inches. The color throughout the solum ranges from very dusky red (2.5YR 2/2) to brown (7.5YR 4/4), except for mottles that in places have a hue of 10YR. Content of coarse fragments in the solum generally ranges from 0 to 45 percent but in places as high as 80 percent in thin, gravelly lenses. The coarse fragment content averages less than 35 percent in the solum. The texture of the B horizon ranges from silt loam to fine sandy loam and in some places is gravelly.

Basher soils are adjacent to Barbour and Wyalusing soils and to Peat. They differ from Barbour soils in that they have low chroma mottling between 18 and 36 inches of the surface, and from Wyalusing soils in that such mottling is

within 12 inches, and from Peat by not being an organic material.

Basher silt loam (0 to 3 percent slopes) (Bc).—This soil is on flood plains. Areas of this soil are up to 20 acres in size.

Included in mapping were small areas of Wyalusing soils that show up as wet spots in spring. Other inclusions are small areas that are too gravelly, too cut up by alternate stream channels, or too scoured for cropping.

A seasonal high water table is within 18 to 36 inches of the surface early in spring, late in fall, and in winter.

Flooding of this soil and the seasonal high water table are limitations for many uses. Most areas of this soil are in crops. (Capability unit IIw–1)

Bath Series

The Bath series consists of deep, well-drained soils that developed in medium-textured and moderately coarse textured glacial till that has a high percentage of sandstone fragments. These soils are on upper hillsides, knobs, and ridges. The native vegetation consisted of mixed hardwood forest.

In uncultivated areas a representative profile of Bath soils has a surface layer of very dark grayish-brown loam about 5 inches thick. The upper part of the subsoil is friable, yellowish-brown channery silt loam that grades to flaggy loam at a depth below 23 inches. The lower part of the subsoil is a dark grayish-brown, very firm, brittle, mottled flaggy sandy loam fragipan that has a coarse-fragment content of about 40 percent.

The fragipan in the lower part of the profile restricts the movement of water and the penetration of plant roots. Bath soils have a moderate available moisture capacity and slow permeability.

Representative profile of Bath channery loam in an area of Bath very stony loam, 12 to 30 percent slopes, in a pasture 1 mile north of Montrose, along State Highway No. 167:

A1—0 to 5 inches, very dark grayish-brown (10YR 3/2) very stony loam; weak, fine, granular structure; very friable, slightly sticky and slightly plastic; abundant fine roots; 30 percent coarse fragments; very strongly acid; abrupt, wavy boundary.

B21—5 to 13 inches, yellowish-brown (10YR 5/4) channery silt loam; weak, fine, subangular blocky structure; friable, slightly sticky and slightly plastic; abundant fine roots; 15 percent coarse fragments; strongly acid; clear, smooth boundary.

B22—13 to 23 inches, yellowish-brown (10YR 5/4) channery silt loam; moderate, medium, subangular blocky structure; friable, slightly sticky and slightly plastic; plentiful fine roots; 30 percent coarse fragments; strongly acid; clear, wavy boundary.

B23—23 to 32 inches, dark-brown (10YR 4/3) flaggy loam; weak, coarse, subangular blocky structure parting to weak, medium, subangular blocky; firm in place, friable when displaced, nonsticky and nonplastic; few fine roots; 35 percent coarse fragments; medium acid; gradual, wavy boundary.

Bx—32 to 50 inches, dark grayish-brown (10YR 4/2) flaggy sandy loam; common, fine, faint streaks of dark brown (7.5YR 4/2); weak, coarse, subangular blocky structure parting to moderate, medium, subangular blocky; very firm and brittle, nonsticky and nonplastic; few fine roots; 40 percent coarse fragments; medium acid.

The solum ranges from 3½ to 5 feet in thickness. The depth to bedrock is more than 4 feet. The color of the A1 horizon ranges from grayish brown (10YR 5/2) to very dark grayish brown (2.5Y 3/2). Content of coarse fragments in the B21, B22, and B23 horizons ranges from 15 to 40 percent but averages less than 35 percent. The texture of the Bx horizon ranges from channery silt loam to flaggy sandy loam.

Bath soils are adjacent to and developed in material similar to that in which Lordstown, Mardin, Volusia, and Chippewa soils developed; they are also adjacent to Lackawanna and Chenango soils. Bath soils, within the upper 30 inches, lack the mottling that is typical of the Mardin, Volusia, and Chenango soils. They lack the gravelly substratum of Chenango soils and the reddish hues of Lackawanna soils. Bath soils are more than 4 feet to bedrock, but the Lordstown soils are less than 3½ feet to bedrock.

Bath channery loam, 3 to 12 percent slopes, moderately eroded (BeB2).—This soil occurs on broad ridgetops and benches. Most areas are 14 acres or less in size. The numerous channery sandstone fragments dotting the surface do not seriously hinder tillage.

Included in mapping were small areas of Mardin and Lordstown soils of similar slope and texture. Also included were some soils that have a coarse-fragment content of more than 35 percent throughout the profile.

This soil has a slowly permeable fragipan in the lower part of the subsoil. The slow permeability and high content of channery fragments are limitations for some uses. Most areas of this soil are in cultivated crops. (Capability unit IIe–1)

Bath channery loam, 12 to 20 percent slopes, moderately eroded (BeC2).—This soil occurs on the sides of ridges and hills that commonly have convex slopes. Most areas are 20 acres or less in size. The numerous channery sandstone fragments dotting the surface do not seriously hinder tillage.

Included in mapping were small areas of Mardin and Lordstown soils of similar slope and coarse-fragment content. Small areas of soils that have a coarse-fragment content averaging more than 35 percent were also included.

This soil has a slowly permeable fragipan in the lower part of the subsoil. Slope, high content of channery fragments, and slow permeability are limitations for many uses of this soil. Most areas are in cultivated crops. (Capability unit IIIe–1)

Bath flaggy loam, 3 to 12 percent slopes, moderately eroded (BfB2).—This soil is on broad ridgetops and benches. Most areas are 10 acres or less in size. The surface of this soil is cluttered with sandstone fragments and flagstones which make tillage difficult and cause excessive wear on machinery.

Included in mapping were small areas of Mardin and Lordstown soils. Some soils having a coarse-fragment content that averages more than 35 percent were also included in mapping.

This soil has a slowly permeable fragipan in the lower part of the subsoil. The high content of flagstones and slow permeability are limitations for many uses of this soil. Most of this soil is in pasture or crops. (Capability unit IIIs–1)

Bath flaggy loam, 12 to 20 percent slopes, moderately eroded (BfC2).—This soil is on the sides of ridges and hills. Most areas are less than 14 acres in size. Sandstone fragments and flagstones on the surface make tillage difficult.

Included in mapping were small areas of Mardin and Lordstown soils of similar slope and flagginess. Some areas of soils that have an average coarse-fragment content of more than 35 percent were also included.

This soil has a slowly permeable fragipan in the lower part of the subsoil. The flagstones, slope, and slow permeability are limitations for many uses of this soil. (Capability unit IVs–1)

Bath flaggy loam, 20 to 30 percent slopes, moderately eroded (BfD2).—This soil is on the sides of ridges and hills. Most areas are 30 acres or less in size. The slope of the soil and the large amounts of channery sandstone fragments and flagstones interfere with cultivation and mowing.

Included in mapping were small areas of some wetter soils and some shallower soils; also included were a few small areas of Bath channery loam and some soils that have an average coarse-fragment content of more than 35 percent in the profile.

This soil has a slowly permeable fragipan in the lower subsoil. Most of the acreage is used for pasture or woodland. (Capability unit IVe–4)

Bath very stony loam, 0 to 12 percent slopes (BsB).—This soil is on broad upland ridgetops, broad benches, and the tops of some knolls. It generally lies on convex slopes and most areas are less than 20 acres in size. The surface is cluttered with channery sandstone fragments, flagstones, and stones that make tillage difficult.

Included in mapping were small areas of soils that have rock within 3 feet of the surface and a coarse-fragment content of more than 35 percent throughout the profile.

This soil has a slowly permeable fragipan in the lower subsoil. Stoniness and slow permeability are limitations for most uses of this soil. Most of the acreage is used for woodland. (Capability unit VIs–1)

Bath very stony loam, 12 to 30 percent slopes (BsD).—This soil has the profile described as representative for the series. It is on the sides of ridges and hills. Most areas are less than 40 acres in size. By volume, the surface layer contains about one-third stones, flagstones, and channery fragments.

Included in mapping were small areas of soils where bedrock is within 3 feet of the surface and some where the coarse-fragment content averages more than 35 percent throughout the profile.

This soil has a slowly permeable fragipan in the lower part of the subsoil. Most of the acreage is used for pasture or woodland. (Capability unit VIs–1)

Bath very stony loam, 30 to 60 percent slopes (BsF).—This soil is on the sides of ridges and hills. Most areas are less than 35 acres in size. The soil is too steep and stony for tilling or mowing.

Included in mapping were small areas of soils having bedrock within 3 feet of the surface and a few areas of steep, nonstony soils. Also included were some soils that have a coarse-fragment content of more than 35 percent throughout the profile.

This soil has a slowly permeable fragipan in the subsoil. Slope, stoniness, and slow permeability are limitations for most uses of this soil. Most of the acreage is used for woodland. (Capability unit VIIs–1)

Chenango Series

The Chenango series consists of deep, well-drained soils that developed in medium-textured and moderately coarse textured glacial outwash. These soils are on outwash terraces and alluvial fans along many streams throughout the county. The native vegetation consisted of mixed hardwoods.

In a representative profile, Chenango soils have a plow layer of dark-brown gravelly silt loam 5 inches thick. The subsoil consists of brown, strong-brown, and dark-brown gravelly silt loam and very gravelly loam. The substratum, at a depth below 35 inches, consists of very pale brown and brown very gravelly sandy loam. Bedrock is at a depth of more than 6 feet.

Chenango soils have low available moisture capacity and moderate to rapid permeability.

Representative profile of Chenango gravelly silt loam, 20 to 30 percent slopes, moderately eroded, in a pasture 1 mile east of Rushville:

Ap—0 to 5 inches, dark-brown (10YR 4/3) gravelly silt loam; weak, fine, granular structure; friable, slightly sticky and slightly plastic; abundant roots; 20 percent coarse fragments; slightly acid; clear, smooth boundary.

B1—5 to 8 inches, strong-brown (7.5YR 5/6) gravelly silt loam; weak, fine, granular structure; friable, slightly sticky and slightly plastic; plentiful roots; 20 percent coarse fragments; medium acid; clear, wavy boundary.

B21—8 to 20 inches, brown (7.5YR 5/4) gravelly silt loam; moderate, fine and medium, subangular blocky structure; friable, sticky and slightly plastic; plentiful roots; 30 percent coarse fragments; medium acid; gradual, wavy boundary.

IIB22—20 to 35 inches, dark-brown (7.5YR 4/4) very gravelly loam; massive; very friable, nonsticky and nonplastic; few roots; 50 percent coarse fragments; strongly acid; gradual, wavy boundary.

IIC1—35 to 59 inches, very pale brown (10YR 7/3) very gravelly sandy loam; common, medium, distinct streaks of dark brown (7.5YR 4/4); single grain; loose; 70 percent coarse fragments; medium acid; gradual, wavy boundary.

IIC2—59 to 85 inches, brown (7.5YR 5/4) very gravelly sandy loam; common, medium, distinct mottles of light yellowish brown (10YR 6/4) in the upper part; single grain; loose; 60 percent coarse fragments; medium acid.

The solum ranges from 24 to 36 inches in thickness. The depth to bedrock is more than 6 feet. Content of coarse fragments in the upper 40 inches averages more than 35 percent. The color of the Ap horizon ranges from very dark grayish brown (10YR 3/2) to brown (10YR 5/3). Color throughout the B horizon ranges from dark brown (10YR 3/3) to reddish yellow (7.5YR 7/6). The texture ranges from gravelly or very gravelly silt loam to cobbly sandy loam. The IIC horizon has colors similar to those of the B horizon and ranges from 50 to 80 percent in coarse-fragment content.

Chenango soils differ from Bath and Lackawanna soils on the uplands, from Unadilla soils on low terraces, and from Barbour, Basher, and Wyalusing soils on the flood plains in that they are gravelly throughout the profile and do not have restrictive layers in the profile or bedrock at a depth of less than 6 feet. They also differ from Unadilla soils, which have less than 1 percent coarse fragments in the solum.

Chenango gravelly silt loam, 0 to 3 percent slopes (CnA).—This soil is on gravelly fans and on outwash mounds or terraces in the major valleys. Most areas are about 10 acres in size, but some range to 25 acres.

The profile of this soil differs from the one described as representative for the series in that it has a thicker surface layer and subsoil and content of coarse fragments is less in the upper part.

Included in mapping were small areas of Mixed alluvial land and other areas subject to flooding. Some small areas of redder soils were also included.

This soil is subject to excessive leaching of plant nutrients and lime because of the very gravelly substratum. Where flooding does occur, it is rare and in localized channels. The low available moisture capacity and high gravel content are limitations for many uses of this soil. Most of the acreage is in crops. (Capability unit IIs–1)

Chenango gravelly silt loam, 3 to 12 percent slopes, moderately eroded (CnB2).—This soil is on outwash terraces at elevations as much as 40 feet above the streams and on alluvial fans. Generally, areas are less than 20 acres in size. Gravel is scattered throughout this soil.

Included in mapping were small areas of undulating soils and a few slightly steeper soils and narrow escarpments. Also included were some soils on uplands that have a gravel substratum, some spots of wetter soils, and some redder soils.

This soil is subject to excessive loss of plant nutrients by leaching through the sandy and gravelly subsoil. The low available moisture capacity and the high gravel content are limitations for many uses of this soil. Most of the acreage is used for crops. (Capability unit IIs–1)

Chenango gravelly silt loam, 12 to 20 percent slopes, moderately eroded (CnC2).—This soil is on outwash terraces. Most areas range from about 7 to 15 acres in size. Gravel is scattered throughout this soil.

Included in mapping were small areas of undulating soils, small areas of soils underlain by glacial till, and some soils that have a redder surface layer.

The slope, the low available moisture capacity, and the high gravel content are limitations for many uses of this soil. Most areas are in crops or are used for woodland. (Capability unit IIIe–1)

Chenango gravelly silt loam, 20 to 30 percent slopes, moderately eroded (CnD2).—This soil has the profile described as representative for the series. It is on outwash terraces within an elevation of 40 feet above the stream. Areas are generally less than 15 acres in size.

Included in mapping were small areas of soils that have a thin combined surface layer and subsoil and small areas of soils that have a slightly redder color in the surface layer.

Slope, low available moisture capacity, and high gravel content are limitations for most uses of this soil. Most areas are in crops or are used for woodland. (Capability unit IVe–1)

Chippewa Series

The Chippewa series consists of deep, poorly drained soils that developed in medium-textured glacial till. These soils are in depressions and on broad ridges and hilltops, mostly in the northern half of the county. The native vegetation consisted of a mixed hardwood forest.

In a representative profile, Chippewa soils have a mottled gray and very dark grayish-brown silt loam surface layer about 7 inches thick. The upper part of the subsoil is firm, mottled, grayish-brown silt loam. A channery, very brown fragipan mottled with yellowish brown, grayish brown, and gray begins at a depth of about 1 foot; it is about 29 inches thick. The substratum is dark yellowish-brown, firm channery loam mottled with grayish brown; it rests on bedrock at a depth of more than 4 feet.

Root growth is restricted to the upper layers of these soils by the dense fragipan and a seasonal high water table. Available moisture capacity is moderate to low, and permeability is slow because of the fragipan.

Water ponds on the surface of many of these soils every fall, winter, and spring and during rainy periods in summer. In summer any ponding is usually of short duration.

Representative profile of Chippewa silt loam, in an area of Norwich and Chippewa soils, 0 to 3 percent slopes, in a pasture one-half mile north of Montrose:

A11—0 to 2 inches, very dark grayish-brown (2.5Y 3/2) silt loam; many, fine, faint, grayish-brown (2.5Y 5/2) and distinct, dark yellowish-brown (10YR 4/4) mottles; weak, medium, granular structure; friable, slightly sticky and nonplastic; abundant roots; medium acid; abrupt, wavy boundary.

A12—2 to 7 inches, gray (5Y 5/1) silt loam; common, fine, prominent mottles of yellowish brown (10YR 5/6); moderate, medium, subangular blocky structure; slightly sticky and slightly plastic; few roots; medium acid; clear, smooth boundary.

B1g—7 to 12 inches, grayish-brown (2.5Y 5/2) silt loam; common, fine, distinct mottles of yellowish brown (10YR 5/4); moderate, medium, subangular blocky structure; firm, slightly sticky and slightly plastic; 5 percent coarse fragments; medium acid; gradual, wavy boundary.

Bx1—12 to 23 inches, grayish-brown (2.5Y 5/2) channery silt loam; many, medium, distinct mottles of yellowish brown (10YR 5/6); moderate, coarse, prismatic structure parting to moderate, medium, blocky; very firm, slightly sticky and slightly plastic; thin discontinuous clay films on ped faces; 15 percent coarse fragments; medium acid; gradual, wavy boundary.

Bx2—23 to 35 inches, gray (N 5/0) channery silt loam; common, fine, distinct mottles of yellowish brown (10YR 5/6); moderate, coarse, prismatic structure parting to weak, medium, blocky; very firm and brittle, sticky and slightly plastic; thin, patchy, gray (N 5/0) clay films on polygon faces and in some pores; 20 percent coarse fragments; medium acid; gradual, wavy boundary.

Bx3—35 to 41 inches, dark-brown (10YR 4/3) channery silt loam; common, fine, distinct mottles of gray (10YR 6/1); moderate, coarse, prismatic structure parting to moderate, thick, platy; firm, slightly sticky and nonplastic; 45 percent coarse fragments; medium acid; clear, irregular boundary.

C—41 to 50 inches, dark yellowish-brown (10YR 4/4) channery loam; common, fine, faint mottles of grayish brown (10YR 5/2); moderate, medium, platy structure; firm, sticky and slightly plastic; 30 percent coarse fragments; slightly acid.

The solum ranges from 40 to 60 inches in thickness. The depth to bedrock is more than 4 feet. Depth to mottling ranges from 10 to 20 inches. The color of the A11 horizon ranges from black (10YR 2/1) to very dark grayish brown (2.5Y 3/2). The matrix color of the A12 horizon ranges from dark gray (10YR 4/1) to olive gray (5Y 5/2). An A2g horizon that has platy structure occurs in the position of the B1g horizon in many places. The matrix color of the Bx horizon ranges from dark gray (10YR 4/1) to olive (5Y 5/3). The Bx and C horizons range from channery loam to channery silty clay loam and are 15 to 50 percent coarse fragments.

Chippewa soils occur adjacent to Lordstown, Bath, Mardin, and Volusia soils and are similar to the Norwich soils. Chip-

pewa soils are mottled nearer the surface than Lordstown, Bath, Mardin, or Volusia soils. They are less wet and less red than Norwich soils.

Chippewa soils are mapped only in undifferentiated units with Norwich soils in Susquehanna County.

Cut and Fill Land

Cut and fill land (0 to 35 percent slopes) (Cu) consists of areas that have been deeply excavated or filled. They are generally less than 30 acres in size. The largest areas are along highways where soil material has been cut away from the hillsides and used as fill in the adjacent low areas. There are also areas of Cut and fill land along the railroads. A few small areas are in urban developments and in home and industrial building sites. Three small areas of strip mine spoil near Forest City, totaling less than 10 acres, were included in mapping.

This material varies greatly in texture, drainage, depth, and acidity. Some areas are planted to trees, which help in the control of erosion on steep slopes. In a few places the texture and slope are such that crops may be grown if the soil is limed and fertilized. (Not placed in a capability unit)

Holly Series

The Holly series consists of deep, poorly drained soils that developed in medium-textured and moderately fine textured alluvium. These soils are along many streams throughout the county. The native vegetation consisted of soft maple, willow, and other water-tolerant trees.

In a representative profile, the surface layer is dark grayish-brown silt loam that is 4 inches thick and mottled with yellowish red and dark gray. The subsoil is dark-gray and dark greenish-gray silty clay loam and clay loam that has gray, dark-red, and yellowish-red mottles. This rests, at a depth of 36 inches, on alluvium consisting of dark-brown gravelly loam. Bedrock is at a depth of more than 6 feet.

The Holly soils are frequently flooded early in spring, late in fall, and in winter. The water table is usually within 6 inches of the surface late in spring and early in summer. Permeability is moderate, and the available moisture capacity is high.

