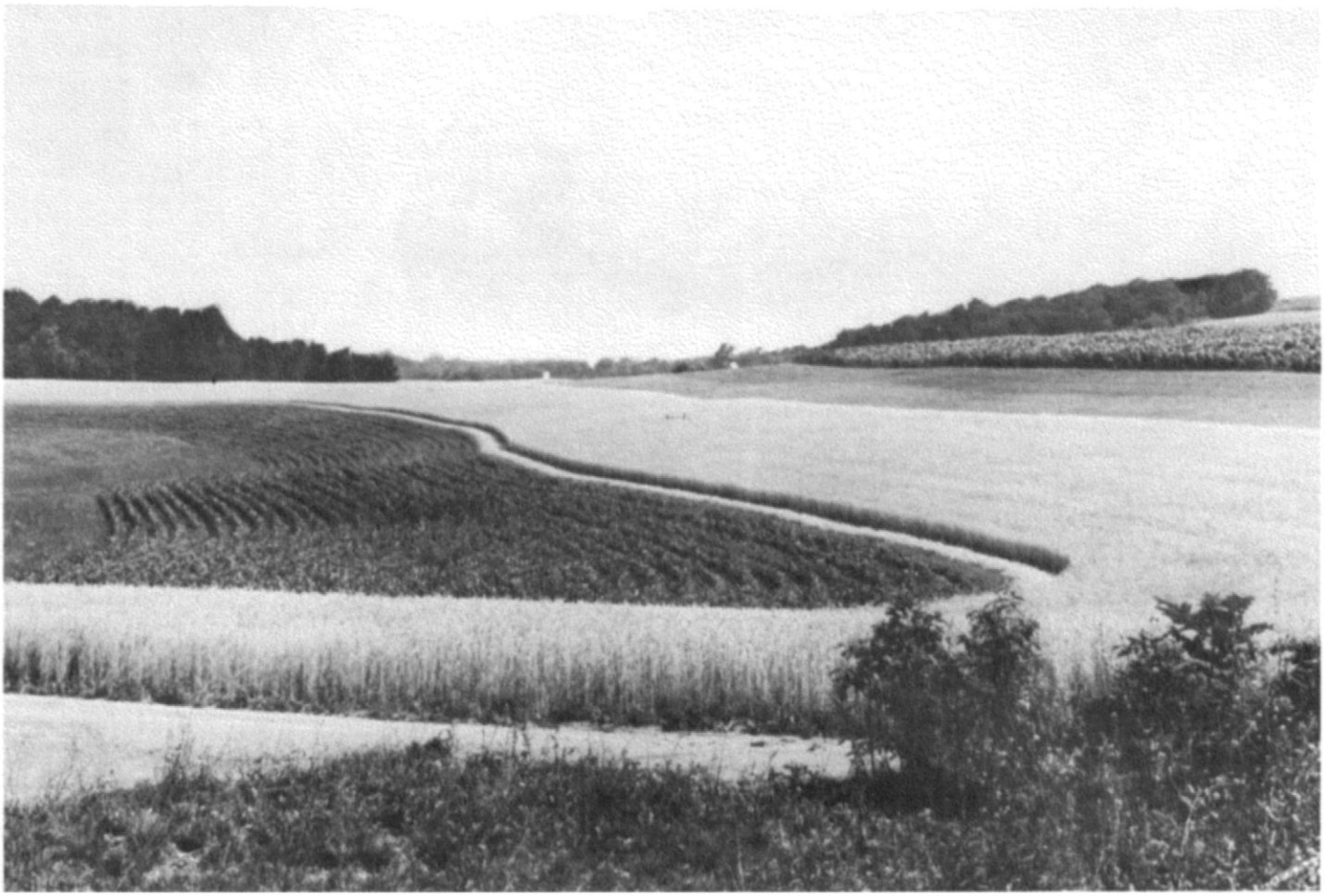
SOIL SURVEY

Carroll County, Maryland



UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
MARYLAND AGRICULTURAL EXPERIMENT STATION

Major fieldwork for this soil survey was done in the period 1944–64. Soil names and descriptions were approved in 1965. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1966. This survey was made cooperatively by the Soil Conservation Service and the Maryland Agricultural Experiment Station; it is part of the technical assistance furnished to the Carroll Soil Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY of Carroll County, Md., contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, or other structures; and in judging tracts of land for agriculture, industry, or recreation.

Locating Soils

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

On each sheet of the detailed map, soil areas are outlined and are identified by symbol. 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 in the survey. This guide lists all of the soils of the county in alphabetic order by map symbol. It shows the page where each kind of soil is described, and also the page for the capability unit and woodland group in which the soil has been placed.

Individual colored maps showing the relative suitability or limitations of soils for many specific purposes can be developed by using the soil map and 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 in the soil descriptions and in the discussions of the capability units and woodland suitability groups.

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

Game managers, sportsmen, and others concerned with wildlife will find information about soils and wildlife in the subsection "Wildlife."

Community planners and others concerned with areas of expanding industry and housing can read about the soil properties that affect the choice of homesites, industrial sites, schools, and parks in the subsections "Nonfarm Uses of Soils" and "Recreational Uses of Soils."

Engineers and builders will find, under "Engineering Uses of Soils" tables that give engineering descriptions of the soils in the county and that name soil features that affect engineering practices and structures.

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

Newcomers in Carroll 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 section "Climate."

***Cover picture.*—Contour stripcropping on a farm near Manchester. The main soil is Manor loam, 8 to 15 percent slopes, moderately eroded.**

U.S. GOVERNMENT PRINTING OFFICE: 1969

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

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Issued October 1969

311-232—69——2

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UNITED STATES DEPARTMENT OF AGRICULTURE IN COOPERATION WITH MARYLAND AGRICULTURAL EXPERIMENT STATION

CARROLL COUNTY is in the north-central part of Maryland (fig. 1). It has a land area of 289,920 acres, or 453 square miles. Westminster, the largest town and the county seat, is near the center of the county.

Carroll County is one of the leading farming areas of Maryland. More than 54 percent of the acreage, or about 157,000 acres, can be cultivated regularly, and an additional 19 percent, or 54,000 acres, can be cultivated occasionally if measures are used for conserving soil and water. About 14 percent of the county, or 39,000 acres, is poorly suited to crops but is suited to pasture. The remaining acreage, or about 13 percent, is so steep, so rough, so stony, or so severely eroded that it is of little use in farming, though it is well suited to trees.

Although the county is dominantly rural, its population is growing as more people establish homes here but commute to jobs in Baltimore and other metropolitan areas nearby.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in Carroll County, where they are located, and how they can be used.

They went into the county knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; 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 roots of plants.

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. To use this survey efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

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. Baile and Mt. Airy, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that go with their behavior in the natural, untouched landscape. Soils of one series can differ somewhat in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man.

Many soil series contain soils that differ in texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Elioak silt loam and Elioak silty clay loam are two soil types in the Elioak series. The difference in texture of their surface layers is apparent from their names.

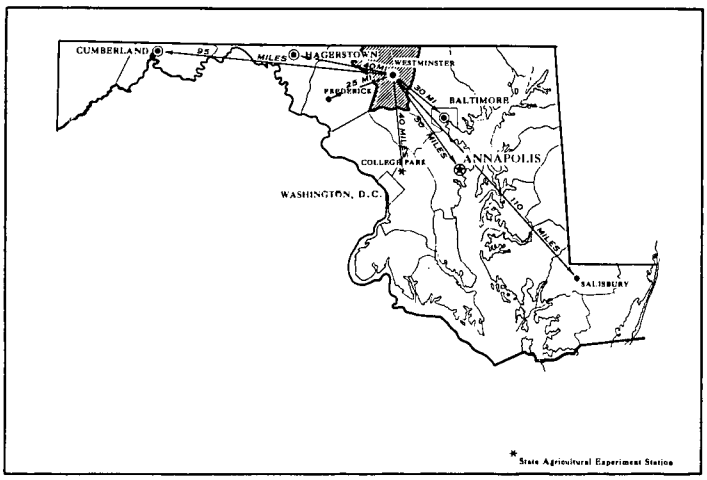

Figure 1.—Location of Carroll County in Maryland.

Some types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use, that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases. The name of a soil phase indicates a feature that affects management. For example, Conestoga silt loam, 0 to 3 percent slopes, is one of several phases of Conestoga silt loam, a soil type that ranges from nearly level to moderately steep.

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 greatly help in drawing boundaries accurately. The soil map in the back of this survey 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 management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. 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 type or soil phase.

In preparing some detailed maps, the soil scientists have a problem of delineating areas where different kinds of soils are so intricately mixed, and so small in size that it is not practical to show them separately on the map. Therefore, they show this mixture of soils as one mapping unit and call it a soil complex. Ordinarily, a soil complex is named for the major kinds of soil in it, for example, Penn-Steinsburg loams, 3 to 8 percent slopes, moderately eroded.

Another task is that of delineating areas where two or more soils occur together without regularity in pattern and proportion. These soils are mapped together as one unit, called an undifferentiated mapping unit. At least one of the component soils occurs in every delineated area. The soils of an undifferentiated unit are similar enough in behavior that their separation is not important for the objectives of the survey. An example of an undifferentiated unit is Abbottstown and Readington silt loams, 0 to 3 percent slopes.

Figure 2.—**Farming on soils of the Penn-Klinesville-Abbottstown soil association. The farm in background is the birthplace of Francis Scott Key.**

Most surveys include areas where the soil material is so rocky, so shallow, or so disturbed or modified that it cannot be classified by soil series. These areas are shown on the map like other mapping units, but are given descriptive names, such as Made land, and are called land types.

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 soils 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 kinds of soils. Yields 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 a way that it is readily useful to different groups of readers, among them farmers, managers of woodland, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in soil surveys. On basis of the yield and practice tables and other data, the soil scientists set up trial groups, and then test them by further study and by consultation with farmers, agronomists, engineers, and others. Then, the scientists adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present 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 Carroll 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 farming or other land use. Such a map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

The six soil associations in Carroll County are discussed in the following pages.

1. Penn-Klinesville-Abbottstown Association

Somewhat excessively drained to somewhat poorly drained, nearly level to steep soils that are shallow to deep over red shale and sandstone

This association occupies the area known as red lands in the northwestern part of the county (fig. 2). About 65 percent of the total acreage is Penn soils, 8 percent is Klinesville soils, 7 percent is Abbottstown soils, and 20

percent is minor soils. The association covers about 20 percent of the county.

The Penn soils are moderately deep, well drained, and, in most places, gently sloping. The Klinesville soils are shallow and droughty. Most of their acreage is sloping to very steep and is severely eroded. The nearly level and gently sloping Abbottstown soils occupy broad areas, mostly southwest of Taneytown. They are somewhat poorly drained and are wet much of the year, but they do not hold moisture well and may be droughty if summer is dry.

Among the minor soils are the well-drained Birdsboro, Bucks, and Elsinboro, all of which are deeper than most areas of the major soils. Other soils are the sandy, droughty Lewisberry soils; the moderately well drained to somewhat poorly drained Raritan and Readington soils, which are much like the Abbottstown soils in most respects; and the Bermudian, Rowland, and Bowmansville soils on flood plains.

Farming on this association is of the general type. The major soils, except for the Klinesville, have a moderate capacity for holding water available to plants, and they produce a moderately good growth of crops.

The well-drained soils of this association are suitable for residential development. In excavating for basements and deep foundations, however, rock generally is encountered within a depth of 1 to 4 feet. In most areas the rock is shale that can be excavated with little difficulty, but in some places it is very hard sandstone. Because rock generally is so near the surface, disposing of sewage through individual septic tanks is moderately or severely limited. In the deeper Bucks, Birdsboro, and Elsinboro soils, limitations affecting the use of septic tanks are less restricting. Seasonal wetness limits the use of the Abbottstown, Readington, and Raritan soils for building sites and septic tanks.