Representative profile of Holly silt loam in a swamp forest 4 miles southeast of Little Meadows [sample No. S58–Pa–57–11(1–3) for laboratory characterization]:

A1—0 to 4 inches, dark grayish-brown (10YR 4/2) silt loam; common, fine, faint mottles of yellowish red (5YR 4/6) and dark gray (N 4/0); weak, fine, subangular blocky structure; slightly sticky and slightly plastic; few roots; less than 1 percent coarse fragments; medium acid; gradual, wavy boundary.

B1g—4 to 20 inches, dark-gray (N 4/0) silty clay loam; common, medium, prominent streaks and mottles of dark red (2.5YR 3/6) and gray (N 5/0); weak, fine, subangular blocky structure; sticky and slightly plastic; few roots; 1 percent coarse fragments; strongly acid; gradual, wavy boundary.

B2g—20 to 36 inches, dark greenish-gray (5BG 4/1) clay loam; many, fine to medium, prominent mottles of gray (N 5/0) and yellowish red (5YR 5/8); weak, fine, blocky structure; sticky and slightly plastic; few roots; 2 percent coarse fragments; medium acid; abrupt, wavy boundary.

IIC—36 to 60 inches, dark-brown (7.5YR 4/4) gravelly loam; weak, medium, blocky structure; friable; 5 percent coarse fragments; medium acid.

The solum ranges from 34 to 50 inches in thickness. The depth to bedrock is more than 6 feet. The depth to gray mottling ranges from 0 to 6 inches. Content of coarse fragments in most of the solum is less than 5 percent, but thin lenses of gravel are common at a depth below 24 inches. B1g and B2g horizons have a texture that ranges from silty clay loam to silt loam. The color ranges from very dark gray (N 3/0) to grayish brown (10YR 5/2) to dark greenish gray (5BG 4/1). The texture of the IIC horizon ranges from gravelly loam to silty clay loam.

Holly soils are adjacent to the Barbour, Basher, and Wyalusing soils and areas of Peat. They differ from the Barbour and Basher soils in that they have mottling within 6 inches of the surface and from Wyalusing soils in that they have a finer texture in their B horizon. Holly soils are mineral soils; Peat consists of organic material.

Holly silt loam (0 to 3 percent slopes) (Hw).—This soil is on flood plains, mainly in kettles or upland depressions filled with local alluvium. Most areas are smaller than 20 acres in size.

Included in mapping were small areas of Peat, some very poorly drained mineral soils, and some soils that have a fine sandy loam texture in the subsoil.

The high water table and flooding are limitations for most uses of this soil. Most of this soil is used for pasture. (Capability unit VIw–1)

Lackawanna Series

The Lackawanna series consists of deep, well-drained soils that developed in medium-textured and moderately coarse textured glacial till that has a high proportion of sandstone fragments. These soils are on upper hillsides, knobs, and ridges throughout the county. The native vegetation consisted of a mixed hardwood forest.

In a representative profile, Lackawanna soils have a dark-brown to brown channery silt loam surface layer 10 inches thick over a brown channery silt loam and channery loam subsoil. A firm, dark-brown and dark reddish-brown fragipan begins at a depth of 20 inches and extends to a depth of about 38 inches. It is underlain by channery fine sandy loam to a depth of about 50 inches.

The fragipan in the lower part of the soil restricts the movement of water and the penetration of plant roots. The available moisture capacity is moderate.

Representative profile of Lackawanna channery silt loam, 3 to 12 percent slopes, moderately eroded, in a pasture 2 miles west of South Auburn [sample No. S58–Pa–57–18(1–7) for laboratory characterization]:

Ap—0 to 7 inches, dark-brown (7.5YR 3/2) channery silt loam; moderate, medium, granular structure; friable, slightly sticky and slightly plastic; 49 percent coarse fragments; slightly acid; abrupt, wavy boundary.

A2—7 to 10 inches, brown (7.5YR 4/2) channery silt loam; weak, medium, platy structure parting to weak, fine, granular; friable, slightly sticky; 15 percent coarse fragments; medium acid; clear, broken boundary.

B21—10 to 16 inches, brown (7.5YR 5/4) channery silt loam; weak, thick, platy structure parting to moderate, fine, subangular blocky; friable, slightly sticky and slightly plastic; 30 percent coarse fragments; strongly acid; clear, wavy boundary.

B22—16 to 20 inches, brown (7.5YR 5/4) channery loam; weak, coarse, prismatic structure parting to weak, medium, platy; friable; thin patchy silt and clay films on ped faces; 30 percent coarse fragments; very strongly acid; clear, wavy boundary.

Bx1—20 to 28 inches, dark reddish-brown (5YR 3/4) and reddish-brown (5YR 4/4) channery loam; weak, coarse, prismatic structure parting to weak, medium, platy; firm; thin patchy silt and clay films on ped faces; 38 percent coarse fragments; very strongly acid; clear, wavy boundary.

Bx2—28 to 38 inches, dark-brown (7.5YR 4/4) gravelly loam; weak, coarse, prismatic structure parting to weak, coarse, blocky; firm; thin patchy silt and clay films on ped faces; 30 percent coarse fragments; extremely acid; clear, wavy boundary.

IIB3—38 to 50 inches, dark-brown (7.5YR 4/4) channery fine sandy loam; few, fine, distinct mottles of reddish brown (5YR 4/4) and dark red (2.5YR 3/6); weak, coarse, prismatic structure parting to weak, medium and coarse, blocky; friable; thin light reddish-brown (2.5YR 6/4) silt and clay films on ped faces; 35 percent coarse fragments; extremely acid.

The solum ranges from 40 inches to 60 inches in thickness. The depth to bedrock is more than 4 feet. Coarse-fragment content in the solum ranges from 10 to 50 percent but averages less than 35 percent above the fragipan. The color of the Ap horizon ranges from reddish brown (5YR 4/3) to dark brown (7.5YR 3/2). Color in the individual B2 and Bx horizons ranges from brown (7.5YR 5/4) to dusky red (2.5YR 3/2). Texture of the B2 and Bx horizons ranges from silt loam to sandy loam.

Lackawanna soils are associated on the landscape with Morris, Norwich, Oquaga, and Wellsboro soils. They are similar to Bath and Chenango soils. Lackawanna soils differ from Wellsboro, Morris, and Norwich soils by being free of mottling at depths above 30 inches and from Chenango soils in that they have a fragipan and are less gravelly throughout. Lackawanna soils have redder hues than Bath soils and are deeper to bedrock than Oquaga soils.

Lackawanna channery silt loam, 3 to 12 percent slopes, moderately eroded (LaB2).—This soil has the profile described as representative for the series. It is on broad upland ridgetops, on broad benches on the sides of ridges, and on the tops of some knolls. Most areas are less than 15 acres in size. The slopes are convex and generally single, but some are undulating. Numerous channery sandstone fragments dot the surface, and a slowly permeable fragipan is in the lower part of the subsoil.

Included in mapping were small areas of Wellsboro, Morris, and Oquaga soils that have similar slope and coarse-fragment content. Small areas of soils that have a coarse-fragment content of more than 35 percent throughout were also included.

The slow permeability and high content of channery fragments are limitations for some uses of this soil. Most of the acreage is used for cropland. (Capability unit IIe–1)

Lackawanna channery silt loam, 12 to 20 percent slopes, moderately eroded (LaC2).—This soil is on the sides of ridges and hills and on some convex lower side slopes. Most areas are less than 15 acres in size. Where the soil has recently been plowed, many channery sandstone fragments are on the surface.

Included in mapping were small areas of Wellsboro and Oquaga soils that have similar slope and coarse-fragment content. Also included were some soils with an average coarse-fragment content of more than 35 percent throughout the profile.

This soil has a slowly permeable fragipan in the lower part of the subsoil. The slope, slow permeability, and high content of channery fragments are limitations for most uses of this soil. Most of the acreage is used for cropland. (Capability unit IIIe–1)

Lackawanna channery silt loam, 20 to 30 percent slopes, moderately eroded (LaD2).—This soil is on the sides of ridges and hills and has convex single slopes or complex slopes. The areas are generally less than 15 acres in size. The surface is dotted with numerous channery sandstone fragments.

Included in mapping were small areas of soils having bedrock within a depth of 3 feet and some soils that have a coarse-fragment content that averaged more than 35 percent.

This soil has a slowly permeable fragipan in the lower part of the subsoil. The slope, slow permeability, and high content of channery fragments are limitations for most uses. Most of this soil is in crops or is used for pasture. (Capability unit IVe–1)

Lackawanna flaggy silt loam, 3 to 12 percent slopes (LfB).—This soil is on broad upland ridgetops, on benches, and on the tops of some knolls. The areas are generally 15 acres or less in size. Slopes are generally convex and single, but some are undulating. Where this soil has been plowed, the surface is cluttered with channery fragments and flagstones that increase the wear on tillage machinery. In most places about half the surface layer consists of sandstone fragments and flagstones.

Included in mapping were small areas of Wellsboro, Morris, and Oquaga soils that are similar in slope and number of flagstones and small areas of soils that have a coarse-fragment content that averaged more than 35 percent.

This soil has a slowly permeable fragipan in the lower part of the subsoil. The high content of flagstones and slow permeability are limitations for many uses of this soil. Most areas are in pasture or in cropland. (Capability unit IIIs–1)

Lackawanna flaggy silt loam, 12 to 20 percent slopes, moderately eroded (LfC2).—This soil is on the sides of hills and ridges and on convex lower side slopes. Most areas are less than 20 acres in size. In many places channery sandstone fragments and flagstones make up nearly half the surface layer.

Included in mapping were small areas of Wellsboro and Oquaga soils that are similar in slope and number of flagstones and small areas of soils that have an average coarse-fragment content of more than 35 percent.

This soil has a slowly permeable fragipan in the lower part of the subsoil. The high content of flagstones, steepness, and slow permeability are limitations for many uses of this soil. Most areas are in pasture or in cropland. (Capability unit IVs–1)

Lackawanna flaggy silt loam, 20 to 30 percent slopes, moderately eroded (LfD2).—This soil is on the sides of ridges and hills. Most areas are less than 20 acres in size. The slope and the large amount of channery sandstone fragments and flagstones make tillage difficult.

Included in mapping were small areas of wetter soils, small areas of shallower soils, and some areas of soils that have a coarse-fragment content of more than 35 percent throughout the profile.

This soil has a slowly permeable fragipan in the subsoil. The slope and the large amount of flagstones on the surface are limitations for most uses of this soil. Most of the acreage is used for woodland or pasture. (Capability unit IVe–4)

Lackawanna very stony silt loam, 0 to 12 percent slopes (lgB).—This soil is on broad upland ridgetops and benches, the tops of some lower sloping knolls, and on convex side slopes. Most areas are less than 20 acres in size. In many places the surface layer is nearly half stones, flagstones, and channery fragments, and there are stones on the surface.

The profile of this soil differs from the one described as representative for the series in that a higher proportion of coarse fragments is in each layer.

Included in mapping were areas of Wellsboro, Morris, and Oquaga soils and areas of soils that have a coarse-fragment content of more than 35 percent throughout the profile.

This soil has a slowly permeable fragipan in the lower part of the subsoil. The high content of stones and coarse fragments is a limitation for most uses of this soil. Most of the acreage is used for woodland or pasture. (Capability unit VIs–1)

Lackawanna very stony silt loam, 12 to 30 percent slopes (lgD).—This soil is on the sides of ridges and hills. Most areas are less than 50 acres in size. The surface layer is nearly half stones, flagstones, and channery fragments.

The profile of this soil differs from the one described as representative for the series in that it has stones and a higher proportion of coarse fragments in each layer. Included in mapping were small areas of soils having bedrock within 3 feet of the surface and some areas of soils that have a coarse-fragment content averaging more than 35 percent.

Slope and the amount and size of stones are limitations for most uses of this soil. Most areas are used for woodland or pasture. (Capability unit VIs–1)

Lackawanna very stony silt loam, 30 to 50 percent slopes (lgF).—This soil is on the sides of ridges and hills and along drainageways near entrenched streams. The areas are generally less than 30 acres in size. It is too stony and steep for tillage or good pasture, and there are stones on the surface. The profile of this soil differs from the one described as representative for the series in that it has a higher proportion of coarse fragments in each layer. Included in mapping were small areas of steep, nonstony soils and small areas of soils that have a coarse-fragment content averaging more than 35 percent.

Slope and stoniness are limitations for most uses of this soil. Most of the acreage is used for woodland. (Capability unit VIIs–1)

Lordstown Series

The Lordstown series consists of moderately deep, well-drained soils that developed in medium-textured glacial till over sandstone bedrock. These soils are on ridgetops, hillsides, and benches, mostly in the northern half of the county. The native vegetation consisted of a mixed hardwood forest.

In a representative profile, Lordstown soils, in woodland, have a thin, black, matted organic layer that is 2 inches thick over a grayish-brown channery silt loam surface layer. The subsoil is yellowish-brown channery loam that grades to brown and has many sandstone fragments in the lower part. The substratum is brown flaggy loam that has a high content of coarse fragments. Solid sandstone bedrock occurs at a depth of about 28 inches.

Lordstown soils have a low available moisture capacity and moderate permeability.

Representative profile of Lordstown channery silt loam in an area of Lordstown and Oquaga channery silt loams, 3 to 12 percent slopes, moderately eroded, in woodland, one-half mile northeast of East Lake:

O2—2 inches to 0, black (N 2/0) partly decomposed organic matter; extremely acid; abrupt boundary.

A2—0 to 2 inches, grayish-brown (10YR 5/2) channery silt loam; moderate, medium, platy structure; very friable, nonsticky and nonplastic; abundant roots; 35 percent coarse fragments; very strongly acid; abrupt, wavy boundary.

B2—2 to 12 inches, yellowish-brown (10YR 5/6 and 5/4) channery loam; weak, fine, subangular blocky structure; friable, slightly sticky and slightly plastic; plentiful roots; 20 percent coarse fragments; strongly acid; gradual, wavy boundary.

B3—12 to 21 inches, brown (10YR 5/3) channery loam; weak, fine, subangular blocky structure; friable, nonsticky and nonplastic; plentiful roots; 34 percent coarse fragments; very strongly acid; gradual, wavy boundary.

C—21 to 28 inches, brown (10YR 4/3) flaggy loam; weak, fine, subangular blocky structure; friable, nonsticky and nonplastic; few roots; 40 percent coarse fragments; very strongly acid; abrupt, smooth boundary.

R—28 inches +, gray, solid sandstone bedrock.

The solum ranges from 20 to 30 inches in thickness. The depth to bedrock ranges from 20 to 40 inches. The coarse-fragment content ranges from 15 to 60 percent and averages less than 35 percent in the solum. The color of the A2 horizon ranges from very dark grayish brown (10YR 3/2) to brown (7.5YR 5/4). In cultivated areas, the O2 and A2 horizons are mixed with part of the B2 horizon to form an Ap horizon that has intermediate characteristics. Texture of the B2, B3, and C horizons ranges from silt loam to loam and from channery to very flaggy.

Lordstown soils are adjacent to Bath, Mardin, Volusia, and Chippewa soils and are similar to the Oquaga soils. They differ from Bath, Mardin, Volusia, and Chippewa soils in that Lordstown soils have no fragipan. They are less red than Oquaga soils. Lordstown soils are mapped only in undifferentiated units with Oquaga soils in this county.

Lordstown and Oquaga channery silt loams, 3 to 12 percent slopes, moderately eroded (lkB2).—Any given area of this mapping unit may consist of one or both of these soils, but the acreage of each kind is about equal countywide.

The Lordstown soil in this unit has the profile described as representative for the series. The Oquaga soil is described under Oquaga series.

These soils are on slightly convex ridgetops and benches. Many areas are about 10 acres in size, but some range to 30 acres. Channery sandstone fragments litter the surface of these soils but do not seriously hinder tillage.

Included in mapping were small areas of shallow soils, small areas of Bath and Mardin soils, and small areas of moderately deep soils that are mottled above their contact with bedrock. Small areas of soils that have a coarse-fragment content averaging more than 35 percent throughout and small areas having a fine sandy loam texture in the B horizon were also included. Rock outcrops are common.

These soils are subject to rapid losses of lime and fertilizer through leaching. Depth to bedrock and the high content of coarse fragments are limitations for most uses of these soils. The bedrock consists of marketable

blue flagstone in some areas. About half of the acreage in this unit is in cropland. (Capability unit IIe–2)

Lordstown and Oquaga channery silt loams, 12 to 20 percent slopes, moderately eroded (lkC2).—Any given area of this mapping unit may consist of one or both of these soils. However, the acreage of each soil is about equal countywide. The Oquaga soil is described under Oquaga series and has the profile described as representative for that series.

These soils are on convex upper sides of ridges. Most areas are less than 25 acres in size. Channery sandstone fragments litter the surface but do not seriously interfere with tillage.

Included in mapping were small areas of shallow soils, small areas of Bath and Mardin soils, and small areas of soils that have a coarse-fragment content averaging more than 35 percent throughout the profile. Rock outcrops are common.

Depth to bedrock, high content of channery fragments, and slopes are limitations for most uses of these soils. The bedrock consists of marketable blue flagstone in some areas. About half the soils in this unit are in cropland and the other half in pasture and woodland. (Capability unit IIIe–3)

Lordstown and Oquaga channery silt loams, 20 to 30 percent slopes, moderately eroded (lkD2).—Any given area of this mapping unit may consist of one or both of these soils. However, the acreage of each soil is about equal countywide. The Oquaga soil is described under Oquaga series.

These soils are on convex ridgesides. Generally areas are smaller than 20 acres in size. Channery sandstone fragments litter the surface but do not seriously interfere with tillage.

Included in mapping were small areas of deeper soils and some shallow soils and small areas of soils that have a coarse-fragment content averaging more than 35 percent throughout the profile. Rock outcrops are common.

Depth to bedrock, slope, and the high content of channery fragments are limitations for most uses of these soils. The bedrock consists of marketable blue flagstone in some areas. Most areas of these soils are in pasture or woodland, but some are in cropland. (Capability unit IVe–3)

Lordstown and Oquaga flaggy silt loams, 3 to 12 percent slopes (loB).—Any given area of this mapping unit may consist of one or both of these soils. However, the acreage of each soil is about equal countywide. The Oquaga soil is described under Oquaga series.

These soils are on slightly convex ridgetops and benches. Most areas are about 10 acres in size, but some range to 25 acres. Tillage is inhibited by the numerous flagstones that litter the surface of the soil.

Included in mapping were small areas of Bath and Mardin soils and moderately deep soils that are mottled just above their contact with bedrock. Many small areas of shallow soils and soils that have a coarse-fragment content averaging more than 35 percent throughout were also included. Rock outcrops are common.

Depth to bedrock and the flagstones throughout the soil are limitations for most uses of these soils. The bedrock consists of marketable blue flagstone in some areas. Most of this unit is in cropland. (Capability unit IIIs–1)

Lordstown and Oquaga flaggy silt loams, 12 to 20 percent slopes, moderately eroded (loC2).—Any given area of this mapping unit may consist of one or both of these soils. However, the acreage of each soil is about equal countywide. The Oquaga soil is described under Oquaga series.

These soils are on convex upper sides of ridges in areas that are less than 30 acres in size. The numerous flagstones littering the surface make tillage difficult.

Included in mapping were small areas of Bath and Mardin soils, small areas of shallow soils, and a few rock outcrops. Small areas of soil that have a coarse-fragment content of more than 35 percent throughout the profile were also included.

Depth to bedrock, slope, and the high content of flagstones are limitations for most uses of these soils. The bedrock consists of marketable blue flagstone in some areas. Most areas are in woodland or pasture. (Capability unit IVs–1)

Lordstown and Oquaga flaggy silt loams, 20 to 30 percent slopes, moderately eroded (loD2).—Any given area of this mapping unit may consist of one or both of these soils. However, the acreage of each kind is about equal countywide. The Oquaga soil is described under Oquaga series.

These soils are on the convex side slopes of ridges. Generally, areas are less than 25 acres in size. Tillage is difficult because of steepness and the numerous flagstones littering the surface.

Included in mapping were small areas of Bath and Mardin soils, many areas of shallow soils and rock outcrops, and some small areas of soil that has a coarse-fragment content of more than 35 percent throughout the profile.

Depth to bedrock, the high content of flagstones, and slopes are limitations for most uses of these soils. The bedrock consists of marketable blue flagstone in some areas. Most areas are in woodland. (Capability unit IVe–4)

Lordstown and Oquaga very stony silt loams, 0 to 12 percent slopes (lsB).—Any given area of this mapping unit may consist of one or both of these soils. However, the acreage of each soil is about equal countywide. The Oquaga soil is described under Oquaga series.