Until community systems for supplying water and disposing of sewage are installed, the soils of this association are likely to remain primarily agricultural.

2. Mt. Airy-Linganore Association

Somewhat excessively drained, nearly level to steep, channery soils that are moderately deep and deep over schist

This association occupies only small areas in the county. The largest of these lies roughly between Bachman Mills and Gunpowder in the northeastern part. In addition, there is a small area just south of Manchester, another just south of Wakefield, and two small ones in the vicinity of Picketts Corner and Gosnell. Figure 3 shows a typical landscape.

The Mt. Airy soils make up about 60 percent of the total acreage; the Linganore soils, 30 percent; and minor soils 10 percent. Altogether, the association covers only about 2 percent of the county.

The major soils, the Mt. Airy and Linganore, all consist mostly of rock fragments and partly of fine soil material between the fragments. Hard bedrock occurs within a depth of 2 to 3 feet. The Mt. Airy soils contain many fragments of yellowish-brown mica schist, and the Linganore soils, a large amount of hard, dark-gray, slaty schist. Soils of both series are somewhat excessively drained and hold little moisture in dry periods.

***Figure 3.*—The rugged terrain of the Mt. Airy-Linganore soil association southeast of New Windsor. The diversion terrace in foreground checks runoff on a Linganore channery soil.**

Farming on this association is of the general type. The soils tend to be droughty, however. They are moderately difficult to excavate for foundations and basements, but in other respects they make suitable sites for buildings, except in areas that are too strongly sloping. Using the soils for septic tanks is severely limited by shallowness to rock.

3. Conestoga-Hagerstown Association

Well-drained, chiefly sloping soils that are deep over high-lime schist and limestone

This association is in small areas near Union Bridge. About 60 percent of it is Conestoga soils, 30 percent is Hagerstown soils, and 10 percent is other soils. The association makes up less than 1 percent of the county.

The major soils, the Conestoga and Hagerstown, are deep and well drained and are readily penetrated by roots. They have a naturally high content of lime, are well suited to practically all crops, and are among the most fertile soils in the county. They are used chiefly for farm crops, but generally they have few if any limitations for other farm uses, though strong slopes and the erosion hazard are limiting in some places.

Also in the association are spots of moderately well drained Wiltshire soils. These are naturally fertile but have some limitations because of seasonal wetness. Along the streams there are flood plains occupied by the Lindside and Melvin soils, both of which are of limited use because their drainage is impeded and flooding is a seasonal hazard.

The Conestoga and Hagerstown soils have few limitations that affect most nonfarm uses.

4. Glenelg-Chester-Manor Association

Well-drained, chiefly rolling and hilly, micaceous soils that are deep over mica schist

This association occupies most of the eastern one-third of the county. The Glenelg soils make up about 40 percent of

the total acreage; the Chester soils, 20 percent; the Manor soils, 20 percent; and minor soils, 20 percent. The association accounts for about 29 percent of the county.

The dominant soils, the Glenelg, Chester, and Manor, all are well drained and generally are deep to micaceous bedrock. Chester soils are somewhat micaceous and have a thick, clayey subsoil. Glenelg soils also have a clayey subsoil, but they are more micaceous than the Chester soils and their subsoil is thinner. The Manor soils lack a clayey subsoil; they are fairly uniform in texture throughout and are highly micaceous.

Among the minor soils are the somewhat excessively drained Mt. Airy soils; the well drained Elioak and Elsinboro soils; the moderately well drained Glenville and Delanco soils; and the poorly drained Baile soils. The Comus, Codorus, and Hatboro soils lie in small areas on the flood plains of streams.

The major soils in this association generally are rolling to hilly. They are nearly level on the crests of some hills, however, and are steep on some side slopes above streams. The chief limitations that affect use are slope and erosion. In some areas the soils are too strongly sloping for regular safe cultivation and are more suitable as woodland or for pasture, recreation, or wildlife. In small areas the soils are very stony.

Farming is intensive on this association. Much of the acreage is contour farmed, and row crops and hay crops are grown in alternate strips. Many farmers raise livestock, and some of them specialize in producing milk, beef, or other animal products. As a result, the farms include large areas of pasture. Plants used for hay or pasture do well, and they are commonly grown on soils that are too steep for regular cultivation. Also, there are many productive orchards on this association.

Except in places that are too steep or too stony, the major soils make good sites for buildings. Generally, excavating is not difficult and is not limited by wetness.

5. Glenelg-Manor-Mt. Airy Association

Well-drained and somewhat excessively drained, mainly hilly soils that are deep and moderately deep over schist

This association occurs mostly in a large, irregularly shaped area that lies in a north-south direction across the central part of the county. It also extends eastward to the vicinity of Louisville, Gamber, and Finksburg, and there are small areas near Manchester and Hampstead.

About 50 percent of the acreage is Glenelg soil, 25 percent is Manor soils, 15 percent is Mt. Airy soils, and 10 percent is minor soils. The association makes up about 14 percent of the county.

The dominant soils, in their major characteristics, are transitional between the more uniformly deep soils in association 4 and the somewhat shallower, more stony soils in association 6. The Glenelg and Manor soils of this association are deep, but the Mt. Airy soils are not so deep.

The minor soils are chiefly the Chester, Elioak, Glenville, and Baile soils. In addition, the Comus, Codorus, and Hatboro soils occur on flood plains.

This association generally is a little steeper and rougher than association 4. The chief limitations affecting use of the major soils are strong slopes, the erosion hazard, limited depth to bedrock, and the rock fragments in the Mt. Airy soils. Many areas are too steep for safe regular cultivation. As a consequence, proportionately less of this association is used for crops than of association 4, and proportionately more of it is wooded or covered with grass.

Farming is intensive on this association, but measures for conserving soil and water generally are needed in cultivated fields. Livestock are raised on many farms, and probably there are more orchards than on association 4.

Except in areas where slopes are too strong, the major soils make good sites for buildings, but the Mt. Airy soils are only 2 to 3 feet deep to bedrock. Mt. Airy soils are firm for foundations but may be difficult to excavate, and they have severe limitations that restrict the use of septic tanks. The Glenelg and Manor soils can be excavated more easily, and their use for disposing of sewage through individual septic tanks is less severely limited.

6. Mt. Airy-Glenelg Association

Dominantly somewhat excessively drained, rolling to very steep, channery soils that are moderately deep and deep over schist

This association is mainly in a large area that extends roughly north and south through the west-central part of the county. Also, smaller areas occur in other parts. The Mt. Airy soils make up about 65 percent of the association; the Glenelg soils, 20 percent; and minor soils, 15 percent. The association is the most extensive in Carroll County and occupies about 34 percent of the total acreage.

Generally, the Mt. Airy soils are only 2 to 3 feet deep to bedrock. Throughout the profile they contain many flat pieces of mica schist. These soils have little clay in their subsoil, and they can hold only a small amount of moisture available to plants. In years that are especially dry, crops on these soils frequently show a lack of sufficient moisture. Glenelg soils are deep and well drained.

The soils of this association are more strongly sloping, and their slopes are more broken, than the soils in other parts of the county. About half the acreage of Mt. Airy soils is sloping and is highly erodible if not protected. About one-third of the acreage is so steep that the soils generally are unsuitable for cultivation and should be kept in such use as pasture or woodland. Only about one-sixth of the acreage occupied by Mt. Airy soils is nearly level or gently sloping. The ridgetops generally are narrow and, in many places, consist of nearly level Glenelg soils.

In fields used for crops, measures are needed for conserving soil and water. Suitable rotations are ones that include only an occasional tilled or row crop and that keep the soil in close-growing crops most of the time. For large parts of the association, a good use is hay crops, pasture, or carefully sodded orchards. Large areas are still woodland, and most of these should remain wooded. Some of the steeper cleared areas that are eroded should be reforested, either naturally or by planting. A cover of trees in these areas would protect the watershed and, in other areas, would reduce damage by floodwater and transported soil material.

The major soils in this association are suitable as sites for buildings, but in most places they are of limited depth to bedrock and may be difficult to excavate. Commonly, the soils are too shallow or too steep for the use of septic tanks.

Descriptions of the Soils

This section describes the soil series and mapping units of Carroll County. The acreage and proportionate extent of each mapping unit are given in table 1.

The procedure in this section is first to describe the soil series, and then the mapping units in that series. For each soil series, a profile of a soil representative of the series is described. Thus, to get full information on any one mapping unit, it is necessary to read the description of the soil series to which it belongs.

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

Following the name of each mapping unit, there is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description is the capability unit and the woodland suitability group in which the mapping unit has been placed. The pages on which each capability unit and each woodland group are described can be found by referring to the "Guide to Mapping Units" at the back of the soil survey.

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

Mapping unit	Area	Extent	Mapping unit	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Abbottstown and Readington silt loams, 0 to 3 percent slopes	3, 302	1. 1	Glenelg channery loam, 3 to 8 percent slopes, moderately eroded	11, 405	3. 9
Abbottstown and Readington silt loams, 3 to 8 percent slopes, moderately eroded	1, 812	. 6	Glenelg channery loam, 8 to 15 percent slopes, moderately eroded	6, 754	2. 3
Baile silt loam, 0 to 3 percent slopes	3, 435	1. 2	Glenelg channery loam, 8 to 15 percent slopes, severely eroded	1, 891	. 7
Baile silt loam, 3 to 8 percent slopes	2, 657	. 9	Glenelg channery loam, 15 to 25 percent slopes, moderately eroded	1, 093	. 3
Bermudian silt loam	602	. 2	Glenelg channery loam, 15 to 25 percent slopes, severely eroded	1, 330	. 5
Birdsboro silt loam, 0 to 3 percent slopes	325	. 1	Glenelg loam, 0 to 3 percent slopes	631	. 2
Birdsboro silt loam, 3 to 8 percent slopes, moderately eroded	424	. 1	Glenelg loam, 3 to 8 percent slopes, moderately eroded	12, 991	4. 5
Bowmansville silt loam	544	. 2	Glenelg loam, 3 to 8 percent slopes, severely eroded	706	. 2
Bucks silt loam, 0 to 3 percent slopes	515	. 2	Glenelg loam, 8 to 15 percent slopes, moderately eroded	5, 299	1. 8
Bucks silt loam, 0 to 8 percent slopes, moderately eroded	2, 508	. 8	Glenelg loam, 8 to 15 percent slopes, severely eroded	2, 062	. 7
Cardiff channery silt loam, 3 to 15 percent slopes, moderately eroded	245	. 1	Glenville silt loam, 0 to 3 percent slopes	2, 477	. 9
Chester silt loam, 0 to 3 percent slopes	500	. 2	Glenville silt loam, 3 to 8 percent slopes	8, 015	2. 8
Chester silt loam, 3 to 8 percent slopes, moderately eroded	6, 357	2. 2	Hagerstown silt loam, 0 to 3 percent slopes	98	(1)
Chester silt loam, 8 to 15 percent slopes, moderately eroded	759	. 3	Hagerstown silt loam, 3 to 8 percent slopes, moderately eroded	999	. 3
Chester silt loam, 8 to 15 percent slopes, severely eroded	165	. 1	Hagerstown silt loam, 8 to 15 percent slopes, moderately eroded	131	(1)
Codorus silt loam	4, 823	1. 7	Hatboro silt loam	6, 258	2. 1
Comus silt loam	256	. 1	Klinesville gravelly loam, 3 to 8 percent slopes, moderately eroded	268	. 1
Comus silt loam, local alluvium, 0 to 3 percent slopes	231	. 1	Klinesville soils, 8 to 25 percent slopes, very severely eroded	698	. 2
Comus silt loam, local alluvium, 3 to 8 percent slopes	1, 232	. 4	Klinesville soils, 15 to 65 percent slopes, severely eroded	2, 165	. 7
Conestoga silt loam, 0 to 3 percent slopes	232	. 1	Lewisberry gravelly fine sandy loam, 3 to 8 percent slopes, moderately eroded	453	. 2
Conestoga silt loam, 3 to 8 percent slopes, moderately eroded	1, 630	. 6	Lewisberry gravelly fine sandy loam, 8 to 15 percent slopes, moderately eroded	765	. 3
Conestoga silt loam, 8 to 15 percent slopes, moderately eroded	793	. 3	Lewisberry gravelly fine sandy loam, 15 to 25 percent slopes	161	. 1
Conestoga silt loam, 8 to 15 percent slopes, severely eroded	145	. 1	Lindside silt loam	842	. 3
Conestoga silt loam, 15 to 25 percent slopes, severely eroded	191	. 1	Linganore channery silt loam, 3 to 8 percent slopes, moderately eroded	1, 439	. 5
Delanco silt loam, 0 to 3 percent slopes	332	. 1	Linganore channery silt loam, 8 to 15 percent slopes, moderately eroded	2, 138	. 7
Delanco silt loam, 3 to 8 percent slopes, moderately eroded	386	. 1	Linganore channery silt loam, 8 to 15 percent slopes, severely eroded	427	. 1
Elioak silt loam, 3 to 8 percent slopes, moderately eroded	1, 179	. 4	Linganore channery silt loam, 15 to 25 percent slopes, moderately eroded	1, 168	. 4
Elioak silt loam, 8 to 15 percent slopes, moderately eroded	335	. 1	Linganore channery silt loam, 25 to 45 percent slopes	1, 628	. 6
Elioak silty clay loam, 15 to 25 percent slopes, severely eroded	95	(1)	Made land	324	. 1
Elsinboro gravelly loam, 3 to 8 percent slopes, moderately eroded	1, 156	. 4	Manor gravelly loam, 3 to 8 percent slopes, moderately eroded	2, 473	. 9
Elsinboro gravelly loam, 8 to 15 percent slopes, moderately eroded	691	. 2	Manor gravelly loam, 8 to 15 percent slopes, moderately eroded	3, 204	1. 1
Elsinboro silt loam, 0 to 3 percent slopes	91	(1)			
Elsinboro silt loam, 3 to 8 percent slopes, moderately eroded	1, 006	. 3			
Elsinboro silt loam, 8 to 15 percent slopes, moderately eroded	365	. 1			