These soils are on slightly convex ridgetops and benches. Generally, areas are about 10 acres in size, but some range to 50 acres. Tillage is prevented by the stones on the surface.

Included in mapping were small areas of Bath and Mardin soils, many small areas of shallow soils, and a few rock outcrops. Also included were small areas of soils that have a coarse-fragment content of more than 35 percent throughout the profile.

Depth to bedrock and stoniness are limitations for most uses of these soils. The bedrock consists of marketable blue flagstone in some places. Most areas are in woodland. (Capability unit VIs–1)

Lordstown and Oquaga very stony silt loams, 12 to 30 percent slopes (lsD).—Any given area of this mapping unit may consist of one or both of these soils. However, the acreage of each kind is about equal countywide. The Oquaga soil is described under Oquaga series.

These soils are on the convex sides of ridges. The areas are as much as 100 acres in size. Tillage is prevented because of the very stony soils.

Included in mapping were small areas of Bath and Mardin soils, many small areas of shallow soils, and a few rock outcrops. Small areas of soils that have a coarse-fragment content averaging more than 35 percent throughout the profile were also included.

Depth to bedrock, stoniness, and slope are limitations for most uses of these soils. The bedrock consists of marketable blue flagstone in some places. Most of the acreage is woodland. (Capability unit VIs–1)

Lordstown and Oquaga very stony silt loams, 30 to 70 percent slopes (LsF).—Any given area of this mapping unit may consist of one or both of these soils. However, the acreage of each kind is about equal countywide. The Oquaga soil is described under Oquaga series.

These soils are on the sides of ridges. Most areas are about 10 acres in size, but some are as large as 80 acres. Tillage is prevented by steepness and stoniness.

Included in mapping were small areas of Bath and Mardin soils, many small areas of shallow soils, a few rock outcrops, and small areas of soils that have a coarse-fragment content averaging more than 35 percent throughout the profile.

Depth to bedrock, stoniness, and slope are limitations for most uses of these soils. The bedrock consists of marketable blue flagstone in some areas. These soils are in woodland except for a few nonstony inclusions that are in poor-quality pasture. (Capability unit VIIs–1)

Mardin Series

The Mardin series consists of deep, moderately well drained soils that developed in medium-textured glacial till. These soils are on hilltops, hillsides, and lower side slopes. The native vegetation consisted of a mixed hardwood forest.

In a representative profile Mardin soils have a dark-brown channery silt loam surface layer 7 inches thick. It is underlain by 4 inches of yellowish-brown channery loam. The upper part of the subsoil is light olive-brown to grayish-brown channery loam that has strong-brown mottles at a depth below 16 inches. A mottled dark grayish-brown and dark-brown, firm fragipan begins at a depth of 20 inches.

Mardin soils have a moderate available moisture capacity and slow permeability.

Representative profile of Mardin channery silt loam, 8 to 15 percent slopes, moderately eroded, 2 miles northwest of Friendsville in a cultivated field: [sample No. S58–Pa–12(1–7) for laboratory characterization]:

Ap—0 to 7 inches, dark-brown (10YR 3/3) channery silt loam; weak, fine, granular structure; friable; abundant roots; 30 percent coarse fragments; neutral; clear, wavy boundary.

A2—7 to 11 inches, yellowish-brown (10YR 5/4) channery loam; weak, thin, platy structure; friable; abundant roots; 30 percent coarse fragments; slightly acid; clear, wavy boundary.

B2—11 to 16 inches, light olive-brown (2.5Y 5/4) channery loam; weak, fine and medium, subangular blocky structure; friable; few roots; thin patchy clay films on ped faces; 35 percent coarse fragments; slightly acid; clear, wavy boundary.

A'2—16 to 20 inches, grayish-brown (2.5Y 5/2) channery loam; common, medium, prominent mottles of strong brown (7.5YR 5/6); weak, thin to medium, platy structure; friable; thin patchy clay films on ped faces; nonplastic; few roots; 30 percent coarse fragments; slightly acid; abrupt, irregular boundary.

B'x1—20 to 30 inches, dark grayish-brown (10YR 4/2) channery loam; few, coarse, prominent mottles of gray (10YR 6/1) and strong brown (7.5YR 5/6); weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; very firm and brittle, slightly sticky and slightly plastic; thin patchy clay films on ped faces; 28 percent coarse fragments; strongly acid; gradual, wavy boundary.

B'x2—30 to 38 inches, dark-brown (10YR 4/3) channery loam; few, coarse, prominent mottles of gray (10YR 6/1); weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; very firm, slightly sticky and slightly plastic; very thin patchy clay films on ped faces; few black iron and manganese coatings; 27 percent coarse fragments; strongly acid; clear, wavy boundary.

B'x3—38 to 50 inches, dark grayish-brown (10YR 4/2) and dark-brown (10YR 4/3) channery loam; weak, coarse, prismatic structure parting to weak, medium, platy; firm; few patchy clay films on ped faces; few black iron and manganese coatings; 28 percent coarse fragments; medium acid.

The solum ranges from 40 to 60 inches in thickness. The depth to bedrock is more than 3½ feet. The depth to gray mottling ranges from 18 to 30 inches. The Bx horizon ranges in color from dark brown (10YR 4/3) to dark grayish-brown (2.5Y 4/2) and from 15 to 45 inches in thickness, and it begins at a depth of 18 to 30 inches.

The solum is a channery or flaggy soil that has a coarse-fragment content ranging from 15 to 50 percent in each horizon but averaging 35 percent or less above the Bx horizon.

Mardin soils are adjacent to Lordstown, Bath, Volusia, and Chippewa soils and are similar to Wellsboro soils. They are more than 3½ feet deep to bedrock, but Lordstown soils are less than 3½ feet. They have mottles within 30 inches of the surface, but Bath soils are free of mottling to a depth of 3 feet. Mardin soils lack the mottling within 15 inches of the surface that is characteristic of Volusia and Chippewa soils. They are less red than Wellsboro soils.

Mardin channery silt loam, 3 to 8 percent slopes, moderately eroded (McB2).—This soil is on slightly convex lower side slopes, tops of knolls, and broad gentle ridgetops. Areas are generally less than 20 acres in size. The surface is littered with channery sandstone fragments, which are conspicuous after plowing, but the fragments do not seriously interfere with tilling operations.

Included in mapping were a few areas of soils that have a gravelly substratum and a few areas where bedrock is within 40 inches of the surface. Also included were areas of soils that have a coarse-fragment content of more than 35 percent throughout the profile.

A seasonal high water table is at a depth between 18 and 30 inches early in spring, late in fall, and in most of the winter. Permeability is slow. The seasonal high water table, high content of channery fragments, and slowly permeable subsoil are limitations for most uses. About half this soil is in crops. (Capability unit IIw–2)

Mardin channery silt loam, 8 to 15 percent slopes, moderately eroded (McC2).—The profile of this soil is the one described as representative for the Mardin series. It is on slightly convex lower hillsides. Areas are generally less than 35 acres in size. The surface is conspicuously littered with channery sandstone fragments, but the fragments do not seriously interfere with tillage.

Included in mapping were small areas of severely eroded soils, small areas of Volusia, Wellsboro, and Bath soils, and some soils that have a coarse-fragment content averaging more than 35 percent throughout.

A seasonal high water table is at a depth between 18 and 30 inches early in spring, late in fall, and in winter. Permeability is slow.

The seasonal high water table, high content of channery fragments, and slowly permeable subsoil are limitations for most uses. About half of this soil is used for cropland. (Capability unit IIIe–2)

Mardin channery silt loam, 15 to 25 percent slopes, moderately eroded (McD2).—This soil is on convex hillsides. Most areas are less than 20 acres in size. The channery sandstone fragments on the surface do not seriously interfere with tillage.

Included in mapping were a few wet spots and small areas of severely eroded soils that need special conservation treatment. Also included were small areas of Wellsboro and Bath soils and some soils that have a coarse-fragment content of more than 35 percent throughout the profile.

A seasonal high water table is at a depth between 18 and 30 inches early in spring, late in fall, and in winter. Permeability is slow.

The seasonal high water table, high content of channery fragments, slowly permeable subsoil, and slope are limitations for most uses. Most of this soil is in pasture and woodland, but small areas are used for cropland. (Capability unit IVe–2)

Mardin flaggy silt loam, 3 to 8 percent slopes, moderately eroded (MfB2).—This soil is on slightly convex lower side slopes, the tops of knolls, and broad gentle ridgetops. Most areas are less than 20 acres in size. The field surface is littered with flagstones that make tillage difficult and cause excessive wear on machinery.

Included in mapping were small areas of Volusia soils, small areas of Wellsboro soils, and small areas of soils that have a coarse-fragment content averaging more than 35 percent throughout the profile.

A seasonal high water table is at depths between 18 and 30 inches early in spring, late in fall, and in winter. Permeability is slow.

The seasonal high water table, the flagstones, and the slowly permeable subsoil are limitations for most uses of this soil. Most of this acreage is used for cropland. (Capability unit IIIs–2)

Mardin flaggy silt loam, 8 to 15 percent slopes, moderately eroded (MfC2).—This soil is on slightly convex lower hillsides. Most areas are about 8 acres in size, but some are as large as 25 acres. The surface is conspicuously littered with flagstones that make tillage difficult and cause excessive wear on machinery.

Included in mapping were small areas of soils having bedrock within 40 inches of the surface, small areas of Wellsboro soils and soils that have a coarse-fragment content averaging more than 35 percent throughout the profile, and small areas of Volusia soils that show up as wet spots.

A seasonal high water table is at depths between 18 and 30 inches early in spring, late in fall, and in winter. Permeability is slow.

The seasonal high water table, flagstones, slowly permeable subsoil, and steepness are limitations for most uses of this soil. About half of the acreage is used for crops. (Capability unit IVs–1)

Mardin flaggy silt loam, 15 to 25 percent slopes, moderately eroded (MfD2).—This soil is on convex hillsides. Generally, areas are about 10 acres in size, but some are as large as 35 acres. The surface of the soil is littered with flagstones that make tillage difficult and cause excessive wear on machinery.

Included in mapping were small areas of wetter soils and some severely eroded soils that need special conservation treatment. Small areas of Wellsboro soils and soils that have a coarse-fragment content averaging more than 35 percent throughout the profile were also included.

A seasonal high water table is at a depth between 18 and 30 inches early in spring, late in fall, and in winter. Permeability is slow.

The seasonal high water table, flagstones, slow permeability, and steepness are limitations for most uses. Most of this soil is used for pasture or cropland. (Capability unit IVe–5)

Mardin very stony silt loam, 0 to 8 percent slopes (MgB).—This soil is on slightly convex lower side slopes and on some broad, flat ridgetops. Most areas are less than 15 acres in size. Surface stones prevent extensive tillage and mowing.

The profile of this soil differs from that described as representative for the series because it has no plow layer. Instead, it has a thin layer of humus over a very dark brown, very friable surface layer that is about 3 inches thick.

Included in mapping were small areas of Wellsboro soils and small areas of soils that have a coarse-fragment content averaging more than 35 percent throughout the profile.

A seasonal high water table is at a depth between 18 and 30 inches early in spring, late in fall, and in winter. Permeability is slow.

The seasonal high water table, slow permeability, and stoniness are limitations for most uses. Most of this soil is used for woodland. (Capability unit VIs–1)

Mardin very stony silt loam, 8 to 25 percent slopes (MgD).—This soil is on convex hillsides. Most areas are less than 45 acres in size. Surface stones prevent extensive tillage and mowing.

The profile of this soil differs from that described as representative for the series in having, instead of a plow layer, a thin layer of humus over a very dark brown, very friable surface layer that is about 3 inches thick.

Included in mapping were small areas of Wellsboro soils and some soils that have an average coarse-fragment content of more than 35 percent throughout the profile.

This soil has a seasonal high water table at depths of 18 to 30 inches for periods early in spring, late in fall, and in winter. Permeability is slow.

The seasonal high water table, slow permeability, slope, and stoniness are limitations for most uses. Most of this soil is used for woodland. (Capability unit VIs–1)

Mardin very stony silt loam, 25 to 50 percent slopes (MgF).—This soil is on hillsides. Most areas are less than 30 acres in size. Steepness and the surface stones prevent extensive tillage and mowing.

The profile of this soil differs from the one described as representative for the series in having, instead of a plow

layer, a thin layer of humus over a very dark brown, very friable surface layer that is about 3 inches thick.

Included in mapping were a few nonstony areas, some areas of Wellsboro soils, and small areas of soils that have a coarse-fragment content averaging more than 35 percent throughout the profile.

This soil has a seasonal high water table at a depth of 18 to 30 inches early in spring and late in fall. Permeability is slow.

The seasonal high water table, slow permeability, slope, and stoniness are limitations for most uses of this soil. Most areas are in woodland. (Capability unit VIIs–1)

Mixed Alluvial Land

Mixed alluvial land (0 to 8 percent slopes) (Mn) is a miscellaneous land type. It is generally in long narrow areas adjacent to the flood plains of rapidly flowing streams or on alluvial fans. Most areas are idle, less than 20 acres in size, and commondly support grasses or red maple, aspen, or birch. Slopes greater than 3 percent are rarely flooded, but lesser slopes are flooded more frequently. This land type consists of recent deposits of stratified sand, gravel, and cobblestones next to streams. This material is so recent that recognizable soil layers have not developed. Included in mapping were a few small areas of named soils.

This land type ranges from well drained to poorly drained, and permeability is generally rapid. Some areas are scoured and dissected.

This land is used for pasture in areas that are not too cobbly or dissected to grow native grasses. (Capability unit VIs–3)

Morris Series

The Morris series consists of deep, somewhat poorly drained soils that developed in medium-textured glacial till. These soils are on concave lower side slopes, in drainageways, and on broad, gentle hilltops. The native vegetation consisted of a mixed hardwood forest.

In a representative profile, Morris soils have a very dark gray to dark-brown channery silt loam to channery loam plow layer about 11 inches thick over a brown and grayish-brown mottled channery loam in the upper part of the subsoil. A firm, brittle fragipan begins at a depth of 17 inches and extends to a depth of 50 inches.

The fragipan restricts movement of air and water within the soil and impedes the growth of roots. Morris soils have a moderate available moisture capacity and slow permeability.

Representative profile of Morris channery silt loam, 3 to 8 percent slopes, moderately eroded, in a pasture 3 miles west of Hop Bottom near Lord Pond [sample No. S58–Pa–57–3(1–7) for laboratory characterization]:

Ap1—0 to 7 inches, very dark gray (5YR 3/1) channery silt loam; weak, fine, granular structure; friable, slightly sticky and slightly plastic; abundant roots; 20 percent coarse fragments; medium acid; gradual, wavy boundary.

Ap2—7 to 11 inches, dark-brown (7.5YR 4/2) channery loam; few, fine, faint mottles of grayish brown (10YR 5/2); weak, thin, platy structure; friable, slightly sticky and slightly plastic; plentiful roots; 20 percent coarse fragments; medium acid; clear, irregular boundary.

B1—11 to 17 inches, brown (7.5YR 5/4) channery loam; common, medium, distinct mottles of grayish brown (10YR 5/2) and strong brown (7.5YR 5/6); weak, medium, blocky and medium, platy structure; friable, slightly sticky and slightly plastic; few roots; 30 percent coarse fragments; medium acid; clear, irregular boundary.

Bx1—17 to 22 inches, brown (7.5YR 5/2) channery loam; common, medium, distinct mottles of strong brown (7.5YR 5/8) and grayish brown (10YR 5/2); ped interiors are brown (7.5YR 5/4); weak, coarse, prismatic structure parting to weak, medium, blocky; firm in place, brittle; brown (7.5YR 5/2), thin silt and clay films on ped faces and in some pores; 30 percent coarse fragments; medium acid; gradual, wavy boundary.

Bx2—22 to 27 inches, brown (7.5YR 5/2) channery loam; common, medium, distinct mottles of strong brown (7.5YR 5/6) and brown (7.5YR 5/2); ped interiors are brown (7.5YR 5/4); weak, coarse, prismatic structure parting to moderate, medium, blocky; firm in place, brittle; brown (7.5YR 5/2), patchy silt and clay films in some pores and on ped faces; 31 percent coarse fragments; slightly acid; clear, irregular boundary.

Bx3—27 to 34 inches, brown (7.5YR 5/2) channery loam; medium, distinct mottles of strong brown (7.5YR 5/6) and brown (7.5YR 5/2); ped interiors are brown (7.5YR 4/2); weak, coarse, prismatic structure parting to moderate, medium, blocky; firm, brittle; brown (7.5YR 5/2), thin, patchy clay films on ped faces and in some pores; 35 percent coarse fragments; slightly acid; clear, irregular boundary.

Cx—34 to 50 inches, dark-brown (7.5YR 4/4) channery loam; few, medium, faint mottles of strong brown (7.5YR 5/6) and brown (7.5YR 5/2); weak, coarse, prismatic structure parting to weak, medium, platy; firm; few silt and clay films in pores and on polygon faces; 23 percent coarse fragments; neutral.

The solum ranges from 30 to 50 inches in thickness. The depth to bedrock is more than 40 inches. The depth to low-chroma mottling ranges from 6 to 18 inches. The fragipan begins at depths between 10 and 20 inches. The color of the Ap1 and Ap2 horizons ranges from very dark gray (5YR 3/1) to dark brown (7.5YR 4/2). In the B and C horizons the color ranges from weak red (2.5YR 4/2) to brown (7.5YR 5/4) and the texture from channery or flaggy silt loam to channery or flaggy loam. Coarse-fragment content in each of the B and C horizons ranges from 5 to 50 percent but averages less than 35 percent above the fragipan.

Morris soils are adjacent to Oquaga, Lackawanna, Wellsboro, and Norwich soils, and they are similar to Volusia soils. Unlike Oquaga soils, Morris soils do not have bedrock within 40 inches of the surface. They differ from Lackawanna and Wellsboro soils in that they are mottled within 18 inches of the surface. They differ from Norwich soils in that they do not have the low chromas that are dominant in the matrix or on ped faces in all horizons between the Ap horizon and a depth of 30 inches. Morris soils are redder than Volusia soils.

Morris channery silt loam, 0 to 3 percent slopes (MoA).—This soil is in upland depressions. Most areas are less than 15 acres in size. The soil surface is littered with channery sandstone fragments, but these do not seriously interfere with tillage.

The profile of this soil differs from the one described as representative for the series in that the depth to mottling and the seasonal high water table is only about 6 inches.

Included in mapping were small areas of Norwich, Chippewa, and Volusia soils, some soils that have a gravelly layer below the fragipan, areas where bedrock is within 40 inches of the surface, and a few areas of soils that have a coarse-fragment content averaging more than 35 percent throughout the profile.

This soil commonly has a seasonal high water table at depths between 6 and 18 inches late in fall, in winter, and early in spring. It has a slowly permeable fragipan in the subsoil.

The seasonal high water table, the slowly permeable fragipan, and the high content of channery sandstone fragments are limitations for most uses of this soil. However, it has few limitations if used for water impoundments; it is occasionally ponded for short periods. Most of this soil is used for cropland. (Capability unit IIIw–1)

Morris channery silt loam, 3 to 8 percent slopes, moderately eroded (MoB2).—The profile of this soil is the one described as representative for the series. It is generally on lower side slopes, but in a few places it is on broad hilltops and ridgetops. Most areas are less than 25 acres in size. The soil surface is dotted with numerous channery sandstone fragments, but these do not seriously interfere with tillage.

Included in mapping were a few areas of soil where bedrock is less than 40 inches from the surface, some areas of Volusia soils, and a few areas of soils that have a coarse-fragment content of more than 35 percent throughout the profile. Also included were a few areas of soils, in major stream and river valleys, that have a gravelly substratum.

This soil has a seasonal high water table at depths between 6 and 18 inches late in fall, in winter, and early in spring. It has a slowly permeable fragipan in the subsoil.

The seasonal high water table, the slowly permeable fragipan, and the high content of channery sandstone fragments are limitations for most uses of this soil. About half of this acreage is used for crops and about half is used for pasture. (Capability unit IIIw–1)

Morris channery silt loam, 8 to 15 percent slopes, moderately eroded (MoC2).—This soil is on lower side slopes of hills. Most areas are less than 18 acres in size. The channery sandstone fragments that dot the surface of this soil do not seriously interfere with tillage.

The profile of this soil differs from the one described as representative for the series in that the depth to mottling and to the seasonal high water table averages about 12 inches.

Included in mapping were a few areas of Volusia soils and soils that have a coarse-fragment content averaging more than 35 percent throughout the profile.

This soil has a seasonal high water table at a depth of about 12 inches late in fall, in winter, and early in spring. It has a slowly permeable fragipan in the subsoil.

The seasonal high water table, slowly permeable fragipan, slope, and high content of channery sandstone fragments are limitations for most uses of this soil. About half of the acreage is used for cropland and about half for pasture. (Capability unit IIIe–4)

Morris flaggy silt loam, 3 to 8 percent slopes, moderately eroded (MrB2).—This soil generally is on lower side slopes and in depressional areas not crossed by streams, but sometimes it is on broad hilltops and ridgetops. Most areas are less than 24 acres in size. The numerous flagstones littering the surface of the fields tend to interfere with tillage.

Included in mapping were a few areas of soils that have bedrock less than 40 inches below the surface, a few small areas of Volusia soils, and a few areas of soils that have a coarse-fragment content of more than 35 percent throughout the profile. Also included were a few areas of soil in major stream and river valleys that have a gravelly substratum.

This soil has a seasonal high water table at depths between 6 and 18 inches late in fall, in winter, and early in spring. It has a slowly permeable fragipan in the subsoil.

The seasonal high water table, the slowly permeable fragipan, and the high content of flagstones are limitations for most uses. This soil is used for pasture or is in woodland. (Capability unit IVs–2)

Morris flaggy silt loam, 8 to 15 percent slopes, moderately eroded (MrC2).—This soil is on lower side slopes. Most areas are less than 20 acres in size. Numerous flagstones litter the surface of the soil and tend to interfere with tillage.

The profile of this soil differs from the one described as representative for the series in that the depth to mottling and to the seasonal high water table averages about 12 inches. Included in mapping were small areas of Volusia soils and soils that have a coarse-fragment content of more than 35 percent throughout the profile.

This soil has a seasonal high water table at about 12 inches below the surface late in fall, in winter, and early in spring. It has a slowly permeable fragipan in the subsoil.

The seasonal high water table, the slowly permeable fragipan, slope, and the high content of flagstones are limitations for most uses of this soil. About half of the acreage is used as cropland. (Capability unit IVs–2)

Morris flaggy silt loam, 15 to 25 percent slopes, moderately eroded (MrD2).—This soil is on lower hillsides. Most areas are less than 6 acres in size. Many flagstones litter the surface of this soil and make tillage difficult.

The profile of this soil differs from the one described as representative for the series in that the depth to the seasonal high water table averages about 14 inches. Included in mapping were some areas of Volusia soils and soils with a coarse-fragment content averaging more than 35 percent throughout the profile.

It has a slowly permeable fragipan in the subsoil.

The high content of flagstones, the seasonal high water table, slope, and the slowly permeable fragipan are limitations for most uses. Most of the acreage is used for pasture or woodland. (Capability unit VIs–2)

Morris very stony silt loam, 0 to 8 percent slopes (MsB).—This soil is on lower side slopes, in depressions, and on broad hilltops. Most areas are less than 22 acres in size. In most places the surface of this soil is too stony for tillage or mowing.

The profile of this soil differs from the one described as representative for the series in having a thin black layer of humus overlying a dark-brown surface layer and a pinkish-gray subsurface layer.

Included in mapping were a few areas of Volusia soils and soils that have a coarse-fragment content averaging more than 35 percent throughout the profile.

This soil has a seasonal high water table at depths between 6 and 18 inches late in fall, in winter, and early in spring. It has a slowly permeable fragipan in the subsoil.

The seasonal high water table, stoniness, and the slowly permeable fragipan are limitations for most uses. Most of the acreage is used for woodland. (Capability unit VIIs–2)

Morris very stony silt loam, 8 to 25 percent slopes (MsD).—This soil is on lower hillsides. Most areas are less than 20 acres in size. In most places the surface of this soil is too stony for tillage or mowing.

The profile of this soil differs from the one described as representative for the series in having a thin black layer of humus overlying a dark-brown surface layer and a pinkish-gray subsurface layer.

Included in mapping were a few areas of Volusia soils and small areas of soils with a coarse-fragment content averaging more than 35 percent throughout the profile.

This soil has a seasonal high water table at depths between 6 and 18 inches late in fall, in winter, and early in spring. It has a slowly permeable fragipan in the subsoil.

The stoniness, slope, seasonal high water table, and slowly permeable fragipan are limitations for most uses. Most of this soil is used for woodland. (Capability unit VIIs–2)

Norwich Series

The Norwich series consists of deep, very poorly drained soils that developed in medium-textured to moderately fine textured glacial till. These soils are in depressions and on broad hilltops and ridgetops of upland till plains. The native vegetation consisted of a mixed hardwood forest.

In a representative profile, Norwich soils have a very dark gray clay surface layer mottled with dark reddish brown and gray. The subsoil, to a depth of 10 to 25 inches, is mottled gray and dark-gray, yellow, and brown channery clay loam. The material below 25 inches consists of a mottled gray, yellow, and dark-brown, firm fragipan.

Norwich soils have moderate available moisture capacity. The growth of roots is restricted to the upper 25 inches of the solum by the dense fragipan and the high water table.

Representative profile of Norwich clay in an area of Norwich and Chippewa soils, 0 to 3 percent slopes, in a pasture 4 miles south-southeast of Elk Lake [sample No. S58–Pa–57–21 (1–5) for laboratory characterization]:

A1—0 to 8 inches, very dark gray (5YR 3/1) clay; common, fine, faint mottles of dark reddish brown (5YR 3/3) and gray (10YR 5/1); moderate, medium and coarse, granular structure; friable, slightly sticky and slightly plastic; abundant roots; 1 percent coarse fragments; very strongly acid; clear, wavy boundary.

IIB1g—8 to 10 inches, dark-gray (N 4/0) channery clay loam; few, fine, distinct mottles of light yellowish brown (10YR 6/4) and dark yellowish brown (10YR 4/4); weak, medium, blocky structure; friable, slightly sticky and plastic; few roots; few clay films on ped faces; 15 percent coarse fragments; very strongly acid; clear, irregular boundary.

IIB2g—10 to 25 inches, gray (N 5/0) channery clay loam; many, medium, prominent mottles of light yellowish brown (10YR 6/4), yellowish brown (10YR 5/4), and strong brown (7.5YR 5/6 and 5/8); weak, coarse, prismatic structure parting to weak, coarse, blocky; firm, slightly sticky and plastic; few roots; few thin clay films and some organic stains on ped faces; 33 percent coarse fragments; strongly acid; clear, wavy boundary.

IIBx1g—25 to 30 inches, gray (N 5/0) and dark-gray (N 3/0) very channery loam; many, medium, distinct mottles of gray (10YR 5/1), strong brown (7.5YR 5/6), and dark reddish brown (5YR 3/3); ped interiors are yellowish brown (10YR 5/4); moderate, coarse, prismatic structure parting to weak, thick, platy; very firm, few gray (N 5/0) and dark-gray (N 3/0) silt and clay films on ped faces; 35 percent coarse fragments; strongly acid; clear, wavy boundary.

IIBx2g—30 to 50 inches, dark-brown (7.5YR 4/2) channery loam; common, medium, distinct mottles of brown (7.5YR 5/4), strong brown (7.5YR 5/6), and pinkish gray (5YR 6/2); very weak, medium, platy structure; firm, slightly sticky and nonplastic; few thin clay films on ped faces and in pores; black iron and manganese coatings on some stones; 35 percent coarse fragments; medium acid.

The solum ranges from 30 to 55 inches in thickness. Depth to bedrock is more than 5 feet. The depth to the fragipan ranges from 10 to 25 inches. In the A1 horizon the matrix color ranges from black (5YR 2/1) to dark brown (7.5YR 3/2), and in the Bx horizon it ranges from dark reddish gray (5YR 4/2) to brown (7.5YR 5/4).

The texture of the Bx horizon ranges from channery clay loam to very channery loam. The coarse-fragment content ranges from 5 to 50 percent but averages less than 35 percent above the fragipan.

Norwich soils are adjacent to Oquaga, Lackawanna, Wellsboro, and Morris soils and are similar to Chippewa soils. All of these, except the Chippewa soils, are free of mottling in the upper part. Norwich soils are redder than Chippewa soils.

Norwich soils are mapped only in undifferentiated units with Chippewa soils in Susquehanna County.

Norwich and Chippewa soils, 0 to 3 percent slopes (NcA).—Any given area of this mapping unit may consist of either the Norwich or the Chippewa soils, or of both.

These soils are mainly in upland depressions not crossed by streams, but in a few places they are on broad level ridges and hilltops. Most areas are less than 15 acres in size.

Each of these soils has the profile described as representative for its respective series. The texture of the surface layer ranges from silt loam to clay.

Included in mapping were a few areas of Holly soils and of soils that have bedrock within 3 feet of the surface.

These soils have a water table that is within 6 inches of the surface early in spring, late in fall, and in winter. They have a slowly permeable fragipan in the subsoil.

The high water table, the occasional ponding, and the slow permeability of the subsoil are limitations for most uses. Most areas of these soils are used for pasture. (Capability unit IVw–2)

Norwich and Chippewa soils, 3 to 8 percent slopes (NcB).—Any given area of this mapping unit may consist of either the Norwich or Chippewa soils, or of both. The Chippewa soils are described under Chippewa series.

These soils are on lower side slopes, in upland depressions not crossed by streams, and on broad, level ridges and hilltops. Most areas are less than 6 acres in size. The texture of the surface layer ranges from silt loam to clay.

Included in mapping were small areas of Volusia soils and of soils that have bedrock within 3 feet of the surface early in spring, late in fall, and in winter. They have a slowly permeable fragipan in the subsoil.

The high water table and slowly permeable subsoil are limitations for most uses. Most areas are in pasture, but a few are in cropland. (Capability unit IVw–2)

Norwich and Chippewa very stony soils, 0 to 8 percent slopes (NsB).—Any area of this mapping unit may consist of either the Norwich or Chippewa soils, or of both.

The profiles of these soils differ from the representative profiles for each series in having a larger amount of

stones and other coarse fragments in the upper 12 inches.

These soils are on lower side slopes, in depressional areas not crossed by streams, and on broad ridges and hilltops. Most areas are less than 7 acres in size. The texture of the surface layer ranges from silt loam to clay. In most places the surface layer is too stony for tillage or mowing.

Included in mapping were a few areas of soils that have bedrock within 3 feet of the surface and a few areas of somewhat poorly drained soils.

These soils have a water table that is at the surface early in spring, late in fall, and in winter. They have a slowly permeable fragipan in the subsoil.

The high water table, stoniness, and slowly permeable subsoil are limitations for most uses. Most of the acreage is used for pasture or woodland. (Capability unit VIIs–2)

Oquaga Series

The Oquaga series consists of moderately deep, well-drained soils that developed in medium-textured glacial till overlying frost-fractured sandstone bedrock. These soils are on ridgetops and benches and in gently sloping areas that have been scraped by glaciers. The native vegetation consisted of mixed hardwood forest.

In a representative profile, Oquaga soils have a dark reddish-brown channery silt loam surface layer 8 inches thick over a reddish-brown channery silt loam subsoil that extends to a depth of 24 inches. The substratum is reddish-brown very channery loam that has a 65 percent coarse-fragment content. Sandstone bedrock is at a depth of 33 inches.

Oquaga soils have low available moisture capacity and moderately rapid permeability.

Representative profile of Oquaga channery silt loam in an area of Lordstown and Oquaga channery silt loams, 12 to 20 percent slopes, moderately eroded, in a pasture 2 miles east of Montrose:

Ap—0 to 8 inches, dark reddish-brown (5YR 3/3) channery silt loam; weak, fine, granular structure; friable, slightly sticky and nonplastic; abundant roots; organic matter accumulation in the upper 2 inches; 30 percent coarse fragments; strongly acid; clear, wavy boundary.

B1—8 to 16 inches, reddish-brown (5YR 4/3) channery silt loam; weak, very fine, subangular blocky structure; friable, slightly sticky and nonplastic; plentiful roots; 35 percent coarse fragments; strongly acid; gradual, wavy boundary.

B2—16 to 24 inches, reddish-brown (5YR 4/4) channery silt loam; weak, fine, subangular blocky structure; friable, slightly sticky and slightly plastic; plentiful roots; 40 percent coarse fragments; strongly acid; clear, irregular boundary.

C—24 to 33 inches, reddish-brown (5YR 4/3) very channery loam; very weak, fine, subangular blocky structure; very friable, slightly sticky and nonplastic; plentiful roots; 65 percent coarse fragments; very strongly acid; abrupt, wavy boundary.

R—33 inches +, red and gray, thin-bedded sandstone bedrock; medium to thick bedded below 40 inches.

The solum ranges from 15 to 30 inches in thickness. The depth to bedrock ranges from 20 to 40 inches. Color hues range from 2.5YR to 7.5YR throughout the profile. Coarse-fragment content above the bedrock averages more than 35 percent. In unplowed areas the A1 horizon is underlain by an A2 horizon of loam 3 to 5 inches thick. In some areas an O2 horizon exists in place of the A1 horizon. In the B and C horizons, the color ranges from dark reddish brown (2.5YR 3/4) to strong brown (7.5YR 5/6). The texture of the B1 and B2 horizons ranges from channery silt loam to flaggy loam.

Oquaga soils are adjacent to Lackawanna, Wellsboro, Morris, and Norwich soils and are similar to Lordstown soils. Oquaga soils differ from Lackawanna, Wellsboro, Morris, and Norwich soils in having no mottling nor fragipan and by having less than 40 inches of soil over bedrock. They have redder colors than Lordstown soils.

Oquaga soils are mapped only in undifferentiated units with Lordstown soils in Susquehanna County.

Peat

Peat (0 to 3 percent slopes) (Pt) consists of organic material that has accumulated in ponds, lakes, or depressions as the plants died and became submerged. Eventually the depression was filled with partly decomposed material and silt. Areas of Peat are generally less than 20 acres in size. The vegetation is cattails, shrubs, grasses, or trees.

Peat is very dark brown to black, wet, and unstable. Some areas have a mucky surface layer. The depth to the underlying gray, silty, mineral material ranges from about 2 to 25 feet. The depth to bedrock is more than 4 feet.

Peat has high available moisture capacity. It is ponded the year around. Depth of water over the peat is usually about 6 inches. Some areas are potential sources of commerical peat. (Capability unit VIIw–1)

Terrace Escarpments

Terrace escarpments (25 to 70 percent slopes) (Te) are on stream-cut faces of outwash terraces. Most areas are elongated and less than 30 acres in size. These escarpments are in woodland because steepness and cobblestones make them impractical to till or mow.

This land type is a source of gravel. Slope is the major limitation for most uses. (Capability unit VIIe–1)

Unadilla Series

The Unadilla series consists of deep, well-drained soils that developed in medium-textured, moderately coarse textured, and coarse textured old alluvium. They are on low terraces in stream valleys throughout the county. The native vegetation consisted of mixed hardwood forest.

In a representative profile, Unadilla soils have a plow layer of dark-brown silt loam about 10 inches thick. The subsoil is friable, dark yellowish-brown and dark-brown silt loam and very fine sandy loam that extends to a depth of 35 inches. The substratum is grayish-brown and dark grayish-brown very fine sandy loam in the upper part, but it is more sandy with increasing depth.

Unadilla soils have high available moisture capacity and moderate permeability.

Representative profile of Unadilla silt loam in a pasture one-half mile north of States Mill Pond and 3 miles south of Springville:

Ap—0 to 10 inches, dark-brown (10YR 3/3) silt loam; weak, fine, granular structure; friable, slightly sticky and slightly plastic; abundant roots; slightly acid; abrupt, smooth boundary.

B1—10 to 20 inches, dark yellowish-brown (10YR 4/4) very fine sandy loam; weak, fine, granular structure; fria-

ble, nonsticky and nonplastic; plentiful roots; medium acid; gradual, wavy boundary.

B2—20 to 35 inches, dark-brown (10YR 4/3) silt loam; weak, fine, subangular blocky structure; friable, nonsticky and nonplastic; plentiful roots; medium acid; gradual, wavy boundary.

C1—35 to 45 inches, dark grayish-brown (2.5Y 4/2) very fine sandy loam; weak, medium, platy structure; very friable, nonsticky and nonplastic; plentiful roots; medium acid; gradual, wavy boundary.

IIC2—45 to 55 inches, grayish-brown (2.5Y 5/2) fine sandy loam; weak, medium, platy structure; friable, nonsticky and nonplastic; few roots; medium acid; gradual, wavy boundary.

IIC3—55 to 60 inches, dark grayish-brown (10YR 4/2) loamy fine sand; few, medium, prominent streaks of strong brown (7.5YR 5/6); weak, thin, platy structure; friable, nonsticky and nonplastic; few roots; medium acid.

The solum ranges from 35 to 45 inches in thickness. The depth to bedrock is more than 6 feet. The color hues in all horizons range from 7.5YR to 2.5Y. The texture of the C1 horizon ranges from very fine sandy loam in the upper part to loamy fine sand below a depth of 40 inches. In many places there are strata of finer textured material in the IIC2 and IIC3 horizons.

Unadilla soils differ from associated upland soils in having less than 1 percent coarse fragments in the solum and in having stratified sand and loamy fine sand in the substratum. They have fewer coarse fragments in the solum than Chenango soils and less gravel in the substratum than Barbour soils. Unadilla soils are free of mottling in the solum but Basher, Wyalusing, and Holly soils and Peat have mottling at depths above 30 inches.

Unadilla silt loam (0 to 5 percent slopes) (Us).—This soil occurs on low terraces. Most areas are less than 20 acres in size.

Included in mapping were small areas of moderately well drained soils and somewhat poorly drained soils.

This soil has few limitations for most uses but is poorly suited to water impoundments because of the permeable subsoil. It is well suited to most crops commonly grown in the county (Capability unit I-2)

Volusia Series

The Volusia series consists of deep, somewhat poorly drained soils that developed in medium-textured glacial till. They are on concave lower side slopes and broad hilltops and in drainageways. The native vegetation consisted of mixed hardwoods.

In a representative profile, Volusia soils consist of a dark grayish-brown channery silt loam plow layer 9 inches thick over a light brownish-gray loam subsurface layer that is mottled with dark yellowish brown and dark grayish brown. The subsoil consists of a fragipan beginning at a depth of 13 inches and extending to 43 inches. It is firm, mottled gray and olive-brown channery loam. The fragipan extends into the substratum to a depth of 60 inches or more.

Volusia soils have moderate available moisture capacity and slow permeability. The fragipan slows the movement of air and water within the soil and impedes penetration by plant roots.

Representative profile of Volusia channery silt loam, 3 to 8 percent slopes, moderately eroded, in a pasture 1 mile north of Saint Joseph [sample No. S58–Pa–57–14 (1–6) for laboratory characterization]:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) channery silt loam; moderate, medium to coarse, granular structure; friable; many roots; 15 percent coarse fragments; neutral; abrupt, wavy boundary.

A2g—9 to 13 inches, light brownish-gray (2.5Y 6/2) loam; many, fine to medium, distinct mottles of dark yellowish brown (10YR 4/4) and dark grayish brown (2.5Y 4/2); weak, medium, platy and moderate, fine, blocky structure; friable, slightly sticky and nonplastic; few roots; 10 percent coarse fragments; medium acid; clear, wavy boundary.

Bx1—13 to 21 inches, gray (5Y 6/1) channery loam; many, coarse, prominent mottles of gray (N 6/0) and strong brown (7.5YR 5/8); moderate, coarse, prismatic structure parting to weak, medium, platy; firm, slightly sticky and slightly plastic; thick patchy clay clay films on ped faces; 18 percent coarse fragments; strongly acid; abrupt, irregular boundary.

Bx2—21 to 31 inches, olive-brown (2.5Y 4/4) channery loam; many, fine and medium, distinct mottles and ped coatings of olive gray (5Y 5/2), light brownish gray (2.5Y 6/2), light yellowish brown (10YR 6/4), and strong brown (7.5YR 5/8); moderate, coarse, prismatic structure parting to moderate, medium, platy; polygons are 18 to 24 inches in diameter; very fine, slightly sticky and slightly plastic; thick patchy clay films on ped faces; 27 percent coarse fragments; strongly acid; abrupt, irregular boundary.

Bx3—31 to 43 inches, olive-brown (2.5Y 4/4) channery loam; many, coarse, prominent mottles of strong brown (7.5YR 5/8) and gray (5Y 6/1); moderate, coarse, prismatic structure parting to weak, medium, platy; firm, slightly sticky and slightly plastic; thin patchy clay films on ped faces; 29 percent coarse fragments; few, thin, iron and manganese coatings; medium acid; abrupt, irregular boundary.