See footnote at end of table.

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

Mapping unit	Area	Extent	Mapping unit	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Manor gravelly loam, 8 to 15 percent slopes, severely eroded	1, 508	. 5	Penn loam, 0 to 8 percent slopes, moderately eroded	4, 720	1. 6
Manor gravelly loam, 15 to 25 percent slopes, moderately eroded	983	. 3	Penn shaly silt loam, 3 to 8 percent slopes, moderately eroded	5, 051	1. 9
Manor gravelly loam, 15 to 25 percent slopes, severely eroded	1, 641	. 6	Penn shaly silt loam, 8 to 15 percent slopes, moderately eroded	1, 770	. 6
Manor loam, 0 to 8 percent slopes, moderately eroded	8, 883	3. 3	Penn shaly silt loam, 8 to 15 percent slopes, severely eroded	1, 288	. 4
Manor loam, 3 to 8 percent slopes, severely eroded	2, 381	. 8	Penn silt loam, 0 to 3 percent slopes, moderately eroded	1, 174	. 4
Manor loam, 8 to 15 percent slopes, moderately eroded	5, 583	1. 9	Penn silt loam, 3 to 8 percent slopes, moderately eroded	10, 209	3. 5
Manor loam, 8 to 15 percent slopes, severely eroded	4, 853	1. 7	Penn silt loam, 8 to 15 percent slopes, moderately eroded	2, 576	. 9
Manor loam, 15 to 25 percent slopes, moderately eroded	1, 817	. 6	Penn silt loam, 8 to 15 percent slopes, severely eroded	443	. 2
Manor loam, 15 to 25 percent slopes, severely eroded	3, 874	1. 3	Penn soils, 15 to 25 percent slopes	860	. 3
Manor loam, 25 to 45 percent slopes	3, 791	1. 3	Penn-Steinsburg loams, 3 to 8 percent slopes, moderately eroded	612	. 2
Manor very stony loam, 3 to 15 percent slopes	1, 418	. 5	Penn-Steinsburg loams, 8 to 15 percent slopes, severely eroded	220	. 1
Manor very stony loam, 15 to 25 percent slopes	1, 306	. 5	Raritan silt loam, 0 to 3 percent slopes	417	. 1
Manor very stony loam, 25 to 45 percent slopes	2, 942	1. 0	Raritan silt loam, 3 to 8 percent slopes	302	. 1
Manor very stony loam, 45 to 75 percent slopes	933	. 3	Rowland silt loam	1, 359	. 5
Melvin silt loam	270	. 1	Steinsburg channery loam, 3 to 8 percent slopes, moderately eroded	587	. 2
Mt. Airy channery loam, 0 to 3 percent slopes	209	. 1	Steinsburg channery loam, 8 to 25 percent slopes, severely eroded	411	. 1
Mt. Airy channery loam, 3 to 8 percent slopes, moderately eroded	19, 291	6. 7	Urbana silt loam, 0 to 3 percent slopes	87	(1)
Mt. Airy channery loam, 8 to 15 percent slopes, moderately eroded	34, 489	11. 9	Urbana silt loam, 3 to 8 percent slopes, moderately eroded	215	. 1
Mt. Airy channery loam, 8 to 15 percent slopes, severely eroded	5, 836	2. 0	Wiltshire silt loam	122	(1)
Mt. Airy channery loam, 15 to 25 percent slopes, moderately eroded	13, 635	4. 7			
Mt. Airy channery loam, 25 to 45 percent slopes	22, 182	7. 7	Total	289, 920	100. 0

[1] Less than 0.05 percent.

The color of each soil horizon is described in words, such as grayish brown, but it can also be indicated by symbols for the hue, value, and chroma, such as 10YR 5/2. These symbols, called Munsell color notations (*5*),[1] are used by soil scientists to evaluate the color of the soil precisely.

Many terms used in the soil descriptions and other sections of the survey are defined in the Glossary.

Abbottstown Series

The Abbottstown series consists of nearly level and gently sloping, strongly acid, somewhat poorly drained soils that have a fragipan. These soils occur in depressions and on broad upland flats in the northwestern part of the county. They have a surface layer of dark grayish-brown silt loam. The upper part of their subsoil is brown heavy silt loam to light reddish-brown light silty clay loam and is mottled; the lower part is a dark reddish-brown fragipan that is mottled with pinkish gray. The subsoil is wet and poorly aerated much of the year. Oak, hickory, maple, and other hardwoods make up the native vegetation on these soils.

The Abbottstown soils are fairly easy to work if their moisture content is within the optimum range, but in spring they are usually wet and warm up late. Consequently, the planting of crops may be delayed. Artificially draining the soils will improve the growth of most crops and will lengthen the grazing season on pasture. Although the fragipan retards the movement of water, these soils have moderate available moisture capacity, and they produce fairly well if they are properly managed. Nevertheless, their use is limited by seasonal wetness, somewhat poor drainage, slow movement of moisture, and the restricted depth of the root zone. In addition, erosion is a hazard in sloping areas.

Profile of an Abbottstown silt loam, located in a level cultivated area on the north side of Uniontown Road, about 1¼ miles east of Middleburg:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, granular structure; friable when moist, slightly sticky and slightly plastic when wet; many fine roots; slightly acid (limed); abrupt, smooth boundary. Horizon is 8 to 10 inches thick.

B1—10 to 16 inches, brown (7.5YR 5/4) heavy silt loam; a few, fine, distinct mottles of reddish yellow (7.5YR 6/8) and light brownish gray (10YR 6/2); moderate, coarse, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; fine roots common; very strongly acid; clear, smooth boundary. Horizon is 3 to 6 inches thick.

B2t—16 to 23 inches, light reddish-brown (5YR 6/4) light silty clay loam; many, medium, distinct mottles of light brownish gray (10YR 6/2); moderate, medium and

[1] Italic numbers in parentheses refer to Literature Cited, p. 90.

coarse, subangular blocky structure; firm when moist, slightly sticky and slightly plastic when wet; fine roots common; thin continuous clay films; very strongly acid; abrupt, wavy boundary. Horizon is 6 to 10 inches thick.

Bx1—23 to 41 inches, dark reddish-brown (2.5YR 3/4) heavy silt loam; common, coarse, prominent mottles of pinkish gray (5YR 6/2); moderate, coarse, prismatic structure and moderate, medium, blocky structure; very firm when moist, slightly sticky and slightly plastic when wet; a few fine roots; continuous prominent clay films of pinkish gray (5YR 6/2); very strongly acid: clear, smooth boundary. Horizon is 10 to 20 inches thick.

IIBx2—41 to 48 inches, dark reddish-brown (2.5YR 3/4) shaly silt loam; common, medium, prominent mottles of pinkish gray (5YR 6/2); weak to moderate, coarse, prismatic structure; firm when moist, slightly sticky and slightly plastic when wet; very few fine roots; some thick, pinkish-gray (5YR 6/2) clay flows; strongly acid; abrupt, wavy boundary. Horizon is 6 to 12 inches thick.

IIR—48 inches +, dark reddish-brown (2.5YR 3/4), weakly weathered shale that is fractured but mostly unseparated.

The B2t horizon is heavy silt loam in some places. The horizons below the B2t horizon are silt loam, but their clay content is somewhat higher than that of the A horizon. Few if any coarse fragments occur above the IIBx2 horizon. Fragments of shale make up about 25 percent of the IIBx2 horizon. In some places between this horizon and the IIR layer, there is a IIC horizon that is 60 percent or more shale fragments. The solum ranges from 30 to nearly 60 inches in thickness. Generally, the depth to bedrock is 4 to 6 feet.

In wooded areas these soils have a thin, dark-brown or dark reddish-brown A1 horizon and an A2 horizon that is 2 to 5 inches thick. Normally, the color of the A2 horizon is 5YR 4/3 to 7.5YR 5/4. In the Ap horizon the hue is 10YR to 5YR and the chroma is 2 or 3. The B2t, Bx1, and IIBx2 horizons have a hue ranging from 7.5YR to 2.5YR, and the redness commonly increases with depth. The mottles in the B1 horizon may have both high and low chromas, but seldom do the mottles in and below the B2t horizon have a chroma of more than 2.

The Abbottstown soils are similar to the Glenville, Raritan, and Urbana soils in morphology. They are redder than the Glenville and Urbana soils, and they are a little more poorly drained than the Raritan soils. In addition, the Abbottstown soils are underlain by shale, whereas the Raritan soils are underlain by gravelly sand that contains shale fragments. Abbottstown soils are more poorly drained than the Readington soils.

Abbottstown and Readington silt loams, 0 to 3 percent slopes (ArA).—The soils in this undifferentiated unit are nearly level, have slow runoff, and are subject to little erosion. About 70 percent of the total acreage is Abbottstown silt loam, nearly 30 percent is Readington silt loam, and a small percentage is inclusions. Any given area may consist of the Abbottstown soil, the Readington soil, or both soils in any proportion.

The subsoil of the somewhat poorly drained Abbottstown soil is mottled closer to the surface than that of the moderately well drained Readington soils. In addition, the Abbottstown soil dries out and warms up later in spring than the Readington soil. A fragipan occurs in both soils, but it is thicker in the Abbottstown soil and is more firm and dense in the Readington soil.

Included with these soils are a few eroded spots and some small gullies. Also included are small wet depressions, which are indicated by symbol on the soil map.