Cx—43 to 60 inches, olive (2.5Y 4/4) channery silt loam; weak, coarse, prismatic structure parting to weak, medium, platy and fine blocky; firm, slightly sticky and slightly plastic; 16 percent olive (5Y 4/3) sandstone fragments; medium acid.

The solum ranges from 40 to 60 inches in thickness. The depth to bedrock is more than 3½ feet. The depth to fragipan ranges from 10 to 18 inches. The depth to mottling ranges from 6 to 15 inches. In the Ap horizon the color ranges from very dark grayish brown (10YR 3/2) to olive brown (2.5Y 4/4). In the Bx and Cx horizons, the matrix color ranges from very dark gray (10YR 3/1) to olive brown (5Y 6/6). Coarse-fragment content of each Bx and Cx horizon ranges from 10 to 50 percent.

Volusia soils are adjacent to Lordstown, Bath, Mardin, and Chippewa soils. Volusia soils are similar to Morris soils. They differ from Lordstown soils in not having bedrock within 40 inches of the surface. They differ from Bath and Mardin soils in having low-chroma mottling within 18 inches of the surface. Volusia soils differ from Chippewa soils in that they do not have chromas of 2 or less in the matrix or on ped faces in all horizons from the Ap horizon to a depth of 30 inches. Volusia soils are less red than Morris soils.

Volusia channery silt loam, 0 to 3 percent slopes (VcA).—This soil is in upland depressions. Most areas are less than 10 acres in size. Numerous channery sandstone fragments litter the surface but do not seriously interfere with tillage.

The profile of this soil differs from the one described as representative for the series in that the surface layer is darker colored and in that the depth to mottling and the seasonal high water table each averages only about 6 inches.

Included in mapping were areas of Norwich and Chippewa soils, a few areas of soils that have bedrock within 40 inches of the surface, and a few areas of soils that have a gravelly substratum.

This soil has a seasonal high water table within 6 to 15 inches of the surface in spring, in fall, and in winter. It has a slowly permeable fragipan in the subsoil.

The seasonal high water table, slow permeability, and high content of channery fragments are limitations for most uses. Most areas of this soil are in cropland. (Capability unit IIIw–1)

Volusia channery silt loam, 3 to 8 percent slopes, moderately eroded (VcB2).—This soil has the profile described as representative for the series. It is generally on lower side slopes, but in a few places is on ridgetops. Most areas are about 12 acres in size, but some are as large as 70 acres. Numerous channery sandstone fragments litter the surface but do not seriously interfere with tillage.

Included in mapping were small areas of soils that have bedrock within 40 inches of the surface and a few areas of soils in major stream and river valleys that have a gravelly substratum.

This soil has a seasonal high water table within 6 to 15 inches of the surface in spring, in fall, and in winter. It has a slowly permeable fragipan in the subsoil.

The seasonal high water table, slow permeability, and high content of channery fragments are limitations for most uses. Most areas of this soil are in cropland. (Capability unit IIIw–1)

Volusia channery silt loam, 8 to 15 percent slopes, moderately eroded (VcC2).—This soil is on the lower side slopes of hills. Generally areas are about 10 acres in size, but in places they are as large as 60 acres. Many channery sandstone fragments litter the surface of this soil but do not seriously interfere with tillage.

The profile of this soil differs from the one described as representative for the series in that the depth to mottling and the seasonal high water table each averages about 12 inches. A few areas of soils that have a fine sandy loam subsoil were included in mapping.

This soil has a seasonal high water table within about 12 inches of the surface in spring, in fall, and in winter. It has a slowly permeable fragipan in the subsoil.

The seasonal high water table, slow permeability, slope, and high content of channery fragments are limitations for most uses. Most areas of this soil are in cropland. (Capability unit IIIe–4)

Volusia channery silt loam, 15 to 25 percent slopes, moderately eroded (VcD2).—This soil is on lower hillsides. Most areas are less than 15 acres in size. Numerous channery sandstone fragments litter the surface of this soil, but they do not seriously interfere with tillage.

The profile of this soil differs from the one described as representative for the series in that the depth to mottling and seasonal high water table each averages about 14 inches.

Small areas of soils that have a fine sandy loam subsoil were included in mapping.

This soil has a seasonal high water table at about 14 inches beneath the surface early in spring, late in fall, and in winter. It has a slowly permeable fragipan in the subsoil.

Slope, seasonal high water table, slow permeability, and high content of channery fragments are limitations for many uses. Some areas of this soil are used along with areas of less strongly sloping soils nearby for cropland, but most areas are used for pasture or woodland. (Capability unit IVe–5)

Volusia flaggy silt loam, 3 to 8 percent slopes (VfB).—This soil is on the lower side slopes of hills and on a few ridgetops. Most areas are less than 45 acres in size. Numerous flagstones litter the surface of this soil in fields and cause excessive wear on machinery.

Included in mapping were small areas of soils on tops of ridges that have bedrock within 40 inches of the surface and soils in the major stream and river valleys that have a substratum of gravel.

This soil has a seasonal high water table within 6 to 15 inches of the surface in spring, in fall, and in winter. It has a slowly permeable fragipan in the subsoil.

The flagstones on the surface, seasonal high water table, and slow permeability are limitations for many uses of this soil. (Capability unit IVs–2)

Volusia flaggy silt loam, 8 to 15 percent slopes (VfC).—This soil is on the lower side slopes of hills. Most areas are about 12 acres in size, but some are as large as 50 acres. Numerous flagstones litter the surface of this soil in fields and tend to make tillage difficult.

The profile of this soil differs from the one described as representative for the series in that the depth to mottling and seasonal high water table each average about 12 inches.

Small areas of soils that have a fine sandy loam subsoil were included in mapping.

This soil has a seasonal high water table within about 12 inches of the surface in spring, in fall, and in winter. It has a slowly permeable fragipan in the subsoil.

The seasonal high water table, flagstones on the surface, slow permeability, and slope are limitations for most uses of this soil. (Capability unit IVs–2)

Volusia flaggy silt loam, 15 to 25 percent slopes (VfD).—This soil is on lower hillsides. Most areas are less than 15 acres in size. Numerous flagstones litter the surface of this soil in fields and cause excessive wear on machinery.

The profile of this soil differs from the one described as representative for the series in that the depth to mottling and seasonal high water table each averages about 14 inches.

A few areas of soils that have a fine sandy loam subsoil were included in mapping.

This soil has a seasonal high water table within about 14 inches of the surface early in spring, late in fall, and in winter. It has a slowly permeable fragipan in the subsoil.

Steepness, flagstones on the surface, seasonal high water table, and slow permeability are limitations for most uses of this soil. (Capability unit VIs–2)

Volusia very stony silt loam, 0 to 8 percent slopes (VsB).—This soil is on the lower side slopes and tops of hills and sometimes on ridgetops. Areas are mainly less than 50 acres in size. In most places the surface layer is too stony for tilling or for the use of mowing machinery.

The profile of this soil differs from the one described as representative for the series in having, instead of a plow layer, a thin black layer of humus overlying a very stony, very dark brown subsurface layer about 3 inches thick.

A few areas of soils that have a fine sandy loam subsoil were included in mapping.

This soil has a seasonal high water table within 6 to 15 inches of the surface in spring, in fall, and in winter. It has a slowly permeable fragipan in the subsoil.

The surface stones, seasonal high water table, and slow permeability are limitations for most uses of this soil. Most acreage is in woodland. (Capability unit VIIs–2)

Volusia very stony silt loam, 8 to 25 percent slopes (VsD).—This soil is on lower hillsides. Most areas are about 12 acres in size, but some are as large as 40 acres. The surface layer is too stony for the use of machinery.

The profile of this soil differs from the one described as representative for the series in having, instead of a plow layer, a thin black layer of humus in a mat of roots overlying a very stony, very dark brown surface layer about 3 inches thick.

A few areas of soils that have a fine sandy loam subsoil were included in mapping.

This soil has a seasonal high water table within 6 to 15 inches of the surface in spring, in fall, and in winter. It has a slowly permeable fragipan in the subsoil.

The surface stones, seasonal high water table, and slow permeability are limitations for most uses. Most acreage of this soil is in woodland. (Capability unit VIIs–2)

Wellsboro Series

The Wellsboro series consists of deep, moderately well drained soils that developed in medium-textured glacial till having a high proportion of sandstone fragments. These soils are on hillsides and ridgetops. The native vegetation consisted of mixed hardwood forest.

In a representative profile, Wellsboro soils have a 6-inch, dark-brown channery silt loam surface layer over a brown and reddish-brown channery silt loam upper part of the subsoil. The lower part of the subsoil is a reddish-brown channery loam fragipan mottled with strong brown to grayish brown extending from a depth of about 21 inches to more than 52 inches.

These soils have moderate available moisture capacity and slow permeability.

Early in spring and late in fall these soils are saturated by a seasonal high water table, which occurs at a depth of 18 to 30 inches.

Representative profile of Wellsboro channery silt loam, 8 to 15 percent slopes, moderately eroded, in a cultivated field 1 mile west of White Pond and 2 miles southwest of Rushboro:

Ap—0 to 6 inches, dark-brown (7.5YR 3/2) channery silt loam; weak, very fine, granular structure; very friable, slightly sticky and nonplastic; abundant roots; 35 percent coarse fragments; medium acid; abrupt, smooth boundary.

B1—6 to 15 inches, brown (7.5YR 5/4) channery silt loam; weak, fine, subangular blocky structure; friable, nonsticky and nonplastic; plentiful roots; 30 percent coarse fragments; medium acid; gradual, wavy boundary.

B2—15 to 21 inches, reddish-brown (5YR 5/3) channery silt loam; weak, medium, subangular blocky structure; friable, slightly sticky and slightly plastic; plentiful roots; 30 percent coarse fragments; medium acid; gradual, wavy boundary.

Bx1—21 to 29 inches, reddish-brown (5YR 5/3) channery loam; common, fine, distinct mottles of strong brown (7.5YR 5/6) and brown (7.5YR 5/2); weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; firm and brittle, nonsticky and nonplastic; few roots; 25 percent coarse fragments; medium acid; gradual, wavy boundary.

Bx2—29 to 52 inches, reddish-brown (5YR 4/4) channery loam; many, medium, distinct mottles of grayish brown (10YR 5/2); weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; very firm and brittle, slightly sticky and nonplastic; few roots; 40 percent coarse fragments; medium acid.

The solum ranges from 40 to 60 inches in thickness. The depth to bedrock is more than 3½ feet. The depth to the top of the fragipan ranges from 18 to 30 inches. The color of the Ap horizon ranges from black (N 2/0) to dark reddish brown (5YR 3/3). In some areas, there is an A'2 horizon of mottled channery loam, about 4 inches thick, immediately above the fragipan. In the B horizon the color ranges from dusky red (2.5YR 3/3) to strong brown (7.5YR 5/6). The texture ranges from channery or flaggy silt loam to channery or flaggy loam. Coarse-fragment content ranges from 10 to 35 percent in the B1 and B2 horizons and from 20 to 40 percent in the Bx horizon.

These Wellsboro soils are adjacent to Lackawanna, Oquaga, Morris, and Norwich soils, and they are similar to Mardin soils. Wellsboro soils have low chroma mottling at depths between 18 and 30 inches, but Lackawanna soils are free of mottling at a depth above 3 feet. Wellsboro soils are deeper to bedrock than the Oquaga soils. They are free of mottling at depths above 18 inches, but Morris and Norwich soils are mottled above that depth. Wellsboro soils have redder hues than Mardin soils.

Wellsboro channery silt loam, 3 to 8 percent slopes, moderately eroded (WeB2).—This soil is on lower side slopes and on some parts of flat ridgetops. Areas are less than 20 acres in size. The surface is littered with channery sandstone fragments, but they do not prevent tillage.

Small areas of Lackawanna soils and small spots of wet Morris soils were included in mapping. Also included were a few areas of soils that have bedrock within 40 inches of the surface and a few areas of soils with a coarse-fragment content averaging more than 35 percent throughout the profile.

This soil has a seasonal high water table within 18 to 30 inches of the surface early in spring, late in fall, and in most of the winter. It has a slowly permeable fragipan in the subsoil.

The seasonal high water table, slow permeability, and high content of channery fragments are limitations for most uses. Most acreage of this soil is in crops. (Capability unit IIw–2)

Wellsboro channery silt loam, 8 to 15 percent slopes, moderately eroded (WeC2).—This soil has the profile described as representative for the series. It is on slightly convex lower hillsides. Most areas are less than 25 acres in size. If plowed, the surface of this soil is littered with channery sandstone fragments, but these do not prohibit tillage.

Small areas of Lackawanna soils and small spots of wet Morris soils were included in mapping. Also included were a few areas of severely eroded soils and soil that has a coarse-fragment content averaging more than 35 percent throughout the profile.

This soil has a seasonal high water table within 18 to 30 inches of the surface early in spring, late in fall, and in winter. It has a slowly permeable fragipan in the subsoil.

The seasonal high water table, slow permeability, and high content of channery fragments are limitations for most uses. About half of this acreage is in crops. (Capability unit IIIe–2)

Wellsboro channery silt loam, 15 to 25 percent slopes, moderately eroded (WeD2).—This soil is on convex hillsides. Most areas are less than 18 acres in size. The sur-

face is littered with channery sandstone fragments, but they do not prohibit tillage.

Included in mapping were small areas of severely eroded soils that need special conservation treatment and areas of wet spots that delay tillage. Also included were some soils that have a coarse-fragment content averaging more than 35 percent throughout the profile.

This soil has a seasonal high water table within 18 to 30 inches of the surface in spring, in fall, and in winter. It has a slowly permeable fragipan in the subsoil.

The slope, seasonal high water table, slow permeability, and high content of channery fragments are limitations for most uses of this soil. (Capability unit IVe–2)

Wellsboro flaggy silt loam, 3 to 8 percent slopes, moderately eroded (WlB2).—This soil is on slightly convex lower side slopes and middle sections of some flat ridgetops. Most areas are less than 15 acres in size. The surface is littered with flagstones and channery fragments that make tillage difficult and cause excessive wear on machinery.

Included in mapping were small spots of wet Morris soils, small areas of soils that have bedrock within 40 inches of the surface, and some areas of soils with a coarse-fragment content averaging more than 35 percent throughout the profile.

This soil has a seasonal high water table within 18 to 30 inches of the surface early in spring, late in fall, and in most of the winter. It has a slowly permeable fragipan in the subsoil.

The seasonal high water table, slow permeability, and flagstones in the soils are limitations for most uses of this soil. (Capability unit IIIs–2)

Wellsboro flaggy silt loam, 8 to 15 percent slopes, moderately eroded (WlC2).—This soil is on slightly convex lower hillsides. Most areas are less than 30 acres in size. The surface is littered with flagstones and channery fragments which make tillage difficult and cause excessive wear on machinery.

Included in mapping were small areas of soils with a coarse-fragment content averaging more than 35 percent in all layers. Also included were small areas of Morris soils that show up as wet spots.

This soil has a seasonal high water table within 18 to 30 inches of the surface early in spring, late in fall, and in winter. It has a slowly permeable fragipan in the subsoil.

Flagstones in the soil, slope, seasonal high water table, and slow permeability are limitations for most uses of this soil. (Capability unit IVs–1)

Wellsboro flaggy silt loam, 15 to 25 percent slopes, moderately eroded (WlD2).—This soil is on convex hillsides. Most areas are less than 75 acres in size. The surface of fields is littered with flagstones and channery fragments that make tillage difficult and cause excessive wear on machinery.

Included in mapping were small wet spots and severely eroded areas that need special conservation treatment. Also included were small areas of soils with a coarse-fragment content averaging more than 35 percent in all layers.

This soil has a seasonal high water table within 18 to 30 inches of the surface in spring, late in fall, and in winter.

The slope, flagstones in the soil, seasonal high water table, and slow permeability are limitations for most uses of this soil. (Capability unit IVe–5)

Wellsboro very stony silt loam, 0 to 8 percent slopes (WsB).—This soil is on slightly convex lower side slopes and in the center of some broad flat ridgetops. Most areas are less than 15 acres in size. Generally, surface stones prevent tilling and mowing.

The profile of this soil differs from the one described as representative for the series in having, instead of a plow layer, a thin layer of humus over a very dark brown, very friable surface layer about 3 inches thick.

Included in mapping were a few small areas on flat ridgetops that have bedrock within 40 inches of the surface and some areas of soils that have a coarse-fragment content averaging more than 35 percent throughout all layers.

This soil has a seasonal high water table within 18 to 30 inches of the surface early in spring, late in fall, and winter. It has a slowly permeable fragipan in the subsoil.

The surface stones, seasonal high water table, and slow permeability are limitations for most uses. Most of the acreage is in woodland. (Capability unit VIs–1)

Wellsboro very stony silt loam, 8 to 25 percent slopes (WsD).—This soil is on convex hillsides. Most areas are less than 45 acres in size. Generally many surface stones prevent tilling and mowing.

The profile of this soil differs from the one described as representative for the series in having, instead of a plow layer, a thin layer of humus over a very dark brown, friable surface layer about 3 inches thick.

Included in mapping were small areas of soils that have a coarse-fragment content averaging more than 35 percent in all layers.

This soil has a seasonal high water table between 18 and 30 inches of the surface in spring, late in fall, and in winter. It has a slowly permeable fragipan in the subsoil.

The surface stones, seasonal high water table, and slow permeability are limitations for most uses. Most acreage of this soil is in woodland. (Capability unit VIs–1)

Wellsboro very stony silt loam, 25 to 50 percent slopes (WsF).—This soil is on hillsides. Most areas are less than 30 acres in size. The steepness and stoniness generally prevent tilling and mowing.

The profile of this soil differs from the one described as representative for the series in having, instead of a plow layer, a thin layer of humus over a very dark brown surface layer about 3 inches thick.

Included in mapping were nonstony areas that make up about 15 percent of this unit. These nonstony areas are subject to considerable erosion if they are cleared or overgrazed. Also included were small areas of soils with a coarse-fragment content averaging more than 35 percent in all layers.

This soil has a seasonal high water table within 18 to 30 inches of the surface in spring, in fall, and in winter. It has a slowly permeable fragipan in the subsoil.

The stoniness, slope, seasonal high water table, and slow permeability are limitations for most uses. Most acreage of this soil is in woodland but small, included nonstony areas are in pasture. (Capability unit VIIs–1)

Wyalusing Series

The Wyalusing series consists of deep, poorly drained soils that developed in medium-textured, moderately coarse textured, and coarse textured alluvial deposits. They occur along many streams throughout the county. The native vegetation consisted of bluegrass, white clover, and other water-tolerant plants.

In a representative profile, Wyalusing soils have a 9-inch mottled plow layer of dark grayish-brown silt loam. The subsoil is mottled dark-gray loam and fine sandy loam mottled with grayish brown, yellowish red, dark brown, and gray. The substratum, at a depth of 28 inches, consists of dark greenish-gray fine sandy loam that becomes grayer and more gravelly at depths below 34 inches.

Wyalusing soils have high available moisture capacity. They are subject to flooding. Permeability is moderate, and the water table is generally at the surface or within 6 inches of the surface early in spring and late in fall.

Representative profile of Wyalusing silt loam, in a pasture one-quarter mile west of Fairdale [sample No. S58–Pa–57–7(1–5) for laboratory characterization]:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; common, fine, faint mottles of dark brown (7.5YR 4/4) and gray (N 5/0); weak, fine, granular structure; friable; abundant roots; 4 percent coarse fragments; clear, wavy boundary; medium acid.

B1g—9 to 17 inches, dark-gray (10YR 4/1) loam; many, medium, prominent mottles of grayish brown (10YR 5/2) and yellowish red (5YR 4/6); weak, fine, subangular blocky structure except in upper 2 inches where it is weak, thin, platy; friable, slightly sticky and plastic; few roots; strongly acid; clear, wavy boundary.

B2g—17 to 28 inches, dark-gray (10YR 4/1) fine sandy loam; common, medium, faint mottles of grayish brown (10YR 5/2), dark brown (7.5YR 4/4), and gray (N 5/0); weak, fine, subangular blocky structure with some tendency to weak, thin, platy; friable, nonsticky and nonplastic; few roots; less than 1 percent coarse fragments; medium acid; abrupt, wavy boundary.

C1g—28 to 34 inches, dark greenish-gray (5GY 4/1) fine sandy loam; weak, thin, platy structure; friable, nonsticky and nonplastic; few roots; 3 percent coarse fragments; medium acid; abrupt, wavy boundary.

IIC2g—34 to 50 inches, dark-gray (10YR 4/1), very gravelly loamy sand; single grain; loose; about 62 percent coarse fragments; medium acid.

The solum ranges from 24 to 35 inches in thickness. The depth to bedrock is more than 10 feet. The depth to mottling or gleyed colors ranges from 0 to 6 inches. In the A and B horizons color ranges from very dark gray (10YR 4/1) to grayish brown (10YR 5/1) that, in a few places, has gleyed bluish and greenish streaks. Coarse-fragment content ranges from 0 to 10 percent above the IIC2g horizon and from 0 to 90 percent in the IIC2g horizon. The C1g horizon is absent in many places.

Wyalusing soils are associated on the landscape with Barbour, Basher, and Holly soils and with Peat. They differ from Barbour and Basher soils, in having mottling within 6 inches of the surface, from Peat, which is organic and nearly always flooded, and from Holly soils, which have clay loam and silty clay loam B horizons.

Wyalusing silt loam (0 to 3 percent slopes) (Wy).—This soil is on flood plains. Most areas are about 10 acres in size, but some are as large as 30 acres. Included in mapping were a few small areas of Holly soils and Mixed alluvial land.

This soil is often too wet to work or traverse with machinery. It has a high water table that is within 6 inches of the surface most of the year.

Flooding and the high water table are limitations for most uses of this soil. (Capability unit IVw–1)

Formation and Classification of the Soils

This section of the survey discusses the factors of soil formation, the major soil horizons, the processes of horizon differentiation, and classification of the soils in Susquehanna County.

Factors of Soil Formation

Soils are formed through the interaction of five major factors. They are climate, plant and animal life, parent material, topography, and time. The relative influence of each factor usually varies from place to place. Local variations in soils are due to differences in kind of parent material and in topography and drainage. In places one factor may dominate the formation of a soil and determine most of its properties.

Climate

The climate of Susquehanna County is characteristic of a humid continental type that is marked by extreme seasonal temperature changes. It has an annual precipitation of 37 to 45 inches and a mean annual air temperature of 44 to 48° F. The rainfall is fairly uniform during the growing season of May through September, averaging about 18 to 24 inches. The cool temperature has promoted the accumulation of organic matter in the surface layers of the soils.

Plant and animal life

All living organisms are important to soil formation. These include vegetation, animals, bacteria, and fungi. The vegetation generally determines the color of the surface layer and the amount of organic matter and nutrients in the soil. Animals, such as earthworms, cicadas, and burrowing animals, help keep the soil open and porous. Bacteria and fungi decompose the vegetation, thereby causing nutrients to be released for plant food. In Susquehanna County, the native trees have influenced soil formation more than any other living organism. Man, however, has greatly altered the surface layer where he has cleared the forests and plowed the soil. He has added fertilizers, mixed some of the soil horizons, and has even moved soil materials from place to place.

Parent material

Parent material is the unconsolidated mass from which the soils are formed. It determines the mineralogical and chemical composition of the soil and, to a large extent, the rate at which soil-forming processes take place.

Parent rock is the consolidated rock from which the parent materials developed; it largely determines the mineralogical and chemical composition of the parent materials. The rocks that underlie Susquehanna County soils are horizontally-bedded, fine-grained sandstones and

shales that have little folding or faulting. Most of these belong to the Catskill Formation of the Susquehanna Group. Small scattered areas belong to the Chemung Formation. Rocks of the Susquehanna Group are mostly gray, brownish, and red sandstones and shales. Less than 5 percent of the soils are underlain by rocks of the Pocono, Pottsville, or Post-Pottsville Formations.

The soils formed in glacial till, a mixture of glacial till and residuum, glacial outwash, old alluvium, recent stream alluvium, and organic materials. Most of the soil materials were left after the glaciers melted 10,000 to 15,000 years ago. Alluvial and organic materials are of recent origin and are being deposited at the present time. Soils that formed in glacial till are the most extensive and have a wide range of characteristics. They generally have a firm substratum. Mardin, Volusia, Chippewa, Wellsboro, and Morris soils are a few examples. The Lordstown and Oquaga soils formed in glacial till and residuum. Chenango soils formed in glacial outwash deposits. They generally have a loamy texture and are underlain by stratified sand and gravel. Unadilla soils formed in old alluvium on stream terraces. Soils on the stream bottoms formed in waterlaid materials called recent alluvium. They have a medium texture and show little or no soil development. These soils are the Barbour, Basher, Wyalusing, and Holly soils. Soils that formed in organic materials are called Peat.

Topography

Susquehanna County is in the glaciated part of the Allegheny Plateau of Pennsylvania. This region is a dissected plateau within the Susquehanna River drainage system. In places the plateau is dissected to a depth of several hundred feet. The Susquehanna Valley walls rise sharply to the dissected plateau; and in places the difference in elevation is as much as 500 or 600 feet in less than a mile.

There is a difference of 200 feet in elevation between different sections of the plateau itself. The average elevation over much of the county is between 1,500 and 2,000 feet. Upland slopes are gently rolling over the broad summit areas, and side slopes are sloping to steep. The general features of the upland area have been smoothed by glaciation, giving rise to landscapes with smooth curves rather than sharp, abrupt features.

The shape of the soil surface, commonly called the lay of the land, the slope, and the position of the water table have had great influence on the formation of soils in the county. Sloping soils that have moderate to rapid runoff generally are well drained, have a bright-colored, unmottled subsoil, and, in most places, are leached to greater depths than wetter soils in the same general area. Gently sloping soils that have slower runoff generally exhibit some evidence of wetness for short periods of time, such as mottling in the subsoil. In level areas or slight depressions, where the water table is at or near the surface for long periods. the soils show evidence of wetness to a marked degree. They have a dark-colored. thick surface layer very high in organic-matter content and a strongly mottled or grayish subsoil. Some soils, however, are wet because of a high water table or because of their position on the landscape. The permeability of the soil material, as well as the length, steepness, and configuration of the slopes, influence the kind of soil that is formed from place to place. Local differences in soils are largely the results of differences in parent material and topography.

Time

The formation of soils requires time for changes to take place in the parent materials, and this is usually a long time when measured in years. The soils of Susquehanna County have formed in the period since glaciation. Evidence of this relatively limited time can be seen in the soils.

Soils that formed on low bottoms, subject to varying amounts of flooding may receive new sediments with each flooding. These soils have only weak soil structure and slight color differences between horizons. An example is the Barbour soils. Soils that have well developed soil horizons, such as Wellsboro soils, have been developing for longer periods than the Barbour soils.

Major Soil Horizons

The soil-forming factors result in the formation of different layers, or soft horizons, in a soil profile. The soil profile extends from the surface of the soil downward to materials that are little altered by the soil-forming processes.

The A horizon is the surface layer. It contains the layer that has the largest accumulation of organic matter, called an A1 horizon. It is also the layer of maximum leaching, or eluviation of clay and iron. When considerable leaching has taken place, an A2 horizon is formed. The A2 horizon of some soils in Susquehanna County is brownish as a result of the oxidation of iron.

The B horizon lies underneath the A horizon and is commonly called the subsoil. It is the horizon of maximum accumulation of clay, iron, aluminum, or other compounds that leached from the A horizon. In some soils the B horizon is formed by alteration in place rather than by illuviation. The alteration may result from oxidation and reduction of iron or from the weathering of clay minerals. The B horizon is generally firmer than the A horizon and has a more blocky or prismatic structure. It is generally lighter colored than the A1 horizon but darker than the C horizon. Most young soils have not developed B horizons.

The C horizon is below the A or B horizon. It consists of materials that are little altered by the soil-forming processes but may be modified by weathering.

Processes of Horizon Differentiation

There are several processes involved in the formation of horizons in the soils of Susquehanna County. These include the accumulation of organic matter, the leaching of soluble salts, the reduction and transfer of iron, and some translocation and loss of clay minerals, aluminum, silica, and iron. The processes are continually taking place and generally at the same time throughout the profile. These processes take place over thousands of years.

Organic matter accumulates in the soil as plant residue decomposes. This process darkens the surface layer and helps form the A1 horizon. Replacement of organic matter in the soil takes a long time. The organic-matter con-

tent of the surface layer of soils in Susquehanna County ranges from about 2.5 to 10 percent.

Soils in Susquehanna County have distinct subsoil horizons. Some of the lime and other soluble salts are leached before translocation of iron and clay takes place. Many factors affect this leaching, such as the kind of salts originally present, the depth to which the soil solution percolates, and the texture of the soil profile.

Well drained and moderately well drained soils in Susquehanna County usually have yellowish-brown or reddish-brown subsoil horizons. These colors are mainly caused by thin coatings of iron oxides on sand and silt grains; although in some soils, like the Lackawanna soils, the colors are derived from the reddish glacial materials in which the soils developed. The subsoil has weak to moderate subangular blocky structure, but it contains little or no more clay than the overlying surface layer.

The reduction and transfer of iron is associated mainly with the wetter, more poorly drained soils. This process is called gleying. Poorly drained to very poorly drained soils, such as the Holly, Chippewa, and Wyalusing soils, are grayish colored in the subsoil and underlying materials, indicating that reduction and transfer of iron has taken place. Moderately well drained and somewhat poorly drained soils have yellowish-brown, reddish-brown, and gray mottles as a result of the segregation of iron.

A fragipan formed in the subsoil of nearly all moderately well drained and somewhat poorly drained soils. It is very firm and brittle when moist and hard when dry. Because soil particles are tightly packed, bulk density is high and pore space is low. The genesis of this horizon is not fully understood, but the swelling and shrinking that take place in alternating wet and dry periods may account for the tight packing of soil particles and for a gross polygonal pattern of cracks in the fragipan. Clay, silica, and oxides of aluminum are most likely the cementing agents that cause brittleness and hardness.

Classification of the Soils

Two systems of classifying soils above the series level have been used in the United States in recent years. The older system was adopted in 1938 (*4*) and later revised (*12*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965 and supplemented in March 1967 and September 1968 (*17*). This system is under continual study, and readers interested in the development of the system should refer to the latest literature available.

The current system of classification defines classes in terms of observable or measurable properties of soils (*10*). It has six categories. Beginning with the most inclusive, these categories are order, suborder, great group, subgroup, family, and series. The placement of some soil series, particularly in families, may change as more precise information becomes available.

In table 9 the soil series of Susquehanna County are classified according to the current system. Brief descriptions of the six categories are given in the paragraphs that follow.

ORDER.—Soils are grouped into orders according to properties that seem to have resulted from the same processes acting to about the same degree on the parent material. Ten soil orders are recognized in the current system: Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. Two exceptions, Entisols and Histosols, occur in many different climates. The orders in this county are Entisols, Inceptisols, and Histosols.

Entisols are recent soils in which there has been little, if any, horizon development. This order is represented in Susquehanna County by Holly and Wyalusing soils.

Inceptisols occur on young land surfaces. This order is represented by soils of the Barbour, Basher, Bath, Chenango, Chippewa, Lackawanna, Lordstown, Mardin,

TABLE 9.—*Classification of the soils by higher categories*

Soil series	Family	Subgroup	Order
Barbour	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic.	Fluventic Dystrochrepts	Inceptisols.
Basher	Coarse-loamy, mixed, mesic	Fluvaquentic Dystrochrepts	Inceptisols.
Bath	Coarse-loamy, mixed, mesic	Typic Fragiochrepts	Inceptisols.
Chenango	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Chippewa	Fine-loamy, mixed, mesic	Typic Fragiaquepts	Inceptisols.
Holly	Fine-loamy, mixed, nonacid, mesic	Typic Fluvaquents	Entisols.
Lackawanna	Coarse-loamy, mixed, mesic	Typic Fragiochrepts	Inceptisols.
Lordstown	Coarse-loamy, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Mardin	Coarse-loamy, mixed, mesic	Typic Fragiochrepts	Inceptisols.
Morris	Coarse-loamy, mixed, mesic	Aeric Fragiaquepts	Inceptisols.
Norwich	Fine-loamy, mixed, mesic	Typic Fragiaquepts	Inceptisols.
Oquaga	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Peat [1]			Histosols.
Unadilla	Coarse-silty, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Volusia	Fine-loamy, mixed, mesic	Aeric Fragiaquepts	Inceptisols.
Wellsboro	Coarse-loamy, mixed, mesic	Typic Fragiochrepts	Inceptisols.
Wyalusing	Coarse-loamy over sandy or sandy-skeletal, mixed, nonacid, mesic.	Typic Fluvaquents	Entisols.

[1] Histosols are not classified at the subgroup and family levels, because classification at these levels was provisional at the time the survey was sent to the printer.

Morris, Norwich, Oquaga, Unadilla, Volusia, and Wellsboro series.

Histosols have a high organic-matter content. They formed in saturated plant remains and some mineral matter. This order is represented by Peat.

SUBORDER.—Each order is divided into suborders, primarily on the basis of soil characteristics that seem to produce classes having the greatest genetic similarity. The soil properties used are mainly those that reflect either the presence or absence of waterlogging or differences in climate or vegetation. The climatic range of the suborders is narrower than that of the orders.

GREAT GROUP.—Each suborder is divided into great groups on the basis of uniformity in the kinds and sequence of major horizons and soil features. The horizons considered are those in which clay, iron, and humus have accumulated and those that have pans which interfere with the growth of roots or the movement of water. The features considered are the self-mulching properties of clay, soil temperature, chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like. This soil survey contains no great soil grouping by the 1938 classification system.

SUBGROUP.—Each great group is divided into subgroups, one representing the central (typic) segment of the group and others, called intergrades, that have properties of one great group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside the range of any other great group, suborder, or order.

FAMILY.—Families are established within a subgroup primarily on the basis of properties that affect the growth of plants or the behavior of soils when used for engineering purposes. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizon, and consistence.

SERIES.—The series is a group of soils in the same family that have major horizons which, except for texture of the surface layer, are similar in important characteristics and in arrangement in the profile.

Laboratory Data [6]

The physical and chemical properties of selected soils in Susquehanna County are shown in tables 10 and 11. Soils of the Barbour, Basher, Holly, Lackawanna, Mardin, Morris, Norwich, Volusia, Wellsboro, and Wyalusing series were sampled and characterized. Profiles of the soils sampled, except for the Wellsboro soil, are described in the section "Descriptions of the Soils." The Wellsboro profile sampled is described in this section.

Data for one profile of each series is presented. Samples were collected from each horizon that could be recognized in a pit dug through the solum and into the underlying material.

Profile of Wellsboro channery silt loam, 3 to 8 percent slopes, moderately eroded, in a clover field 7.5 miles east of Springville in Lathrop Township: Profile No. S58 Pa–57–4(1–6) sampled for laboratory characterization.

Ap—0 to 10 inches, dark-brown (7.5YR 3/2) channery silt loam; weak, fine, granular structure and weak, fine, subangular blocky structure; friable; 40 percent coarse fragments; medium acid; abrupt, wavy boundary.

A2—10 to 15 inches, brown (7.5YR 5/2) channery and gravelly loam; common, fine, faint mottles of yellowish brown (10YR 5/5); weak, thin, platy structure; friable, nonplastic; 30 percent coarse fragments; very strongly acid; clear, irregular boundary.

B2—15 to 20 inches, reddish-brown (5YR 4/3) channery silt loam; common, fine, faint mottles of reddish gray (5YR 5/2) and yellowish red (5YR 5/6); weak, medium, blocky structure to moderate, medium, platy; firm in place, friable when removed, slightly plastic; thin continuous clay films; 30 percent coarse fragments; very strongly acid; gradual, irregular boundary.

Bx1—20 to 30 inches, reddish-brown (5YR 4/3) channery silt loam; common, medium, faint mottles of reddish gray (5YR 5/2) and gray (5YR 6/1) polygon faces; polygons 5 to 7 inches across parting to weak, fine and medium, blocky structure to weak, medium, platy; firm in place, friable when removed, plastic; thick clay films in larger pores, thin films in smaller pores; 35 percent coarse fragments; strongly acid; gradual, wavy boundary.

Bx2—30 to 39 inches, dark reddish-gray (5YR 4/2) channery loam; few, medium, distinct mottles of yellowish red (5YR 4/6); polygon faces are gray (5YR 6/1) with streaks of yellowish red (5YR 5/6); polygons 7 to 10 inches across parting to weak, medium, blocky structure; firm in place, friable when removed, slightly plastic; thick clay films in larger pores, thin films in smaller pores; 40 percent coarse fragments; strongly acid; gradual, wavy boundary.

Bx3—39 to 45 inches, dark-brown (7.5YR 4/2) channery loam; coatings of gray (N 6/0) and yellowish red (5YR 4/8) on polygon faces; polygons 7 to 10 inches across; friable to firm, less plastic than Bx2 horizon; 40 percent coarse fragments; strongly acid.

Methods of Analysis

Air dry samples were crushed so that soil material would pass through a 2-millimeter sieve. Care was taken to avoid breaking the rock fragments larger than 2 millimeters. The percentage of material larger than 2 millimeters is reported in table 10 as percent of coarse fragments by weight. All other determinations in tables 10 and 11, except those for bulk density, are based on that part of the sample which was less than 2 millimeters in diameter. Analyses of particle-size distribution were made by the pipette method (*6*). Bulk density was determined for triplicate 1- by 2-inch cylindrical core samples taken with a modified Uhland core sampler (*13*, *15*). Moisture held at one-third atmosphere tension was measured with a pressure plate apparatus (*15*). Moisture held at 15 atmosphere tension was measured with pressure membrane apparatus (*15*).

Reaction (pH) was determined electrometrically (glass electrode-pH meter) for samples which had been air dried, and a soil-water ratio of 1 to 1 was used. Percentage of organic carbon was determined by a modification of the Walkley-Black wet oxidation method (*8*). The Kjeldahl method was used to determine the percentage of total nitrogen (*3*). The amount of calcium, magnesium, sodium, and potassium extracted by neutral, normal ammonium acetate was determined by the meth-

[6] Laboratory analyses and interpretations of the data were made at the Soil Characterization Laboratory of the Pennsylvania State University.

ods of Peech and others (*8*). Extractable acidity (hydrogen) was determined by leaching with barium chloride solution buffered at pH 8.1 with triethanolamine (*7*). The cation exchange capacity (sum) is the total of extractable cations including acidity. Cation exchange capacity (NH_4OA_c) was determined by the methods of Peech and others (*8*), in which samples were saturated with ammonium and washed with ethanol. The ammonium was then displaced with sodium chloride and the amount determined by the Kjeldahl method.

The percentages of clay minerals were determined in the Agronomy Department of the Pennsylvania University. X-ray diffraction traces were obtained from oriented clay samples by use of copper radiation, Geiger counter, and chart recorder. Air dry soil samples were treated with hydrogen peroxide to destroy organic matter. Iron oxides were removed by treatment with oxalic acid, potassium oxalate, and magnesium ribbon (*5*). The clay (particles smaller than 0.002 millimeters) was separated with a centrifuge, one part saturated with potassium ions and one part saturated with magnesium ions. Suspensions of clay were placed on glass slides, allowed to air dry, and then used to obtain diffraction traces. The magnesium saturated sample was then solvated with ethylene glycol. The potassium saturated sample was heated to 300° C. and to 500° C. successively. Diffraction traces were obtained from each treatment. Quantitative interpretations of the traces were based on the relative height of the various diffraction peaks.

Summary of Data

PARTICLE-SIZE DISTRIBUTION.—The proportion of sand, silt, and clay in the Lackawanna, Mardin, Morris, Norwich, Volusia, and Wellsboro soils indicates a relative uniformity in the glacial till in which they formed. The fact that the very poorly drained Norwich soil has considerably more clay and less sand than the other glacial till soils can be explained, at least in part, by the tendency for fine particles to wash from high spots and collect in very poorly drained low areas. Somewhat poorly drained Morris and Volusia soils tend to have slightly more clay than the better drained Lackawanna, Mardin, and Wellsboro soils. Except that there tends to be more sand and less silt and clay at greater depths, there are no consistent changes in particle size in the soils derived from glacial till.

Barbour, Basher, Holly, and Wyalusing soils formed in alluvium, which is material deposited by flood waters along streams. Sharp changes in particle-size distribution with depth (stratification) are typical in these soils. Because these materials were deposited by water, they are better sorted than glacial till. The particle-size data reflects this sorting in that a larger percentage of the total sample in many cases is concentrated in a narrow size-range, such as fine and very fine sand (Barbour) or silt (Holly), and there is generally less clay and medium-to-coarse sand than in the glacial till. Soils developed in poorly sorted materials tend to develop a dense, impermeable subsoil, while those formed in well sorted materials resist this tendency.