Seasonal wetness is the main limitation that affects the use of these soils (fig. 4). Tiling or ditching can be used to improve drainage, and in places ditches or tile lines are needed to divert runoff or seepage from adjoining higher areas. After the soils are drained, they are suited to most of the common crops. In winter, however, alfalfa and other herbaceous perennials may be damaged by frost heaving. The limitations of the more extensive Abbottstown soil govern the use of the unit. (Capability unit IIIw–1; woodland suitability group 23)

Figure 4.—**Ponding in an area of Abbottstown and Readington silt loams, 0 to 3 percent slopes. The water is standing on the Abbottstown soil.**

Abbottstown and Readington silt loams, 3 to 8 percent slopes, moderately eroded (ArB2).—These gently sloping soils have lost a significant part of their original surface layer through erosion, and locally they are cut by shallow gullies. Abbottstown silt loam makes up about 60 percent of the total acreage; Readington silt loam, nearly 40 percent; and small inclusions, the rest. Any given area may consist of Abbottstown soil, of Readington soil, or some of both.

The somewhat poorly drained Abbottstown soil contains mottles closer to the surface than the moderately well drained Readington soil. Also, the Abbottstown soil dries out and warms up later in spring than the Readington soil. Both soils have a fragipan.

Included are some wet spots or depressions, indicated by symbol on the soil map, and small areas in which the slope is more than 8 percent.

The use of these soils is limited mainly by the erosion hazard and to some extent by seasonal wetness. Long-term hay or improved pasture provides a cover that helps to control erosion, and ditches or tile lines can be used to improve drainage. Even after the soils are drained, however, they are subject to frost heaving that may damage alfalfa and other perennial crops. The limitations of the Abbottstown soil govern the use of the unit. (Capability unit IIIw–1; woodland suitability group 23)

Baile Series

The Baile series consists of poorly drained soils that occur in upland depressions, around the heads of drains, and on foot slopes adjacent to minor drainageways, most

of which lack channels. These soils have a dark-gray silt loam surface layer and a thick, gray clay loam or heavy silt loam subsoil that is mottled, streaked, and spotted with brownish colors. Water moves slowly through the Baile soils. The native vegetation consists of wetland hardwoods, mostly oak and maple. About half the acreage has been cleared.

The Baile soils are not easily worked, because they are hard when a little too dry and are sticky when a little too wet. Normally, the water table is near the surface until late in spring. Water moves through the soils slowly, and draining them is difficult. Consequently, these soils are among the last in the county to be ready for working and planting in spring, and only a few areas are planted to cultivated crops. The Baile soils have a high available moisture capacity and, if they are well managed, produce a favorable growth of crops. Nevertheless, their use is severely limited by poor drainage, slow movement of moisture, a high water table, and the difficulty of tillage. Locally, their use also is limited by stoniness.

Profile of Baile silt loam, 0 to 3 percent slopes, in a pastured area just west of Greenmount:

Ap—0 to 9 inches, dark-gray (5Y 4/1) silt loam; weak, medium, granular structure; friable when moist, sticky and slightly plastic when wet; roots abundant; many brown specks, apparently of organic matter; medium acid (limed); abrupt, smooth boundary. Horizon is 7 to 9 inches thick.

A1—9 to 20 inches, dark-gray (N 4/0) silt loam; some streaks and smears of yellowish brown (10YR 5/6); very weak, coarse, blocky structure and weak, medium, granular structure; friable when moist, sticky and plastic when wet; roots common; many fine pores; a few coarse fragments; medium acid; clear, wavy boundary. Horizon is 9 to 12 inches thick.

B21tg—20 to 40 inches, gray (N 5/0) light clay loam; common coarse mottles and streaks of yellowish brown (10YR 5/8); moderate, medium and coarse, blocky and subangular blocky structure; firm when moist, sticky and plastic when wet; discontinuous yellowish-brown (10YR 5/4) clay films; strongly acid; gradual, wavy boundary. Horizon is 16 to 24 inches thick.

IIB22tg—40 to 52 inches, gray (5Y 5/1) heavy silt loam; many, coarse, prominent mottles of strong brown (7.5YR 5/6); weak, coarse, blocky structure; firm when moist, sticky and plastic when wet; no roots; some light brownish-gray (10YR 6/2) clay films and some scattered black clay films; a considerable amount of fine mica, some angular pebbles of white quartzite, and chips of mica schist; very strongly acid; clear, smooth boundary. Horizon is 10 to 15 inches thick.

IICg—52 to 60 inches +, greenish-gray (5GY 5/1), highly micaceous saprolite of loam texture; inherent schistose structure; friable to firm when moist, sticky and slightly plastic when wet; no roots; strongly acid to very strongly acid.

Locally, the texture of the Ap horizon grades toward silty clay loam. In places the A horizon is thinner than the one described in the representative profile. Here, the entire horizon has been mixed into the plow layer. The B2t horizon is generally clay loam, silty clay loam, or heavy silt loam. Normally, the IICg horizon is loam, silt loam, or light clay loam in texture. The angular pebbles of quartzite are relics from the underlying rock or, if they occur on or near the surface, are of local colluvial origin. In a few places there are local colluvial stones on or near the surface. The solum ranges from 30 to more than 50 inches in thickness; its thickness depends a good deal on the amount of local alluvial or colluvial material deposited on the surface. The depth to bedrock ranges from 5 to 8 feet or more.

In undisturbed areas the Baile soils have an A1 horizon that has a hue of 5Y, 2.5Y, or neutral; a value generally of 4; and a chroma of 0, 1, or 2. In places there is an A2 horizon that is 5 to 10 inches thick and is almost like the A1 horizon in color but is 1 or 2 units higher in value. The hue of the Ap horizon ranges from 5Y to 10YR, its value is 4 or 5, and its chroma is 1 or 2.

In the B horizon the matrix has a hue ranging from 10YR to neutral; a value of 5 or 6; and a chroma of 0, 1 or, in a few places, 2. Mottles in this horizon are common or many, medium or coarse, and distinct or prominent; their hue is dominantly 10YR and 7.5YR; their value is generally 5; and their chroma is 6, 8, or, in a few places, 4. The clay films are similar to the mottles in hue and value, but their chroma generally is 2 to 4 units lower. The IICg horizon has a strongly gleyed matrix that may be mottled with colors similar to the mottling in the B horizon. In some places where mottles are lacking in the IICg horizon, this horizon has a bluish cast. In some other places the mottles are so coarse and so many that they appear to be the matrix and the highly gleyed part appears to be gray mottling. In unlimed areas the profile is strongly acid to extremely acid, and the acidity increases with depth.

The Baile soils are similar to no other soils in Carroll County, but they are associated with the Glenville and Hatboro soils. Baile soils are more poorly drained than the Glenville soils, and they lack the dense fragipan that occurs in the subsoil of those soils. They are generally in higher positions along drainageways than the poorly drained Hatboro soils, which lie on flood plains.

Baile silt loam, 0 to 3 percent slopes (BaA).—This soil has the profile described as representative of the series. Included with it are some eroded spots, and some small areas in which the subsoil is finer textured than normal. Also included are a few stony areas, indicated by symbol on the soil map.

This soil is difficult to drain and, even if drained, is difficult to work because it is sticky when wet and becomes hard as it dries. For this reason, it is seldom used for cultivated crops. Permanent hay or pasture is generally the most intensive farm use that is suitable. The soil remains wooded in many areas, and it can provide excellent cover for some kinds of wildlife. Many nonfarm uses are severely limited by wetness and poor workability. (Capability unit Vw–1; woodland suitability group 38)

Baile silt loam, 3 to 8 percent slopes (BaB).—This soil has a profile similar to that described for the series. Included with this soil are a few stony areas, some spots that are moderately or severely eroded, and some small areas in which the slope is slightly greater than 8 percent.

Wetness and poor drainage are the major limitations affecting the use of this soil. In addition, erosion is a hazard because water is taken in slowly and most rainwater and melting snow are lost as runoff unless the soil is protected. Most areas are wooded or used for pasture. (Capability unit VIw–2; woodland suitability group 38)

Bermudian Series

The Bermudian series consists of deep, reddish-brown, strongly acid or very strongly acid soils that occupy the flood plains of streams in the northwestern part of the county. Their surface layer of silt loam is somewhat darkened by organic matter, but in other respects it is much the same as the material beneath it. Bermudian soils are well drained, though locally they may be temporarily flooded if rainfall is heavy or snowmelt is rapid. The native vegetation consists of hardwoods, dominantly oak and hickory. In Carroll County, however, most areas have been cleared.

The Bermudian soils are easily worked when they are not wet. Because they are well drained, they generally can be worked and planted early in spring, provided the dan-

ger of flooding has passed. Although artificial drainage is not needed, in some places it is necessary to intercept and divert runoff from adjacent areas. The soils have high available moisture capacity, but the movement of water through them is moderately slow. Under good management these soils produce a good growth of crops. They respond well to lime and fertilizer. The soils are most commonly used for hay or pasture, though they are well suited to corn and other row crops. Flooding is the major limitation affecting use, and fall-seeded grain may be damaged by temporary flooding in spring.

Profile of Bermudian silt loam, located in a level pastured area about one-fourth mile east of the intersection of John Shirk Road and Hapes Mill Road:

Ap—0 to 12 inches, dark reddish-brown (5YR 3/4) silt loam; moderate, medium, granular structure; friable when moist, slightly sticky and slightly plastic when wet; roots plentiful; many pores of all sizes and many worm channels; medium acid (limed); abrupt, smooth boundary. Horizon is 10 to 12 inches thick.

C1—12 to 34 inches, reddish-brown (5YR 4/4) heavy silt loam; massive (structureless) to very weak, coarse, subangular blocky structure; friable to slightly firm when moist, moderately sticky and slightly plastic when wet; roots common in upper part; many very fine pores; strongly acid; gradual, smooth boundary. Horizon is 20 to 24 inches thick.

C2—34 to 50 inches +, yellowish-red (5YR 4/6) heavy silt loam or very light silty clay loam; massive (structureless) to very weak, medium, subangular blocky structure; firm when moist, sticky and plastic when wet; no roots; a few fine and medium pores; strongly acid to very strongly acid.

In some places the C horizon is stratified in layers that range from silt loam to very light silty clay loam in texture. Fine waterworn pebbles can occur in any part of the profile, but they are seldom abundant except in the C2 horizon.

In unplowed areas there may be a very thin A1 horizon in which the value is one unit darker than that of the C1 horizon. The hue is 5YR or 2.5YR throughout the profile. The Ap horizon has a value and a chroma of 3 or 4. In the C horizon the value is 3, 4, or 5 and the chroma is 4 or, in a few places, 6. In places a C2 horizon is lacking and the C1 horizon extends to a depth of 4 feet or more. Here, it is underlain by an unconforming, generally coarser textured IIC horizon. In some places there are faint mottles below a depth of 40 inches. The depth to bedrock ranges from 6 to 20 feet or more.

Like the Comus soils, the Bermudian soils lie on flood plains and are well drained, but they are reddish brown instead of yellowish brown, and they lack the large amount of finely divided mica contained in Comus soils. The Bermudian soils are on the same flood plains as the moderately well drained Rowland soils and the poorly drained Bowmansville soils.

Bermudian silt loam (Be).—This nearly level soil is smooth in most places, but locally its surface is slightly wavy or hummocky. Included are small, scattered areas in which the slope is slightly more than 3 percent. The hazard of seasonal flooding is the main limitation that affects use of this soil. (Capability unit I–6; woodland suitability group 29)

Birdsboro Series

In the Birdsboro series are deep, well-drained, level to gently sloping soils that lie on benchlike terraces just above the flood plain, or first bottom, along some of the major streams in the northwestern part of the county. These soils have a surface layer of dark reddish-brown silt loam and a thick subsoil of yellowish-red to dark-red silty clay loam or gravelly silty clay loam. The native vegetation consists of hardwoods, including many kinds of oak and hickory, but most areas in Carroll County have been cleared.

The Birdsboro soils are easily worked if they are not too wet or too dry. They warm up early in spring, usually soon enough for normal farming operations. The soils have high available moisture capacity and produce well under good management. They are well suited to all the common crops.

Profile of Birdsboro silt loam, 0 to 3 percent slopes, in a cultivated area on the bend of Big Pipe Creek at Crouse Mill:

Ap—0 to 9 inches, dark reddish-brown (5YR 2/2) silt loam; weak, fine, granular structure; friable when moist, slightly sticky and slightly plastic when wet; roots plentiful; many pores; some fine waterworn pebbles; slightly acid (limed); clear, smooth boundary. Horizon is 8 to 10 inches thick.

B21t—9 to 19 inches, yellowish-red (5YR 5/6) silty clay loam; moderate, fine, subangular blocky structure; firm when moist, sticky and plastic when wet; few roots; thin but distinct clay films; many fine and medium pores; about 10 percent of material is waterworn gravel; medium acid; gradual, smooth boundary. Horizon is 10 to 12 inches thick.

B22t—19 to 39 inches, dark-red (2.5YR 3/6) gravelly silty clay loam; moderate to strong, medium, blocky structure; very firm when moist, plastic and very sticky when wet; few roots; distinct clay films; about 20 percent of material is waterworn gravel; some thin, horizontal seams of somewhat sandy material in lower part; strongly acid; clear, irregular boundary. Horizon is 15 to 24 inches thick.

C—39 to 45 inches +, dark reddish-brown (2.5YR 3/4) stratified very gravelly silt and sand; structureless (single grain); friable when moist, slightly sticky and slightly plastic when wet; no roots; strongly acid to very strongly acid.

In some places the B2t horizon is heavy silt loam or clay loam, and locally it is sandy clay loam in the lower part. The C horizon may be loam, silt loam, or sandy loam, and in places these materials are stratified with gravelly silt and sand. This horizon is always coarser textured than the B2t horizon. In some places, within a 5-foot depth, there is a IIC horizon that is loose, very sandy, and commonly gravelly. Waterworn gravel can occur in any part of the profile, locally in significant amounts, though in some places the solum is practically free of gravel. The solum ranges from 30 to 50 inches or more in thickness, but in only a few places is it less than 36 inches thick.

In wooded areas there is a thin A1 horizon, generally dark reddish brown, and an A2 horizon that is normally reddish brown or dark brown (5YR 4/3 to 4/4 or 7.5YR 4/2 to 4/4). In most places the Ap horizon is dark reddish brown (5YR 2/2 to 3/4). The B2t horizon ordinarily has a value of less than 4 in some part. The chroma is mainly 6 but locally is 8. In the C horizon the hue is generally 2.5YR but, in a few places, is 5YR; the value is 3 or 4; the chroma is 2 to 4; and there is no evidence of wetness. Bedrock, generally red shale, occurs at a depth ranging from 6 to 20 feet or more.

In Carroll County the Birdsboro soils are similar to many other soils in depth, drainage, suitability, and limitations. They are most nearly like the deep, well-drained Elsinboro soils, but they are redder than those soils and lack the high content of fine mica flakes. The Birdsboro soils occur on the same terraces as the moderately well drained or somewhat poorly drained Raritan soils.

Birdsboro silt loam, 0 to 3 percent slopes (BrA).—This nearly level soil has the profile described as typical for the series. Included with it are a few small areas that are moderately or severely eroded.

This soil holds moisture and plant nutrients well. If it is well managed, it can be safely used for practically any kind of farming. The soil is suited to all crops common

in the county, but it is subject to erosion if it is row cropped continuously and is clean cultivated up and down the slope. (Capability unit I–4; woodland suitability group 30)

Birdsboro silt loam, 3 to 8 percent slopes, moderately eroded (BrB2).—This soil is more susceptible to erosion than Birdsboro silt loam, 0 to 3 percent slopes. In about 80 percent of the total acreage, it has lost so much of its original surface layer that plowing to a normal depth turns up part of the subsoil. Here, the plow layer is redder, more sticky when wet, and more difficult to work than the original surface layer. Included with this soil are some gravelly spots, a few severely eroded spots where the subsoil is exposed, and a few areas in which the slope is slightly more than 8 percent.

This soil can be kept from eroding by easily applied measures. Locally, it needs protection from water that runs off adjacent higher areas. (Capability unit IIe–4; woodland suitability group 30)

Bowmansville Series

The Bowmansville series consists of deep, nearly level, poorly drained soils that lie on the flood plains along streams in the northwestern part of the county. These soils are primarily gray; they have a surface layer of dark reddish-gray silt loam and a subsoil of reddish-gray to gray light silty clay loam that is mottled with yellow. Bowmansville soils are strongly acid or very strongly acid unless they have been limed. The native vegetation consists of water-tolerant hardwoods, including willow, alder, and some kinds of oak and maple. Many areas of these soils have been cleared.

The Bowmansville soils are fairly easy to work when they are not too wet or too dry, but excess moisture commonly delays plowing and planting in spring. The soils also are subject to flooding; they are among the most frequently flooded soils in the county. If they are drained and protected from floodwater, they can be cropped or used for grazing for a longer period each year. Draining these soils by use of tile or open ditches is not difficult if outlets are adequate. Artificial drainage will lower the water table, which is practically at the surface during wet periods.

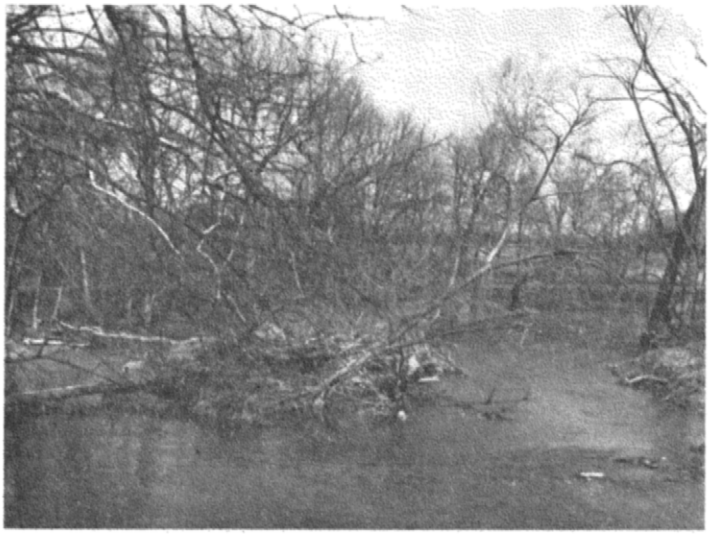

Figure 5.—An area of Bowmansville silt loam recently flooded on Big Pipe Creek.

Profile of Bowmansville silt loam, in a level pastured area on the flood plain of Big Pipe Creek, about 200 yards northeast of Trevanion Road Bridge:

Ap—0 to 12 inches, dark reddish-gray (5YR 4/2) silt loam; moderate, medium, granular structure; friable when moist, slightly sticky and slightly plastic when wet; roots plentiful; medium acid (limed); abrupt, wavy boundary. Horizon is 9 to 12 inches thick.

B2g—12 to 26 inches, reddish-gray (5YR 5/2) light silty clay loam; a few, medium, distinct mottles of yellow (10YR 7/6); very weak, medium, subangular blocky structure; friable when moist, sticky and slightly plastic when wet; few roots; no clay films; strongly acid; clear, wavy boundary. Horizon is 14 to 24 inches thick.

Cg—26 to 60 inches +, gray (5YR 5/1) light clay loam; many, medium, distinct mottles of yellow (10YR 7/6); structureless (massive); firm and dense when moist, sticky and plastic when wet; no live roots, but some old root channels; very strongly acid.

The B2g horizon is silt loam, light silty clay loam, or light clay loam. In places where the B2g horizon has a higher clay content than the A horizon, the original deposits contained more clay, for there is no evidence of clay accumulation in the B2g horizon. The B and C horizons are a little finer textured than those in normal Bowmansville soils, and the solum is somewhat thinner. In some places the Cg horizon is underlain, or is replaced, by a IIC horizon that differs markedly from the B2g horizon in texture and commonly is gravelly or very gravelly. Waterworn pebbles can occur in any part of the profile, but they are seldom abundant except in the unconforming IIC horizon. Bedrock is at a depth ranging from 6 to 20 feet or more.

The Bowmansville soils are similar to the Melvin and Hatboro soils in drainage and susceptibility to flooding. Bowmansville soils are more acid than the Melvin soils but are not so dark gray. They lack the fine mica flakes that are characteristic of the Hatboro soils, which are somewhat olive colored. The Bowmansville soils occupy the same flood plains as the well drained Bermudian soils and the moderately well drained or somewhat poorly drained Rowland soils.

Bowmansville silt loam (Bs).—This nearly level soil occurs on the lowest bottoms or in depressions on flood plains. The risk of flooding is moderate in most places, but it is severe in small included areas.

This soil has high available moisture capacity and is productive under good management. In fields where it is artificially drained and is only moderately susceptible to flooding, it is well suited to corn, hay crops, and improved pasture. Where floods are more likely, however, the only suitable uses are grazing and woodland (fig. 5). (Capability unit IIIw–7; woodland suitability group 22)

Bucks Series

The Bucks series consists of deep, well-drained, nearly level to moderately sloping soils on uplands in the western and northwestern parts of the county. These soils have a surface layer of dark reddish-gray to reddish-brown silt loam and a finer textured, reddish-brown to yellowish-red subsoil that is sticky when wet. The native vegetation is chiefly oaks, but other kinds of hardwoods also grow. Most areas of the Bucks soils have been cleared.

The Bucks soils are easily worked if their moisture content is within the optimum range. They warm up quickly

enough in spring for normal farming operations. The available moisture capacity is high, and the growth of crops is favorable under good management. These soils are suitable for all the common uses.

Profile of Bucks silt loam, 0 to 3 percent slopes, in a wooded area on Ruggles Road, about one-half mile north of Fringer Road:

A1—0 to 2 inches, dark reddish-gray (5YR 4/2) silt loam; weak, fine, granular structure; friable when moist, slightly sticky and slightly plastic when wet; roots abundant; many fine and medium pores; medium acid; clear, smooth boundary. Horizon is to 2 to 3 inches thick.

A2—2 to 8 inches, reddish-brown (5YR 4/4) silt loam; weak, medium, granular structure, with a slight tendency toward thin platiness; friable when moist, slightly sticky and slightly plastic when wet; roots abundant; many pores of all sizes; strongly acid; clear, wavy boundary. Horizon is 5 to 8 inches thick.

B1—8 to 16 inches, reddish-brown (5YR 4/4) heavy silt loam; moderate, medium, subangular blocky structure; friable to firm when moist, slightly sticky and slightly plastic when wet; roots common; many fine and a few larger pores; strongly acid; gradual, wavy boundary. Horizon is 6 to 10 inches thick.

B21t—16 to 28 inches, yellowish-red (5YR 4/6) silty clay loam; moderate, medium and coarse, subangular blocky structure; firm when moist, sticky and plastic when wet; few roots; many fine pores; almost continuous reddish-brown (2.5YR 4/4) clay films; very strongly acid; gradual, irregular boundary. Horizon is 8 to 16 inches thick.

IIB22t—28 to 38 inches, red (2.5YR 4/6) shaly silty clay loam; weak to moderate, medium and coarse, subangular blocky structure; firm when moist, sticky and plastic when wet; very few roots; some fine pores; continuous clay films, and some prominent clay flows; very strongly acid; gradual, irregular boundary. Horizon is 8 to 14 inches thick.

IIC—38 to 44 inches, fragmented red shale; fragments have hard interiors and soft, weathered exteriors; they are coated with reddish-brown (2.5YR 4/4) silt or silt and clay; very strongly acid; abrupt, irregular boundary. Horizon is 4 to 12 inches thick.

IIR—44 inches +, hard, fractured but mostly unseparated red shale; some infiltration of fine material along major cleavages.