COARSE-FRAGMENT CONTENT.—The soils developed in glacial till consistently have great amounts of fragments larger than 2 millimeters throughout. This is one of the limitations of these soils, not only because coarse fragments make the soils hard to work, but also because they act as a dilutent. In other words, more coarse fragments mean less soil material to hold water and plant nutrients. Soils developed in alluvium have few coarse fragments,

TABLE 10.—*Mechanical analyses and*

[Laboratory analyses were made at the Soil Characterization Laboratory of the Pennsylvania

Soil name, sample number, and location	Depth from surface	Particle-size distribution		
		Very coarse sand (2.0 to 1.0 mm.)	Coarse sand (1.0 to 0.5 mm.)	Medium sand (0.5 to 0.25 mm.)
	In.	*Pct.*	*Pct.*	*Pct.*
Barbour fine sandy loam:				
S58Pa57-8; in field 380 feet south of U.S. Highway 106 and one-eighth mile east of intersection with Legislative Route 57007.	0–9	0. 6	0. 9	3. 6
	9–12	. 2	1. 4	8. 5
	12–21	. 7	1. 6	8. 8
	21–30	. 2	. 8	10. 4
	30–34	7. 6	13. 4	19. 0
	34–50	19. 8	17. 4	14. 2
Basher silt loam:				
S58Pa57-18; one-eighth mile southwest of intersection of Legislative Route 57103 and T316, and 210 feet south of T316.	0–10	. 8	. 8	1. 5
	10–17	1. 3	1. 3	2. 4
	17–23	8. 2	5. 6	4. 9
	23–37	1. 0	2. 0	2. 7
	37–50	. 1	. 3	4. 7
Holly silt loam:				
S58Pa57-11; on northwest boundary of State Game Lands No. 140B, between State Route 858 and Apalachin Creek.	0–4	1. 0	4. 6	4. 3
	4–20	. 2	1. 3	2. 5
	20–36	. 4	1. 4	2. 6

except in specific horizons which are usually well below the surface.

BULK DENSITY.—Bulk density is an expression of the weight per unit volume of the naturally occurring soil mass. Mineral particles of soils have densities of about 2.5 grams per cubic centimeter; therefore, a soil that is half pore space would have a bulk density of about 1.25 grams per cubic centimeter. Bulk density values of this magnitude indicate a high degree of aeration (unless waterlogged) and are generally desirable. The data for the Lackawanna, Morris, Norwich, Volusia, and Wellsboro soils, all derived from glacial till, show a sharp increase in bulk density from the surface to a depth of 15 to 25 inches. These depths mark the beginning of a dense, firm fragipan which is common in soils derived from glacial till. The other soils have lower bulk density in the subsoil, indicating that they have more pore space, allow excess water to percolate through the soil more readily, and provide a suitable medium for root penetration.

AVAILABLE MOISTURE CAPACITY.—The amount of moisture at one-third atmosphere is an approximation of the field soil moisture capacity, or the amount of water held against gravity after drainage through the soil has essentially stopped. The amount of moisture at 15 atmospheres is the soil water content at which plants wilt without recovery. The percentage of moisture in a soil subjected to a pressure of 15 atmospheres subtracted from the percentage at one-third atmosphere gives an estimate of the capacity of the soil to store moisture available to plants.

Textures of the soils considered here are similar, and the available moisture capacities of the fine earth material, which is closely related to texture, are also similar. Because the content of coarse fragments varies markedly, a factor must be applied based on the coarse-fragment percentage in order to allow for the dilution effect they have on available moisture capacity. Further multiplication of the available moisture capacity by the bulk density of the soil converts the data to a volume basis or inches of water per inch of soil. This volume figure is useful in practical situations.

The one-third-atmosphere determination was done on soil samples which had been crushed. Subsequent work using undisturbed cores or clods has shown that fragipan horizons, such as the subsoil of the Lackawanna, Mardin, Morris, Volusia, and Wellsboro soils, actually hold much less moisture in the undisturbed or natural state. This is presumably because they are so compact and have relatively little pore space. Few plant roots can penetrate the fragipan to obtain water. Available moisture data for poorly drained soils, such as those of the Holly, Norwich, and Wyalusing series, are probably seldom applicable. The poor internal drainage does not allow the moisture content to go down readily to that at one-third atmosphere. The moisture between one-third atmosphere and saturation, ponded water on the surface, and available moisture can all be used by plants growing in this environment.

ORGANIC CARBON AND NITROGEN.—The organic carbon value multiplied by 2 gives an estimate of the content of total organic matter. For example, the Barbour Ap horizon contains about 3 percent organic matter by weight and the rest is mineral material. The percentage of organic matter on a volume basis would be considerably more, because organic matter is much less dense than soil mineral material. Organic matter, mostly dark, humified material, has beneficial effects on the structure and workability, nutrient-holding capacity, and other properties of the soil. Organic-matter content decreases

physical properties of selected soils

State University. Dashes in columns indicate analysis not made or material not present]

Particle-size distribution—Continued				Coarse fragments (larger than 2.0 mm.)	Bulk density	Moisture held at—		Available moisture (adjusted for coarse fragments)
Fine sand (0.25 to 0.10 mm.)	Very fine sand (0.10 to 0.05 mm.)	Silt (0.05 to 0.002 mm.)	Clay (less than 0.002 mm.)			Tension of 1/3 atmosphere	Tension of 15 atmospheres	
Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct. by weight*	*Gm./cc.*	*Pct.*	*Pct.*	*In./in. of soil*
27. 6	24. 4	33. 4	9. 5	3. 2	1. 43	20. 8	6. 6	0. 19
29. 6	22. 7	29. 5	8. 1	. 1	1. 40	16. 8	4. 9	. 15
29. 5	20. 4	28. 9	10. 1	. 2	1. 28	18. 3	5. 8	. 13
42. 9	18. 4	20. 4	6. 9	. 2	1. 39	13. 7	4. 5	. 10
30. 3	10. 4	13. 3	6. 0	60. 9	1. 69	8. 1	4. 6	. 02
19. 9	8. 5	11. 2	9. 0	84. 2	----------	9. 4	4. 6	----------
13. 1	19. 3	51. 1	13. 4	10. 1	----------	15. 7	7. 8	----------
11. 9	16. 8	50. 9	15. 4	12. 6	----------	17. 5	9. 1	----------
15. 4	19. 2	36. 1	10. 6	55. 8	----------	12. 2	6. 5	----------
11. 4	17. 9	50. 3	14. 7	1. 8	----------	14. 2	7. 9	----------
31. 8	25. 7	32. 6	4. 8	. 6	----------	5. 9	2. 9	----------
6. 8	10. 1	52. 3	20. 9	1. 2	. 67	47. 4	22. 2	. 17
5. 4	8. 9	52. 9	28. 8	1. 6	1. 45	36. 9	17. 2	. 28
9. 4	10. 9	48. 3	27. 0	3. 0	1. 34	35. 4	15. 7	. 26

TABLE 10.—*Mechanical analyses and*

Soil name, sample number, and location	Depth from surface	Particle-size distribution		
		Very coarse sand (2.0 to 1.0 mm.)	Coarse sand (1.0 to 0.5 mm.)	Medium sand (0.5 to 0.25 mm.)
	In.	*Pct.*	*Pct.*	*Pct.*
Lackawanna channery silt loam:				
S58Pa57–19; 1.5 miles west of South Auburn on dirt road T305, and 500 feet south of road.	0–7	9. 3	4. 8	2. 8
	7–10	6. 2	4. 8	3. 0
	10–16	6. 7	5. 4	3. 4
	16–20	9. 2	6. 2	4. 2
	20–28	6. 6	6. 0	3. 9
	28–38	10. 2	8. 1	5. 0
	38–50	10. 8	7. 0	4. 5
Mardin channery silt loam:				
S58Pa57–12; State Game Lands No. 140B, 1,000 feet north of T768 from Route 471, 80 feet west of T768, and east of No. 11 sign.	0–7	3. 8	3. 7	4. 1
	7–11	4. 2	4. 9	5. 2
	11–16	4. 6	5. 3	4. 5
	16–20	4. 6	5. 1	4. 5
	20–30	3. 4	3. 8	3. 7
	30–38	3. 4	3. 8	4. 2
	38–50	4. 1	4. 2	4. 5
Morris channery silt loam:				
S58Pa57–3; 75 miles east of Springville, 1 mile north of Tarbett Pond, in pasture 900 feet northeast of Route 57010.	0–7	. 4	1. 4	3. 5
	7–11	2. 2	3. 6	6. 8
	11–17	3. 3	5. 0	6. 6
	17–22	4. 0	4. 6	5. 9
	22–27	4. 8	5. 6	6. 0
	27–34	3. 7	4. 0	5. 6
	34–50	4. 5	4. 5	5. 2
Norwich clay:				
S58Pa57–21; Auburn Township, 5 miles south of intersection No. 57012, 260 feet southwest of gas line marker along road to power pole, along fence boundary.	0–8	1. 3	2. 2	3. 2
	8–10	. 4	1. 5	2. 3
	10–25	. 2	. 5	2. 3
	25–30	7. 0	1. 6	4. 0
	30–50	3. 8	3. 4	4. 6
Volusia channery silt loam:				
S58Pa57–14; 1 mile north of St. Joseph, Route No. T695, 1,000 feet up, first lane, 400 feet left of lane.	0–9	. 9	1. 8	2. 8
	9–13	1. 3	2. 9	4. 4
	13–21	1. 5	3. 0	3. 2
	21–31	3. 6	3. 6	3. 9
	31–43	3. 4	3. 0	3. 1
	43–60	1. 7	2. 4	2. 7
Wellsboro channery silt loam:				
S58Pa57–4–(1–6); 7.5 miles east of Springville.	0–10	2. 1	2. 2	3. 1
	10–15	3. 4	4. 0	5. 0
	15–20	2. 8	3. 3	4. 4
	20–30	3. 0	3. 5	4. 9
	30–39	2. 5	4. 2	5. 5
	39–45	3. 4	3. 9	5. 7
Wyalusing silt loam:				
S58Pa57–7; Cross bridge west on U.S. Route 106 out of Fairdale, 270 feet southwest of bridge, and 40 feet southeast of road embankment.	0–9	1. 7	1. 7	2. 3
	9–17	. 1	. 2	1. 8
	17–28	. 2	1. 1	4. 7
	28–34	. 1	1. 7	6. 8
	34–50	7. 8	10. 5	13. 9

physical properties of selected soils—Continued

Particle-size distribution—Continued				Coarse fragments (larger than 2.0 mm.)	Bulk density	Moisture held at—		Available moisture (adjusted for coarse fragments)
Fine sand (0.25 to 0.10 mm.)	Very fine sand (0.10 to 0.05 mm.)	Silt (0.05 to 0.002 mm.)	Clay (less than 0.002 mm.)			Tension of 1/3 atmosphere	Tension of 15 atmospheres	
Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct. by weight*	*Gm./cc.*	*Pct.*	*Pct.*	*In/in. of soil*
8.0	12.5	50.7	11.9	62.6	1.27	28.0	10.6	.08
7.6	12.6	53.9	11.9	21.3	1.43	24.5	6.7	.20
7.8	14.1	51.5	11.1	44.8	1.57	23.1	5.4	.15
9.9	15.1	45.0	10.4	43.7	1.81	20.2	5.5	.15
9.4	14.9	45.6	13.6	53.8	1.71	20.5	6.3	.11
10.1	14.7	40.1	11.8	54.2	1.76	18.6	6.1	.10
11.9	18.7	38.6	8.5	49.5	1.76	16.1	5.0	.10
14.2	15.1	47.4	11.7	43.0	1.10	30.8	13.1	.11
17.3	16.6	43.6	8.2	43.0	----------	31.0	12.3	----------
15.0	15.3	40.2	15.1	50.3	----------	26.5	7.9	----------
13.9	15.4	44.9	11.6	49.6	----------	20.9	4.9	----------
12.4	14.1	42.1	20.5	41.1	----------	18.8	8.2	----------
16.8	16.1	35.4	20.3	40.5	----------	18.9	8.2	----------
15.6	23.2	30.2	18.2	40.7	----------	19.8	7.5	----------
15.1	13.7	44.9	21.0	32.2	.97	31.8	16.3	.11
14.7	11.4	41.3	20.0	33.7	1.27	26.5	11.5	.13
16.9	14.1	42.3	11.8	45.5	1.50	19.5	5.1	.11
16.1	14.7	43.0	11.7	47.9	1.66	17.6	4.3	.11
17.0	14.2	39.4	13.0	46.9	2.07	17.0	4.9	.13
14.8	12.8	42.2	16.9	49.7	1.90	18.6	6.2	.12
14.3	13.0	45.2	13.3	34.9	1.92	17.9	5.8	.15
6.2	5.6	36.7	44.8	1.6	.81	50.9	28.8	.18
9.2	7.7	47.0	31.9	24.4	1.42	29.8	14.5	.16
10.2	9.3	49.8	27.7	47.3	1.41	27.3	11.6	.12
13.8	10.2	39.3	24.1	62.8	1.60	24.2	10.2	.08
12.8	12.3	39.8	23.3	50.5	----------	19.8	9.7	----------
11.0	12.6	50.3	20.6	16.1	1.22	29.2	13.9	.15
19.5	20.3	39.8	11.8	10.9	1.47	19.4	6.1	.17
13.0	14.6	46.3	18.4	28.7	1.86	20.1	7.2	.17
12.0	14.0	42.3	20.6	39.5	1.79	19.2	8.9	.11
11.4	13.8	45.6	19.7	43.6	1.74	19.4	8.3	.11
11.1	13.6	53.5	15.0	25.8	1.80	19.5	6.8	.17
13.1	13.0	51.8	14.7	50.5	1.04	31.6	14.3	.08
17.9	18.6	42.6	8.5	28.9	1.61	17.1	3.4	.16
15.4	16.8	44.5	12.8	36.6	1.51	18.0	4.4	.13
14.9	15.5	44.4	13.8	39.7	1.83	17.6	5.1	.13
16.7	16.0	43.2	11.9	48.5	1.68	17.0	4.6	.10
17.7	16.6	42.1	10.6	52.8	1.70	16.1	4.3	.11
17.2	13.8	48.6	14.7	6.8	1.28	29.9	9.0	.25
24.0	24.5	37.7	11.7	.0	1.35	23.4	7.0	.22
31.9	25.0	27.5	9.6	.2	1.51	18.1	5.7	.18
41.3	12.2	33.0	4.9	4.8	.99	16.8	8.3	.08
30.9	16.2	15.7	5.0	72.8	----------	12.5	4.3	----------

TABLE 11.—*Chemical properties*

[Laboratory analyses were made at the Soil Characterization Laboratory of the Pennsylvania State University.

Soil name and sample number	Depth from surface	Organic carbon	Nitrogen	Carbon-nitrogen ratio	Calcium-magnesium ratio	Extractable cations				
						Calcium	Magnesium	Sodium	Potassium	Hydrogen
	In.	*Pct.*	*Pct.*			*Meq./100 gm. soil*	*Meq./100 gm. soil*	*Meq./100 gm. soil*	*Meq./100 gm. soil*	*Meq./100 gm. soil*
Barbour fine sandy loam:	0–9	1. 46	0. 125	11. 7	--------	5. 9	0. 4	0. 5	0. 1	4. 7
S58Pa57–8.	9–12	. 55	. 052	10. 6	--------	2. 2	. 3	. 4	. 1	5. 9
	12–21	. 39	. 052	7. 5	--------	1. 9	. 4	. 3	. 1	6. 7
	21–30	. 32	. 041	7. 8	--------	1. 4	. 1	. 2	. 1	5. 4
	30–34	. 32	. 039	8. 2	--------	1. 7	. 2	. 2	. 1	5. 5
	34–50	. 41	. 046	8. 9	--------	2. 9	. 3	. 2	. 1	5. 5
Basher silt loam:	0–10	1. 65	. 129	12. 8	6. 2	6. 8	1. 1	. 5	. 4	6. 3
S58Pa57–18.	10–17	1. 71	. 148	11. 6	--------	5. 4	. 8	. 4	. 4	8. 6
	17–23	1. 08	. 099	10. 9	--------	3. 5	. 9	. 3	. 3	5. 9
	23–37	. 24	. 044	--------	4. 2	4. 2	. 0	. 3	. 2	5. 8
	37–50	. 12	. 018	--------	--------	2. 4	. 6	. 3	. 2	3. 0
Holly silt loam:	0–4	5. 52	. 282	19. 6	4. 5	10. 9	2. 4	. 7	. 4	22. 0
S58Pa57–11.	4–20	2. 56	. 213	12. 0	2. 8	6. 6	2. 4	. 6	. 4	16. 8
	20–36	2. 07	. 164	12. 6	2. 7	5. 9	2. 2	. 5	. 4	13. 4
Lackawanna channery silt loam:	0–7	3. 74	. 210	17. 8	9. 5	12. 3	1. 3	. 6	. 3	7. 1
S58Pa57–19.	7–10	. 72	. 074	9. 7	--------	2. 9	. 6	. 3	. 3	8. 0
	10–16	. 38	. 054	7. 0	--------	2. 1	. 3	. 2	. 2	5. 1
	16–20	. 23	. 042	--------	--------	1. 2	. 3	. 2	. 1	4. 6
	20–28	. 20	. 035	--------	--------	1. 1	. 3	. 2	. 1	6. 0
	28–38	. 16	. 032	--------	--------	. 9	. 3	. 2	. 1	4. 7
	38–50	. 26	. 025	10. 4	--------	. 7	. 3	. 1	. 1	4. 3
Mardin channery silt loam:	0–7	3. 07	. 181	17. 0	10. 3	11. 3	1. 1	. 6	. 4	7. 4
S58Pa57–12.	7–11	1. 64	. 123	13. 3	--------	4. 0	. 5	. 4	. 3	10. 8
	11–16	. 99	. 084	11. 8	--------	3. 0	. 4	. 3	. 3	9. 2
	16–20	. 32	. 038	8. 4	--------	3. 0	. 3	. 2	. 2	3. 2
	20–30	. 17	. 034	--------	--------	1. 4	. 7	. 2	. 2	7. 4
	30–38	. 13	. 030	--------	1. 1	1. 7	1. 5	. 2	. 2	9. 0
	38–50	. 44	. 051	8. 6	2. 0	2. 4	1. 2	. 2	. 2	7. 1
Morris channery silt loam:	0–7	4. 57	. 354	12. 9	7. 5	10. 5	1. 4	. 8	. 4	15. 0
S58Pa57–3.	7–11	1. 83	. 173	10. 6	6. 4	7. 0	1. 1	. 7	. 3	12. 1
	11–17	. 44	. 050	8. 8	--------	3. 1	. 5	. 4	. 2	5. 4
	17–22	. 20	. 025	--------	--------	3. 0	. 5	. 4	. 2	4. 1
	22–27	. 08	. 021	--------	--------	4. 0	. 8	. 5	. 2	3. 4
	27–34	. 12	. 024	--------	3. 8	6. 0	1. 6	. 6	. 2	3. 5
	34–50	. 08	. 021	--------	4. 0	6. 0	1. 5	. 5	. 2	4. 0
Norwich clay:	0–8	6. 34	. 328	19. 3	5. 6	15. 0	2. 7	. 9	. 8	8. 0
S58Pa57–21.	8–10	. 88	. 098	9. 0	4. 9	7. 3	1. 5	. 6	. 3	10. 7
	10–25	. 27	. 044	6. 1	3. 8	10. 3	2. 7	. 6	. 4	6. 9
	25–30	. 19	. 032	--------	4. 0	8. 3	2. 1	. 5	. 3	4. 1
	30–50	. 12	. 035	--------	3. 8	10. 7	2. 8	. 5	. 3	4. 1
Volusia channery silt loam:	0–9	2. 27	. 198	11. 5	5. 6	8. 4	1. 5	. 5	. 3	7. 0
S58Pa57–14.	9–13	. 44	. 057	7. 7	--------	1. 8	. 5	. 3	. 2	5. 8
	13–21	. 16	. 035	--------	--------	1. 5	. 6	. 2	. 1	5. 5
	21–31	. 08	. 032	--------	1. 4	1. 9	1. 4	. 2	. 1	5. 7
	31–43	. 08	. 029	--------	1. 3	2. 6	2. 0	. 2	. 1	6. 0
	43–60	. 10	. 026	--------	1. 2	2. 0	1. 7	. 2	. 1	5. 0
Wellsboro channery silt loam:	0–10	3. 35	. 252	13. 3	--------	5. 9	. 6	. 7	. 3	12. 4
S58Pa57–4(1–6).	10–15	. 34	. 034	10. 0	--------	. 5	. 2	. 3	. 2	5. 1
	15–20	. 16	. 025	--------	--------	. 6	. 1	. 3	. 1	5. 8
	20–30	. 13	. 023	--------	--------	. 8	. 2	. 2	. 1	5. 5
	30–39	. 10	. 024	--------	--------	. 9	. 3	. 2	. 1	4. 2
	39–45	. 16	. 019	--------	--------	1. 0	. 3	. 2	. 1	4. 2
Wyalusing silt loam:	0–9	2. 36	. 162	14. 6	3. 7	4. 4	1. 2	. 4	. 2	7. 8
S58Pa57–7.	9–17	. 83	. 105	7. 9	--------	2. 6	. 9	. 3	. 1	7. 1
	17–28	. 69	. 077	9. 0	--------	2. 3	. 9	. 3	. 1	5. 6
	28–34	2. 70	. 171	15. 8	4. 4	4. 8	1. 1	. 3	. 1	5. 1
	34–50	1. 11	. 064	17. 3	--------	2. 1	. 6	. 3	. 1	4. 7