In some places the A horizon is heavy silt loam, and in places the B1 horizon is light silty clay loam. The B2t horizon generally is light silty clay loam, but small parts of it grade toward light silty clay. The IIB22t horizon commonly contains more clay than the B21t horizon. The IIC horizon consists mainly of coarse fragments and includes only a small amount of silt or clay or discrete sand grains. Most of the fragments are shale, but some are red sandstone. In places there are a few coarse fragments in the horizons above the IIB22t horizon. Fragments in the IIB22t horizon are abundant in some places. The solum ranges from 36 to 50 inches or more in thickness. Generally, hard bedrock is within 5 feet of the surface.

The color of the A2 horizon is commonly 5YR 4/3 or 4/4, but locally it is 7.5YR 4/4 to 5/6. In cultivated areas the Ap horizon is 5YR 4/3, 5/2, or 5/3. The B21t horizon has a hue of 5YR or 7.5YR, a value of 4 or 5, and a chroma of 6 or, in a few places, 8. In the IIB22t horizon the value is 3 or 4. The IIC horizon has the same hue as the IIB22t horizon, but in places it has a lower chroma.

In Carroll County the Bucks soils are similar to many other soils in depth, drainage, suitability, and limitations. They are most nearly like the Elioak and the Hagerstown soils. The Bucks soils are not so bright red in the subsoil as the Elioak soils, and they are underlain by red shale instead of mica schist. They are less brown than the Hagerstown soils, which are underlain by hard limestone. The Bucks soils commonly occur within larger areas of the Penn soils. They are somewhat lighter reddish brown than the Penn soils; they have a thicker subsoil that generally is finer textured and more sticky; and on the average they are deeper to bedrock. In places the Bucks soils also occur with the moderately well drained Readington soils and the somewhat poorly drained Abbottstown soils.

Bucks silt loam, 0 to 3 percent slopes (BuA).—This soil has the profile described as typical for the series. It is well suited to all upland crops grown in the county, and it has few limitations for most nonfarm uses. If it is well managed, it can be cultivated regularly. In areas that have good air drainage, the soil can be used for orchards or nurseries. (Capability unit I–4; woodland suitability group 30)

Bucks silt loam, 0 to 8 percent slopes, moderately eroded (BuB2).—Erosion has removed a significant amount of the original surface layer from most areas of this soil. In a few spots the plow layer contains subsoil material. The soil can be cultivated regularly and is well suited to all the common upland crops, including hay crops, pasture, and orchards. (Capability unit IIe–4; woodland suitability group 30)

Cardiff Series

The Cardiff series consists of deep, gently sloping and sloping, somewhat excessively drained soils on uplands in the north-central part of the county. These soils are of nearly uniform texture throughout. They have a surface layer of dark grayish-brown channery silt loam and a subsoil of yellowish-brown channery silt loam or very channery heavy loam. The channery fragments are hard, gray slate. The native vegetation is hardwoods, dominantly oaks.

The Cardiff soils are easily worked, but slate fragments tend to wear plow points and cultivators. These soils warm up quickly in spring, and they can commonly be used for some of the earliest crops. They are readily permeable to water, their available moisture capacity is high, and the growth of crops is moderate if management is good.

Profile of Cardiff channery silt loam, 3 to 15 percent slopes, moderately eroded, in a cultivated area about 100 yards west of Babylon Road, at the Mason and Dixon Line:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) channery light silt loam; strong, very fine, granular structure; friable when moist, nonplastic and nonsticky when wet; fine roots plentiful; many pores of all sizes; 20 to 40 percent of horizon consists of slate fragments; slightly acid (limed); clear, smooth boundary. Horizon is 6 to 12 inches thick.

B1—10 to 16 inches, yellowish-brown (10YR 5/4) channery silt loam; moderate, medium, subangular blocky structure; friable when moist, sticky and slightly plastic when wet; fine roots common; many pores of all sizes; 30 to 40 percent slate fragments; medium acid; clear, wavy boundary. Horizon is 0 to 8 inches thick.

B2—16 to 30 inches, yellowish-brown (10YR 5/4) very channery heavy loam; moderate, medium, subangular blocky structure; friable to rather firm when moist, sticky and plastic when wet; few roots; pores of all sizes; slate content increases with depth and fragments make up about 70 percent of horizon lower part; strongly acid; gradual, irregular boundary. Horizon is 8 to 18 inches thick.

C—30 to 45 inches, more than 90 percent soft to very hard fragments of quartzitic slate, interspersed and coated with light yellowish-brown (10YR 6/4) fine material, mostly silt; no roots; strongly acid; gradual, irregular boundary. Horizon is 6 to 24 inches thick.

R—45 inches +, hard, light-gray, thinly fractured but unseparated quartzitic slate.

The B horizon is loam, heavy loam, or light silt loam. The coarse fragments throughout the profile are flat pieces of gray quartzitic slate. The average content of coarse fragments in the solum is more than 50 percent. Although the solum ranges from 15 to 35 inches in thickness, in most places it is 25 to 30 inches thick. Hard bedrock generally occurs at a depth of 40 to 50 inches, but the depth to bedrock is less in some of the steeper areas that are eroded.

In undisturbed areas there is an A1 horizon 1 to 4 inches thick and an A2 horizon 3 to 6 inches thick. Generally, the A1 horizon is 10YR or 2.5YR 3/1 or 3/2; the Ap horizon is 10YR or 2.5Y 4/1 or 4/2; and the A2 horizon is 2.5Y or 5Y 5/2 or 6/2. The B horizon has a hue of 10YR or 2.5Y, a value generally of 5, and a chroma of 4 or 6. In some places the B1 horizon has value of 6.

The hue of the C horizon is most commonly 2.5Y but ranges from 10YR to 5Y. The value in this horizon is high, commonly 6 or 7, and the chroma is 4 or 6. Hues of 2.5Y and 5Y are inherited from the parent rock and are not a result of soil-forming processes or wetness. In unlimed areas the profile is strongly acid or very strongly acid. The acidity commonly increases with depth.

The Cardiff soils are similar to the Mt. Airy and Steinsburg soils but are deeper to bedrock. They are the only soils in Carroll County that developed on hard slate.

Cardiff channery silt loam, 3 to 15 percent slopes, moderately eroded (CaC2).—This soil generally has lost a significant part of its original surface layer through erosion, and in some places it is a little shallower to bedrock than uneroded Cardiff soils. Included with it are a few areas having slopes of a little more than 15 percent. Some of these inclusions are severely eroded.

This soil is suitable for limited cropping, and it can be used for pasture, woodland, or sodded orchards. The soil tends to be droughty because it loses so much moisture as runoff. (Capability unit IIIe–10; woodland suitability group 40)

Chester Series

In the Chester series are deep, well-drained, nearly level to sloping soils on uplands in the eastern and southern parts of the county. These soils lie mainly on or near the crests of slopes, where they developed in material containing much mica. They have a dark-brown silt loam surface layer and a moderately fine textured, mostly yellowish-red subsoil that is sticky when wet. Many kinds of hardwoods, dominantly oaks, make up the native vegetation. The Chester soils are among the better soils for farming in the county, and most of their acreage has been cleared.

The Chester soils are easily worked if they are not too wet or too dry. In spring they warm up quickly enough for all normal farming operations. They have high available moisture capacity and produce well under good management.

Profile of Chester silt loam, 8 to 15 percent slopes, moderately eroded, in a cultivated area on State Route 30 in Greenmount:

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; moderate, fine and medium, granular structure; friable when moist, slightly sticky and slightly plastic when wet; roots abundant; many worm channels and casts; slightly acid (limed); clear, smooth boundary. Horizon is 8 to 10 inches thick.

B1—8 to 13 inches, brown or dark-brown (7.5YR 4/4) light silty clay loam; moderate, fine and medium, subangular blocky structure; friable to firm when moist, sticky and plastic when wet; roots plentiful; old root channels filled with silt and organic matter; slightly acid; gradual, wavy boundary. Horizon is 4 to 8 inches thick.

B21t—13 to 26 inches, yellowish-red (5YR 5/6) clay loam; strong, medium, subangular blocky structure; firm when moist, sticky and plastic when wet; few roots; thin discontinuous clay films; a few angular quartzite fragments; slightly acid; gradual, wavy boundary. Horizon is 10 to 15 inches thick.

B22t—26 to 35 inches, yellowish-red (5YR 5/8) light silty clay loam; moderate to strong, medium, subangular blocky structure, slightly compact in lower part; firm when moist, sticky and plastic when wet; very few roots; thin but distinct, continuous clay films; medium acid; gradual, wavy boundary. Horizon is 8 to 12 inches thick.

B3—35 to 42 inches, yellowish-red (5YR 5/8), very micaceous heavy loam; weak, fine, subangular blocky structure; friable when moist, sticky and slightly plastic when wet; no roots; strongly acid; gradual, wavy boundary. Horizon is 6 to 10 inches thick.

C—42 to 60 inches +, variegated yellowish-red, yellow, and white (5YR 5/8, 10YR 7/6, and 10YR 8/2), highly micaceous saprolite of loam texture; inherent schistose structures; very friable when moist, slightly sticky and slightly plastic when wet; no roots; some fine fragments of schist and angular pebbles of quartzite; strongly acid.

The B1 horizon is heavy silt loam or light silty clay loam. The B2t horizon generally is clay loam or light silty clay loam, but in places it is heavy loam or heavy silt loam. The B3 horizon is thin in some places; it is coarser textured than the B2t horizon but is finer textured than the C horizon. In places the C horizon is fine sandy loam in texture. Fragments of schist or angular pebbles of quartzite may be scattered in any part of the profile. The solum ranges from 34 to 50 inches in thickness. Bedrock occurs at a depth ranging from 5 to 10 feet or more.

In undisturbed areas these soils have an A1 horizon 1 to 3 inches thick and an A2 horizon 6 to 12 inches thick. In the A1 horizon the hue ranges from 10YR to 5YR, the value is generally 3, and the chroma is 1 or 2. The Ap or the A2 horizon has a hue of 10YR or 7.5YR, a value normally of 4, and a chroma of 3 or 4. The hue of the B2t horizon is most commonly 5YR but, in some places, is 7.5YR. This horizon has a value of 4 or 5 and a chroma of 6 to 8. Although the C horizon is variegated, it may be dominantly one color. The variegation is caused by differences in mineralogy and in weathering of the saprolite. It is not caused by wetness.

The Chester soils are less red than the Birdsboro, Bucks, Elioak, and Lewisberry soils. They have a thicker solum and are less micaceous than the Glenelg soils. Chester soils have stronger structure, more distinct horizonation, a less micaceous solum, and a more clayey Bt horizon than the Elsinboro soils. In addition, they lack the waterworn fragments and other evidence of waterworking and stratification that are characteristic of the Elsinboro soils. The Chester soils are better drained than the moderately well drained Glenville soils, which have a fragipan, and the poorly drained Baile soils. The horizon of clay accumulation that occurs in the Chester soils is lacking in the Manor soils.

Chester silt loam, 0 to 3 percent slopes (CeA).—This soil lies on broad ridgetops. It is so nearly level that it has few if any limitations for farm uses. All crops commonly grown in the county do well. (Capability unit I–4; woodland suitability group 30)

Chester silt loam, 3 to 8 percent slopes, moderately eroded (CeB2).—This gently sloping soil is the most extensive one of the Chester series in the county. It has lost part of its original surface layer through erosion. Included with it are a few severely eroded areas and some small areas in which the subsoil is slightly redder and is more clayey and sticky than that described in the typical profile.

This soil can be cultivated regularly if it is well managed. It also can be used for pasture or woodland. (Capability unit IIe–4; woodland suitability group 30)

Chester silt loam, 8 to 15 percent slopes, moderately eroded (CeC2).—This sloping soil has the profile described as typical for the series. Erosion has removed part of the original surface layer, and in places there are a few shallow gullies. Included are small areas where the subsoil is redder and more sticky than the typical one.

The hazard of erosion is the main limitation that affects the use of this soil. Cultivated crops can be used if soil losses are controlled. Other suitable uses are pasture and woodland. (Capability unit IIIe–4; woodland suitability group 30)

Chester silt loam, 8 to 15 percent slopes, severely eroded (CeC3).—In most areas this soil has lost all or nearly all of its original surface layer through erosion. Excessive runoff has formed many gullies that extend through the subsoil and into the soft underlying material. Included are a few areas in which the subsoil is redder than the typical one and is more sticky when wet.

This soil should not be cultivated regularly. It is suited to pasture plants and trees. (Capability unit IVe–3; woodland suitability group 30)

Codorus Series

In the Codorus series are deep, nearly level and gently sloping soils that occur on the flood plains of streams in all parts of the county except the northwestern. These soils have a surface layer of brown or dark-brown silt loam and a subsoil of olive-brown to gray silt loam or light silty clay loam that contains a few yellowish-brown mottles in the lower part. Codorus soils are moderately well drained, are subject to occasional flooding, and are very strongly acid or extremely acid unless they have been limed. The native vegetation consists of hardwoods that can tolerate wetness, at least seasonally. Some fairly large areas have been cleared.

The Codorus soils are fairly easy to work when they are not too wet or too dry. In spring, however, they may be flooded and they are usually wet and warm up slowly. For these reasons, plowing and planting dates may be late. Artificial drainage is of benefit to most crops, and it lengthens the grazing period on pasture. These soils have a fairly high available moisture capacity, and water moves through them readily. If drainage is improved, the water table will be lowered and farming operations can be started earlier in spring. The soils are more easily drained if they are protected from floodwater and from runoff that comes from higher soils.

Profile of Codorus silt loam, in a level wooded area just off Salem Bottom Road, on the flood plain of Little Morgan Run:

A1—0 to 6 inches, brown or dark-brown (10YR 4/3) silt loam; moderate, fine and medium, granular structure; friable when moist, slightly sticky but nonplastic when wet; roots abundant; many pores; some mica flakes; strongly acid; clear, smooth boundary. Horizon is 3 to 6 inches thick.

B1—6 to 18 inches, olive-brown (2.5Y 4/4) silt loam; weak, medium, granular structure; friable when moist, slightly sticky and slightly plastic when wet; roots plentiful; common mica flakes; many fine and medium pores; very strongly acid; clear, smooth boundary. Horizon is 10 to 16 inches inches thick.

B2—18 to 26 inches, olive-brown (2.5Y 4/4) silt loam; common, fine, distinct mottles of gray (5Y 5/1); structureless (massive) to weak, medium, granular structure; friable when moist, slightly sticky and slightly plastic when wet; very few roots; considerable fine mica; very strongly acid; gradual, smooth boundary. Horizon is 6 to 10 inches thick.

B3g—26 to 52 inches, gray (5Y 5/1) light silty clay loam; a few, medium, prominent mottles of yellowish brown ture; firm when moist, sticky and plastic when wet; (10YR 5/6); abundant fine specks of black; structureless (massive) to very weak, coarse, blocky structure; firm when moist, sticky and plastic when wet; no roots; abundant mica flakes and some fine schist fragments; very strongly acid to extremely acid; abrupt, smooth boundary. Horizon is 24 to 32 inches thick.

IICg—52 to 60 inches +, olive-gray (5Y 5/2), gravelly, micaceous coarse sand; stratified; no roots; very strongly acid to extremely acid.

The B horizon ranges from light silt loam to very light silty clay loam. In this horizon there is no evidence of clay accumulation. The B3g horizon many contain pockets or thin strata of material that is coarser textured than that in the range just given. In places where the IICg horizon occurs within a 5-foot depth, it consists of almost any kind of water-deposited material. In some areas, however, this horizon is at a depth of more than 5 feet. Fine waterworn pebbles can occur in any part of the profile, but they are seldom abundant except in the IICg horizon. In some places the B3g horizon does not contain schist fragments. The depth to the gleyed B3g horizon generally ranges from 20 to 30 inches, and the thickness of the solum ranges from 40 to 60 inches. Bedrock is at a depth of 6 to 20 feet or more.

In some places the A horizon is grayish. The Ap horizon has a hue of 10YR or 2.5Y, a value of 3 or 4, and a chroma of 2 or 3. In the B1 and B2 horizons, the hue is commonly 2.5Y or 10YR but ranges to 7.5YR; the value is 4 or 5; and the chroma is 1, 2, or rarely higher. The B3g horizon has a hue of 5Y or 2.5Y, a value of 5 or 6, and a chroma of 1, 2, or, in a few places, higher. Most of the mottles in the B horizon have a hue of 10YR to 5Y, a value of 4 or 5, and a chroma of 3 to 6, but where the chroma of the matrix is 2 or higher, there are commonly mottles having a chroma of 1 or of neutral gray (N 4/0 to 7/0). The IICg horizon may be of any color. Generally, however, it has a chroma or 2 or less and, in some places, is mottled.

The Codorus soils are similar to the Lindside and Rowland soils in being moderately well drained and susceptible to occasional flooding. They are more acid than the Lindside soils and, in contrast to those soils, contain much mica. Codorus soils are distinctly less red than the Rowland soils. The Codorus soils lie on the same flood plains as the well-drained Comus soils and the poorly drained Hatboro soils.

Codorus silt loam (Ch).—This soil occurs in many parts of the county, generally in fairly narrow strips on flood plains. In most places it is nearly level and smooth, but in some small areas it is generally sloping, and in others it has a somewhat irregular or wavy surface that may show the outlines of old stream channels.

Drainage is the chief limitation in fields where the risk of flood damage is only slight or moderate. Here, the soil is suited to many kinds of crops and is used mainly for corn, hay, and pasture. The hazard of flooding is severe, however, in a few small areas that are included, and in these areas the safest use is generally improved pasture or woodland. (Capability unit IIw–7; woodland suitability group 29)

Comus Series

The Comus series consists of deep, nearly level and gently sloping soils in which the texture is mainly silt loam

and the subsoil shows no evidence of clay accumulation. These soils occur in all parts of the county except the northwestern. They lie on the flood plains of streams, as well as at the foot of some slopes and in some upland depressions. In the Comus soils the surface layer of silt loam is darker than the layers beneath it, but in other respects the profile is much the same throughout. These soils are strongly acid or very strongly acid, and they are well drained, though in some areas they may be temporarily flooded at times when rainfall is heavy or snowmelt is rapid. The native vegetation is hardwoods, principally oaks. In Carroll County, however, most areas have been cleared. The only areas still wooded are some of the narrowest flood plains.

The Comus soils are easily worked, and because they are well drained, they can usually be farmed early in spring. Although artificial drainage is not needed, in some places it is necessary to control runoff from higher areas. These soils have high available moisture capacity, and water moves through them readily. They produce satisfactorily under good management, and they respond well to lime and fertilizer. The Comus soils are used most commonly for hay or pasture, but they are well suited to corn and other crops.

Profile of Comus silt loam, in a pastured area on the flood plain of the Patapsco River, 500 yards south of Lawndale Crossing:

Ap—0 to 11 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable when moist, slightly sticky and slightly plastic when wet; roots abundant; many pores; medium acid (limed); abrupt, smooth boundary. Horizon is 10 to 12 inches thick.

B—11 to 41 inches, yellowish-brown (10YR 5/4) silt loam; structureless (massive) to very weak, medium, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; roots plentiful in upper part; many fine mica flakes; many pores; strongly acid; gradual, wavy boundary. Horizon is 24 to 42 inches thick.

C—41 to 60 inches +, weakly stratified, yellowish-brown (10YR 5/6) silt loam and dark yellowish-brown (10YR 4/4) fine sandy loam in thin, alternate bands; very friable when moist; no roots; highly micaceous; very strongly acid.

The B and C horizons are loam, silt loam, or fine sandy loam. Commonly, the material in the C horizon is of two or more of these textures in layers. In some places the B horizon extends to a depth of 5 feet or more. In places there is a IIC horizon that differs markedly from the C horizon in texture. The IIC horizon generally is coarser textured than the C horizon and commonly is gravelly. In Comus soils on flood plains, fine waterworn pebbles can occur in any part of the profile, but they are seldom abundant except locally in the IIC horizon. Where the soils formed in local alluvium, the profile may contain angular or subangular fragments of quartzite or channery fragments of schist.

In unplowed areas these soils have an A1 horizon that is 2 to 4 inches thick and is one or two units darker in color value than the B horizon. Nearly everywhere the Ap horizon has a hue of 10YR, a value of 4 or 5, and a chroma of 2 or 3. In the C horizon the hue is 10YR or 7.5YR, the value is 4 or 5, and the chroma is 4 or, in some places, 6. Mottles generally are lacking, but there may be faint mottles of low chroma below a depth of about 40 inches.

The Comus soils resemble the Bermudian soils in drainage and position on flood plains, but they are grayish brown or yellowish brown instead of reddish brown. In addition, they are more widespread than the Bermudian soils, which occur only in the northwestern part of the county. In some places the Comus soils are on the same flood plains as the moderately well drained Codorus soils and the poorly drained Hatboro soils.

Comus silt loam (Cm).—This soil has the profile described as typical for the series. It is nearly level in most places, though it is very gently sloping in small areas.

This soil is used mainly for hay crops and pasture but, to a lesser extent, for corn and other row crops. Temporary flooding is the only hazard that limits use. Fall-seeded grain may be damaged by floodwater in spring. (Capability unit I–6; woodland suitability group 29)

Comus silt loam, local alluvium, 0 to 3 percent slopes (CnA).—This soil lies in upland depressions and at the foot of slopes, where soil material has accumulated through local washing. Unlike Comus silt loam, this soil is not subject to flooding, but in many areas it needs the protection of measures that intercept runoff and seepage and runoff from higher soils. It can be used for any kind of farming, is suited to all the common crops, and locally is especially desirable for home gardens. (Capability unit I–6; woodland suitability group 29)

Comus silt loam, local alluvium, 3 to 8 percent slopes (CnB).—This soil, which commonly occurs in small areas, is more susceptible to erosion than Comus silt loam, local alluvium, 0 to 3 percent slopes. Because most of the runoff comes from adjacent higher areas, erosion can be checked if the runoff is intercepted and diverted. Cultivated crops, pasture, and woodland are suitable uses for this soil. (Capability unit IIe–6; woodland suitability group 29)

Conestoga Series

The Conestoga series consists of deep, well-drained, nearly level to moderately steep soils that occur on uplands, mostly in the central part of the county. These soils have a surface layer of dark-brown silt loam and a subsoil of yellowish-brown light silty clay loam that is sticky when wet. The native vegetation is made up almost entirely of hardwoods. These are mainly oaks, but there is some hickory, yellow-poplar, and black walnut. Most areas of Conestoga soils have been cleared.

The Conestoga soils are easy to work when they are not too wet or too dry. They warm up early in spring, in time for all normal farming operations. These soils have high available moisture capacity and, if they are well managed, produce a good growth of crops. They are especially susceptible to erosion, however.

Profile of Conestoga silt loam, 8 to 15 percent slopes, moderately eroded, in a cultivated area about seven-tenths of a mile south of Uniontown:

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; moderate, fine, granular structure; friable when moist, nonsticky but slightly plastic when wet; roots abundant; neutral (possibly limed); clear, smooth boundary. Horizon is 8 to 10 inches thick.

A2—8 to 14 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, medium, granular structure; friable when moist, slightly sticky and slightly plastic when wet; roots plentiful; slightly acid; clear, smooth boundary. Horizon is 6 to 8 inches thick.

B21t—14 to 24 inches, yellowish-brown (10YR 5/6) light silty clay loam; moderate, fine, subangular blocky structure; friable to firm when moist, sticky and plastic when wet; few roots; many fine pores and some larger pores; some mica flakes and fine schist fragments; thin, almost continuous clay films; slightly acid; gradual, wavy boundary. Horizon is 8 to 14 inches thick.