[1] Indicated by intensity of X-ray defraction peaks.

of selected soils

Dashes in columns indicate analysis not made or material not present in any significant quantity]

Cation exchange capacity (sum)	Base saturation (sum)	Reaction field (electrometric)	Relative amounts of clay minerals in [1]—					
			Kaolinite	Illite	Vermiculite	Chlorite	Montmorillonite	Interstratified
Meq./100 gm. soil	*Pct.*	*pH*						
11. 6	59	6. 5	----------	Abundant------	Moderate-----	Low----------	----------	Moderate.
8. 9	34	5. 8	----------	Abundant------	Moderate-----	Low----------	----------	Moderate.
9. 4	29	5. 5	----------	Abundant------	Moderate-----	Low----------	----------	Moderate.
7. 2	25	5. 3	----------	Dominant------	Moderate-----	Low----------	----------	Low.
7. 7	29	5. 2	----------	Dominant------	Moderate-----	Low----------	----------	Low.
9. 0	39	5. 5	----------	Dominant------	Moderate-----	Low----------	----------	Low.
15. 1	58	6. 8	Low---------	Abundant------	Moderate-----	Low----------	----------	Moderate.
15. 6	45	6. 1	----------	Abundant------	Moderate-----	Low----------	----------	Moderate.
10. 9	46	6. 0	----------	Dominant------	Moderate-----	Low----------	----------	Low.
11. 5	50	5. 6	----------	Dominant------	Moderate-----	Low----------	----------	Low.
6. 5	54	5. 7	----------	Dominant------	Low----------	Low----------	----------	Low.
36. 4	40	5. 8	Low---------	Dominant------	Low----------	Low----------	----------	Low.
26. 8	37	5. 6	Low---------	Dominant------	Low----------	Low----------	----------	Moderate.
22. 4	40	6. 1	----------	Dominant------	Low----------	Low----------	----------	Moderate.
21. 6	67	7. 2	----------	Moderate------	Low----------	Low----------	----------	Abundant.
12. 1	34	6. 8	----------	Abundant------	Low----------	Moderate------	----------	Moderate.
7. 9	35	6. 3	----------	Abundant------	Low----------	Moderate------	----------	Low.
6. 4	28	5. 2	----------	Dominant------	----------	Moderate------	----------	Low.
7. 7	22	5. 0	----------	Dominant------	----------	Moderate------	----------	Low.
6. 2	24	4. 9	----------	Dominant------	----------	Moderate------	----------	Low.
5. 5	22	5. 0	----------	Dominant------	----------	Moderate------	----------	Low.
20. 8	64	6. 4	----------	----------	----------	----------	----------	
16. 0	33	6. 5	----------	----------	----------	----------	----------	
13. 2	30	6. 3	----------	Dominant------	Low----------	Low----------	----------	Low.
6. 9	54	6. 2	----------	Dominant------	----------	Moderate------	----------	
9. 9	25	6. 1	----------	Dominant------	----------	Low----------	----------	Low.
12. 6	29	5. 1	Low---------	Dominant------	----------	Low----------	----------	
11. 1	36	4. 7	Low---------	Dominant------	----------	Low----------	----------	
28. 1	47	6. 3	----------	----------	----------	----------	----------	
21. 2	43	6. 1	----------	Moderate------	Abundant----	Low----------	----------	Moderate.
9. 6	44	5. 8	----------	Abundant------	Moderate-----	Moderate------	----------	Low.
8. 2	50	5. 6	----------	Abundant------	Low----------	Moderate------	----------	Low.
8. 9	62	5. 6	Low---------	Abundant------	Moderate-----	Moderate------	----------	Low.
11. 9	71	5. 9	----------	Dominant------	Low----------	Moderate------	Low---------	Low.
12. 2	67	6. 2	----------	Dominant------	Low----------	Moderate------	Low---------	Low.
27. 4	71	6. 2	----------	----------	----------	----------	----------	
20. 4	48	5. 4	----------	----------	----------	----------	----------	
20. 9	67	5. 3	----------	----------	----------	----------	----------	
15. 3	73	5. 4	----------	----------	----------	----------	----------	
18. 4	78	5. 7	----------	----------	----------	----------	----------	
17. 7	60	6. 0	----------	Dominant------	Moderate-----	Low----------	----------	Low.
8. 6	33	5. 7	----------	Dominant------	Low----------	Moderate------	Low---------	Low.
7. 9	30	5. 3	----------	Dominant------	Low----------	Moderate------	----------	Low.
9. 3	39	5. 3	----------	Dominant------	Low----------	Moderate------	Low---------	Low.
10. 9	45	5. 4	----------	----------	----------	----------	----------	
9. 0	44	5. 7	----------	----------	----------	----------	----------	
19. 9	38	5. 7	----------	Moderate------	Abundant----	Moderate------	----------	Moderate.
6. 3	19	4. 9	----------	Abundant------	Moderate-----	Moderate------	----------	Low.
6. 9	16	4. 9	----------	Dominant------	Low----------	Abundant------	----------	Low.
6. 8	19	5. 2	----------	Dominant------	----------	Moderate------	----------	Low.
5. 7	26	5. 2	----------	Dominant------	----------	Moderate------	----------	Low.
5. 8	28	5. 1	----------	Dominant------	----------	Low----------	Low---------	Low.
14. 0	44	5. 9	----------	Dominant------	Low----------	Moderate------	----------	Low.
11. 0	35	5. 7	----------	Dominant------	Low----------	Moderate------	----------	Low.
9. 2	39	5. 6	----------	Dominant------	Low----------	Moderate------	----------	Low.
11. 4	55	5. 8	----------	Dominant------	Low----------	Moderate------	----------	Low.
7. 8	40	5. 9	----------	Dominant------	Low----------	Moderate------	----------	Low.

sharply from topsoil to subsoil in most cases. The profile of the Wyalusing soil is an exception that sometimes occurs in alluvial soils. An organic-rich horizon, perhaps once the surface layer, has been buried by more recent alluvium.

Soil organic matter contains nitrogen that becomes available to plants only when released by microbial activity. A typical cultivated soil has a carbon-nitrogen ratio of about 10 to 12. Anything higher than that sometimes indicates a relatively slow release of nitrogen for plant use.

SOIL REACTION.—The pH values reflect the natural acidity of the soils. Several of the soils are higher in pH or less acid at the surface than in the subsoil because of the effect of liming.

CATION EXCHANGE PROPERTIES.—Soil mineral and organic particles absorb positively charged ions, including calcium, magnesium, potassium, and sodium (basic cations), as well as acidic cations, such as aluminum or hydrogen. All of these cations are held in the soil against leaching by water but may be displaced by other cations in solution. Each soil has a particular capacity to hold cations. The total of the extractable cations (basic and acidic) equals the cation exchange capacity of a given soil. Base saturation is the percentage of the cation exchange capacity that is satisfied by basic cations. This is an important index of fertility, because the bases are plant nutrients and excess acidity generally is detrimental to plant growth.

Calcium and magnesium are the most plentiful bases in all the soils sampled. The percentage saturation with magnesium, however, should be higher in most cases for optimum plant growth. This can be corrected by addition of dolomitic limestone or other magnesium-bearing material. Soil testing determines needs in individual cases.

Clay Mineralogy

The clay fractions of all the soils sampled are characterized by the occurrence of illite and chlorite throughout the profile, illite in more abundance than chlorite. This is a vivid illustration of the great influence that the mineralogical composition of the parent rock has on the minerals in the derived soils.

In addition to illite and chlorite, the soils also contain interstratified chlorite-vermiculite and illite-vermiculite along with vermiculite. Minor amounts of montmorillonite are in some profiles. These mineral components are partly inherited from the parent material, but they also reflect the effects of weathering within the profiles.

On the basis of the mode of origin of the parent material, the soils sampled are divided into two groups: the Basher, Barbour, Holly, and Wyalusing soils are derived from alluvium and the Lackawanna, Mardin, Morris, Volusia, and Wellsboro soils are derived from glacial till on uplands. Distribution of clay types among the horizons within a profile is conditioned by the mode of origin. The soils derived from alluvium, that have new parent material deposited periodically on the surface, tend to a uniformity of clay types with depth. Soils on uplands, that have been exposed to weathering for longer periods of time, have developed definite profiles of weathering. This is manifested by a higher content of vermiculite and interstratified chlorite-vermiculite and lower content of illite in the surface layer than in the subsoil.

General Nature of the County

Unless otherwise stated, statistics quoted in this section are from the 1967 Statistical Abstract published by the Pennsylvania Department of Internal Affairs.

The former owners of what is now Susquehanna County were Indians of the Six Nations, including the Oneidas, Delawares, and Tuscaroras. Before the first white settlers arrived in 1787, there was no significant cultivation of soils. Indians used the area as a hunting ground and had villages along the Susquehanna River at Great Bend and Lanesboro. Even the settlers did little extensive farming until well into the 19th century.

The population of Susquehanna County in 1820 was 9,660 and was growing at a rate of about 500 per year. This rate of growth persisted until the population reached 40,354 in 1880. At this point it leveled off until the turn of the century, when it began to decrease. In 1930 the population was just under 34,000, and it largely remains at that level today. The population in 1960 was 33,137, or 39.6 persons per square mile. Only 15.8 percent of the population live in urban areas.

In early days crops grown in the county included wheat, rye, flax, buckwheat, corn, potatoes, and some others. Today wheat, rye, buckwheat, and potatoes are grown in very small acreages and flax is not grown at all.

The following acreages of major crops were harvested in Susquehanna County in 1965: corn for grain, 700 acres; corn for silage, 9,400 acres; oats, 7,000 acres; alfalfa hay, 19,000 acres; hay mixtures of clover and timothy and clover and grass, 58,000 acres; all other hay, 11,000 acres; and grass for silage, 3,700 acres.

The number of farms in the county grew with the population and reached a peak at about the same time. There were 4,814 farms in 1880. After 1880 the number of farms decreased much more rapidly than the population, and it was 1,433 in 1965. The average size of farms, however, increased correspondingly. It reached 200.9 acres in 1959, according to the U.S. Census of Agriculture.

Sheep, milk cows, and oxen were brought into the county by the early settlers. The number of sheep increased until about the middle 1800's, but it has decreased since then. Sheep totaled 2,800 at the beginning of 1966. Dairy farming has grown considerably since the early settlers came and has become the major type of farming in the county. In 1965 Susquehanna County ranked sixth in the State in value of milk produced and fourth in average number of cows milked. About 3,000 beef cattle are kept in the county.

Before 1900 most industry in the county was in support of farming. Since then, however, several nonfarm industries have come in and these employ many people. Marketable blue flagstone is quarried on more farms every year (fig. 9). These nonfarm industries employ many rural people as well as people from the towns and from other counties. During recent years the number of

Figure 9.—**This quarry provides stone for building purposes. Flagstone, cut in rectangular shapes, is ready to be removed.**

idle fields and barns has increased. Also, the number of new homes and redecorated older ones on the countryside has increased.

Main highways across the county are Interstate Highway No. 81, U.S. Highway No. 11, U.S. Highway No. 106, and four State highways, 92, 70, 29, and 267. The Lehigh Valley Railroad hauls freight to Montrose from points south, and several lines of the Erie-Lackawanna Railroad carry freight through the eastern half of the county. A small airport is near South Montrose.

Climate [7]

Located in the northeastern part of Pennsylvania, Susquehanna County has a humid continental climate that provides long, cold winters, cool summers, and bountiful precipitation well distributed throughout the year. A sizable part of the annual precipitation falls as snow during the winter months. Prevailing westerly winds bring most of the weather systems affecting this area eastward from continental regions. As a result, Susquehanna County is subject to a wide variety of weather. Temperature and other atmospheric conditions tend to change every few days in winter and spring and somewhat less frequently in summer and fall. Cloudy skies persist during the winter and early in spring.

Climatic variations within the county are chiefly caused by differences in local topography and elevation. The higher eastern sections have somewhat lower temperatures and more precipitation than western areas. Temperatures average from 48° F. annually along the western border of the county to 44° in the eastern highlands. The 4-degree differential across the county is maintained throughout the year. Data for Montrose in table 12 are representative of the county generally and indicate that monthly temperatures average from 24° in January and February to 69° during July. Temperatures are zero or below on an average of nine days per winter, and an extreme of −27° was recorded in December 1917. Maximum temperatures annually reach 90° on only five days per summer, and the highest recorded temperature was 100° in July, 1936.

The growing season, defined as the interval between the last 32° temperature in spring and the first in fall, normally extends from mid-May to early October, or about 141 days, in central sections of the county. At higher elevations in the eastern part of the county and in the deeper valleys in the western part, the growing season is somewhat shorter and variations from year to year are appreciable. At Montrose the growing season ranged from 97 to 171 days over the period of record.

[7] By NELSON M. KAUFFMAN, climatologist for Pennsylvania, National Weather Service, U.S. Department of Commerce.

TABLE 12.—*Temperature and precipitation data*

[All data from Montrose, elevation 1,560 feet, based on records for the period 1903–67]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Average extreme maximum	Average extreme minimum	Average monthly total	One year in ten will have—		Average monthly snowfall	Average number of days with snow cover of an inch or more
						Less than—	More than—		
	°F.	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*	*Days*
January	31	16	50	−2	2.7	0.7	4.2	14.5	20
February	32	15	50	−3	2.7	1.6	3.7	17.3	20
March	39	22	60	5	3.2	2.0	4.9	16.9	19
April	54	33	76	20	3.5	1.7	6.1	4.3	3
May	66	44	83	29	4.2	1.6	7.4	.1	0
June	75	53	88	41	3.8	2.1	5.9	0	0
July	80	58	90	47	4.0	1.4	7.0	0	0
August	78	56	89	45	3.8	1.3	7.4	0	0
September	70	49	86	33	3.8	.9	7.7	0	0
October	60	39	77	25	3.5	1.4	7.0	.3	(1)
November	46	29	65	11	3.2	1.4	5.4	6.0	4
December	34	18	52	−3	2.9	1.0	4.4	12.0	15
Year	55	36	[2] 100	[3] −22	41.2	34.4	48.4	71.4	81

[1] Less than one-half day.
[2] Highest maximum during 1931–60 period.
[3] Lowest minimum during 1931–60 period.

Data in table 13, which show the probabilities of the last 16°, 20°, 24°, 28°, and 32° temperatures in spring and the first in fall at Montrose, can be applied to other areas in Susquehanna County where elevation and air drainage are similar.

Annual precipitation normally ranges from 37 inches in the western part of the county to 41 inches in the central part and 45 inches in the eastern highlands. Year-to-year variations, however, are sizable, as totals have ranged from 32 to 54 inches over the period of record. Monthly totals show a similar variation, and they range from none in October 1924 to 11.6 inches in July 1922. Precipitation is normally well distributed throughout the year however, averaging 3 to 4 inches per month. Short-period dry spells may develop at any time, but extended severe droughts are rare.

Much of the rainfall during the summer is of the showery, short-duration type that affects only a small part of the county at any particular time. Such rainfall is occasionally heavy and produces fairly rapid runoff and soil erosion in the affected area. Maximum amounts of rainfall of as much as 1.50 inches in one hour and 2.30 inches in two hours have been measured in the county. About 1.20 inches of rainfall per hour can be expected once every other year. By contrast, most of the precipitation during the fall, winter, and spring months is more widespread, less intense, and of longer duration, lasting 6 to 24 hours or more. A third of an inch to 1 inch of precipitation per day is quite common, and about 2.3 inches per day can be expected once each year.

From November into early April much of the precipitation falls as snow. Seasonal totals average from 50

TABLE 13.—*Probabilities of low temperatures in spring and fall*

[Based on records kept at Montrose]

Probability	Dates for given probability and temperature of—				
	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 16	April 28	April 30	May 10	May 31
2 years in 10 later than	April 9	April 21	April 26	May 6	May 26
5 years in 10 later than	March 28	April 7	April 18	April 28	May 15
Fall:					
1 year in 10 earlier than	November 10	October 28	October 17	October 4	September 19
2 years in 10 earlier than	November 14	November 2	October 22	October 9	September 24
5 years in 10 earlier than	November 22	November 12	November 1	October 19	October 3

inches in western areas to slightly more than 70 inches in central and eastern sections of the county. Although seasonal totals vary widely, covering a range from 29 to 125 inches over the period of record, 50 to 90 inches of snow can be expected most winter seasons. Snowfalls of 6 inches or more in 24 hours are observed 5 to 10 days each winter. Snowstorm totals rarely exceed 12 to 15 inches, and the ground is usually snow-covered to varying depths about 80 days each winter.

Water Supply

Susquehanna County has abundant springs, streams, ponds, and wells; but many springs and streams dry up in the summer. Ground water contamination in the county is minimal or nonexistent.

Springs furnish enough water for domestic and barn use on many farms. Springs generally have either a bedrock source or a fragipan source; and usually springs that occur near bedrock are more dependable. In the fragipan springs, water from the surface layer collects on top of the fragipan and comes to the surface in depressions. In wet weather these are much more abundant than the bedrock springs and often produce as much or more flow. The best fragipan springs can be developed by using tile to increase the area of collection, but they are subject to drying up in the summer. Many bedrock springs supply water for individuals, communities, and livestock.

Streams are either continuously flowing or intermittent. The former type is dependable for livestock watering, but the latter is not because it dries up in summer. The Susquehanna River provides a dependable water supply for a few farms and towns.

Ponds and lakes, both natural and artificial, are numerous throughout the county. They are valuable for watering livestock, recreation, irrigation, and, if treated, for human consumption. Nearly every farm has a suitable site for building at least a small pond.

Most of the wells in the county are deep. Some of the shallow dug wells are not dependable in dry years. The deepest wells are on hills, are drilled in bedrock nearly all of the way, and range in depth from 400 to 600 feet. The shallowest drilled wells are in valleys and are not more than about 200 feet deep. Large amounts of water are drawn from deep wells locally by industry. Deep wells also are the usual sources of individual water supplies in the county.

In most years the supply of water is adequate, but it occasionally becomes critically short. Most of the water is soft, but a few springs and wells have hard water.

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Glossary

Acidity. See Reaction, soil.

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 moisture capacity (also termed available water capacity). The capacity of a soil 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.

Channery soil. A soil that contains thin, flat fragments of sandstone, limestone, or schist, as much as 6 inches in length along the longer axis. A single piece is called a fragment.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Cobblestone. A rounded or partly rounded fragment of rock, 3 to 10 inches in diameter.

Colluvum. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

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 easily under gentle 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.

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.

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.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

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 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.

Gleyed soil. A soil in which waterlogging and lack of oxygen have caused the material in one or more horizons to be neutral gray in color. The term "gleyed" is applied to soil horizons with yellow and gray mottling caused by intermittent waterlogging.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, and covered by grass for protection against erosion; used to conduct surface water away from cropland.

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.

Mapping unit. Areas of soil of the same kind outlined on the soil map and identified by a symbol.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineralogical, and biological properties of the various horizons, and their thickness and arrangement in the soil profile.

Mottled. 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.

Muck. An organic soil consisting of fairly well decomposed organic material that is relatively high in mineral content, finely divided, and dark in color.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Peat. Unconsolidated soil material, largely decomposed organic matter that has accumulated where there has been excess moisture.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality of a soil horizon that enables water or air to move through it. In this survey terms used to describe permeability are as follows: *slow*, *moderately slow*, *moderate*, *moderately rapid*, and *rapid*.

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		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

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 ground-water runoff or seepage flow from ground water.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Sedimentary rock. A rock composed of particles deposited from suspension in water. The chief sedimentary rocks are conglomerate, from gravel; sandstone, from sand; shale, from clay; and limestone, from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sands have been consolidated into sandstone.

Series soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three dimensional body of the earth's surface that supports plants and that has properties resulting from the integrated effects 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 characteristics of the soil are largely confined to the solum.

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 (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to flooding. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

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.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks at or near the earth's surface by atmospheric agents. These changes result in more or less complete disintegration and decomposition of the rock.

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