B22t—24 to 40 inches, yellowish-brown (10YR 5/8) light silty clay loam; strong, medium, subangular blocky structure; firm when moist, sticky and plastic when wet;

practically no roots; some mica flakes and schist fragments; distinct yellowish-brown (10YR 5/6) clay films; medium acid; gradual, irregular boundary. Horizon is 12 to 20 inches thick.

C—40 to 60 inches +, yellowish-red (5YR 5/6), highly micaceous saprolite of silt loam texture; inherent schistose structure; very friable when moist, sticky but nonplastic when wet; no roots; some discrete black films; slightly acid to neutral.

Locally, the texture of the C horizon is loam or fine sandy loam. Angular fragments of white quartzite can occur in any part of the profile but only in small amounts. In addition, angular fragments of limestone or marble may be scattered throughout. The solum ranges from 36 to 50 inches or more in thickness, and the depth to bedrock is normally 5 to 8 feet or more.

In undisturbed areas the Conestoga soils have an A1 horizon 2 to 4 inches thick, and in these areas the A2 horizon is as much as 12 inches thick. The Ap, or A1, horizon has a value normally of 4 and a chroma of 2 or 3. The A2 horizon generally has a value and a chroma of 4, but in places the value is 5 or 6, and here the chroma is lower than 4. In the B horizon the hue centers on 10YR but grades toward 7.5YR. The value in the B horizon generally is 5 but may be 4 in the upper part, and the chroma in this horizon ranges from 4 to 8 but most commonly is 6. In some places the C horizon is not redder than the B horizon, and in places it is somewhat variegated.

Unlimed, these soils are medium acid to mildly alkaline. Their pH and base saturation increase with depth. The underlying bedrock is calcareous and in some places the lower part of the C horizon is slightly calcareous.

The Conestoga soils are similar to the Hagerstown, Bucks, and Chester soils in some respects, but they developed from a different kind of material. They are not so red as the Hagerstown soils, which developed over limestone, or the Bucks soils, which overlie red shale. The Conestoga soils are generally a little less red than the strongly acid Chester soils, which formed over acid schist rather than calciferous schist. In some places the Conestoga soils occur near the moderately well drained Wiltshire soils. In contrast to the Conestoga soils, the Wiltshire soils have a fragipan.

Conestoga silt loam, 0 to 3 percent slopes (CoA).—This nearly level soil is practically all in cultivation. It is well suited to most crops grown in the county and to pasture plants and trees. It is especially well suited to alfalfa and similar crops that require good drainage, a deep root zone, and a naturally adequate supply of lime. (Capability unit I–1; woodland suitability group 43)

Conestoga silt loam, 3 to 8 percent slopes, moderately eroded (CoB2).—This gently sloping soil is the most extensive Conestoga soil in the county. It has lost a significant part of its original surface layer through erosion. Included with it are scattered areas that are severely eroded. (Capability unit IIe–24; woodland suitability group 43)

Conestoga silt loam, 8 to 15 percent slopes, moderately eroded (CoC2).—The profile of this sloping soil is the one described as typical for the series. In most areas a large part of the original surface layer has been eroded away, and locally there are a few shallow gullies.

This soil is suitable for limited cropping and for pasture and woodland. Its use for cultivated crops is severely restricted by the hazard of erosion. (Capability unit IIIe–24; woodland suitability group 43)

Conestoga silt loam, 8 to 15 percent slopes, severely eroded (CoC3).—Erosion has removed most of the original surface layer from this sloping soil. Gullies are fairly common, and some of them are so deep that they cannot be crossed by tractors and other power equipment. Included with this soil are spots in which the subsoil is slightly redder and more clayey than normal.

This soil can be cultivated occasionally, but it is better suited to permanent hay or pasture. It also is suited to orchards planted and worked on the contour. The risk of erosion is the main hazard that affects use. (Capability unit IVe–1; woodland suitability group 43)

Conestoga silt loam, 15 to 25 percent slopes, severely eroded (CoD3).—In most places this moderately steep soil has lost nearly all of its original surface layer through erosion, and it is cut by a few to many gullies. Included are a few small areas that are only moderately eroded. Also included are a few areas in which the slope is more than 25 percent and small areas in which the subsoil is redder and more sticky than the typical one.

This soil is not suitable for regular cultivation, but it can be safely used for hay crops, pasture, orchards, or woodland. (Capability unit VIe–1; woodland suitability group 44)

Delanco Series

Soils of the Delanco series are deep, nearly level or gently sloping, and moderately well drained. They lie on narrow, benchlike terraces just above the flood plains, or first bottoms, along some of the major streams in the county. Delanco soils have a surface layer of dark grayish-brown silt loam and a subsoil of yellow or yellowish heavy silt loam or silty clay loam. In the lower part the subsoil is mottled with grayish colors. The mottles indicate that the soils are wet and poorly aerated at least part of the year. The native vegetation is hardwoods, dominantly oaks. In addition, there is some hickory, maple, and sweetgum in most places.

The Delanco soils must be worked when they are neither too wet nor too dry. Because they tend to be wet and warm up rather late, planting dates may be delayed in spring. Artificial drainage is needed in some areas, but the soils generally are not difficult to drain. They have high available moisture capacity and, if they are well managed, produce a moderate to good growth of crops. Some uses of these soils are limited by impeded drainage and seasonal wetness, and sloping areas are readily washed by runoff.

Profile of Delanco silt loam, 0 to 3 percent slopes, in a cultivated area just west of Turkey Foot Road, about 250 yards south of Silver Run Valley Road:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, very fine, granular structure; friable when moist, slightly sticky and slightly plastic when wet; roots abundant; many fine and medium pores; slightly acid (limed); abrupt, smooth boundary. Horizon is 6 to 9 inches thick.

B1—8 to 12 inches, light yellowish-brown (10YR 6/4) heavy silt loam; moderate, fine, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; roots plentiful; many fine and medium pores; some rounded pebbles; slightly acid; clear, smooth boundary. Horizon is 4 to 6 inches thick.

B21t—12 to 23 inches, yellow (10YR 7/6) heavy silt loam; moderate, fine and medium, subangular blocky structure; friable to firm when moist, slightly sticky and slightly plastic when wet; roots common; many fine and medium pores; some faint clay films; medium acid; clear, smooth boundary. Horizon is 10 to 14 inches thick.

B22t—23 to 35 inches, variegated brownish-yellow (10YR 6/6) and light yellowish-brown (2.5Y 6/4) silty clay loam; common, fine and medium, distinct mottles of grayish brown (10YR 5/2); strong, medium, subangular blocky structure; firm when moist, sticky and

plastic when wet; few roots; discontinuous, distinct, brownish-yellow (10YR 6/6) clay films; mica flakes common to abundant; some waterworn gravel; strongly acid; gradual, irregular boundary. Horizon is 8 to 14 inches thick.

C—35 to 50 inches +, variegated and streaked, pale-yellow (2.5Y 7/4) and yellowish-brown (10YR 5/8), gritty micaceous loam; structureless (massive); stratified; friable when moist, slightly sticky but nonplastic when wet; no roots; 15 to 20 percent of horizon consists of waterworn schist and quartzite pebbles; strongly acid to very strongly acid.

The B1 and B21t horizons are heavy silt loam or light silty clay loam. The B22t horizon is silty clay loam, clay loam, heavy loam, heavy silt loam, or heavy fine sandy clay loam. Locally, there is a B3 horizon that has moderate subangular blocky structure but is coarser textured than the B22t horizon and lacks clay films. Waterworn pebbles or cobblestones can occur in any part of the profile, though they are most common in the lower horizons. The solum ranges from 28 to 46 inches in thickness. The depth to bedrock is 6 to 20 feet or more.

In wooded areas these soils have a thin, dark-gray A1 horizon and a somewhat thicker A2 horizon. The Ap horizon has a hue ranging from 10YR to 2.5Y, a value of 4 or 5, and a chroma generally of 2. The A2 horizon has the same range in hue; its value is 5 or 6 and its chroma is normally 4. In the B2t horizon the hue is mainly 10YR or 7.5YR, the value is 4 to 7, and the chroma is generally 6 to 8 but is 4 in some minor variegations. In some places the B22t horizon contains so many grayish mottles of high chroma that the horizon appears gleyed. The C horizon varies in color, and so does the B3 horizon where present. Commonly, these horizons have a high chroma and are more reddish than the horizons above them. They are friable to firm and are moderately to highly micaceous.

The Delanco soils are similar to the Glenville, Raritan, Readington, Urbana, and Wiltshire soils in natural drainage. But the Delanco soils are yellower than the Raritan, Readington, and Urbana soils, and their subsoil is more easily penetrated by roots and water than the firm, dense subsoil that occurs in soils of all five of those series. The Delanco soils are neither so reddish nor so well drained as the Elsinboro soils, which formed in similar material and occupy the same position in the landscape as the Delanco soils.

Delanco silt loam, 0 to 3 percent slopes (DeA).—This nearly level soil has the profile described for the series. Included with it are spots of wetter soils, which are indicated on the soil map by a wet-spot symbol. Locally, the surface layer, or plow layer, contains a considerable amount of rounded gravel. Also included are spots in which some of the original surface layer has been lost by erosion.

The use of this soil is limited mainly by seasonal wetness. If drainage is improved, most kinds of cultivated crops can be grown. In winter, however, alfalfa and other perennial crops may be damaged by frost heaving. The soil also is suited to pasture plants and trees. (Capability unit IIw–1; woodland suitability group 46)

Delanco silt loam, 3 to 8 percent slopes, moderately eroded (DeB2).—In most places this gently sloping soil is not so deep to the gravelly, micaceous substratum as Delanco silt loam, 0 to 3 percent slopes. Nearly all cultivated areas have lost a significant amount of the original surface layer through erosion. Plowing to normal depth may turn up some of the stickier subsoil, and in a few places the subsoil is practically exposed. Gullies occur in some places; a few of the gullies have been cut deeply into the subsoil. Included with this soil are some wet depressions, shown by symbol on the soil map, and a few small areas in which the slope is slightly more than 8 percent.

This soil is suited to most cultivated crops, though frost heaving may damage herbaceous perennials in winter. The soil also can be used for pasture or woodland. The hazard of erosion is the most important limitation that affects use, but improved drainage is needed for some crops or uses. (Capability unit IIe–16; woodland suitability group 46)

Elioak Series

Soils of the Elioak series are deep, mostly red, nearly level to strongly sloping, and well drained. They occupy crests and upper side slopes, mainly in the eastern and southern parts of the county. These soils have a surface layer of brown or dark-brown silt loam and subsoil of red clay loam or silty clay loam that is sticky when wet. Commonly, they contain fine flakes of mica. The native vegetation is hardwoods, principally oaks. Virginia pine has invaded small areas. In most places the Elioak soils have been cleared for use.

Uneroded Elioak soils are fairly easy to work. In eroded areas, however, where subsoil material has been turned up through normal tillage, the plow layer is very sticky when wet and is difficult to work at any moisture content. The Elioak soils warm up fairly early in spring, in time for normal farming operations. They have high available moisture capacity and produce well under good management.

Profile of an Elioak silt loam, located in a wooded area just north of State Route 26 and east of Oklahoma Road:

A1—0 to 3 inches, dark-brown (10YR 3/3) silt loam; moderate, fine, granular structure; very friable when moist, nonsticky and very slightly plastic when wet; roots abundant; some medium and many fine pores; some angular fragments of white quartzite; strongly acid; clear, smooth boundary. Horizon is 3 to 4 inches thick.

A2—3 to 8 inches, brown or dark-brown (7.5YR 4/4) silt loam; moderate, fine and medium, granular structure; very friable when moist, nonsticky and very slightly plastic when wet; roots plentiful; abundant fine and medium pores; some small angular fragments of white quartzite; very strongly acid; clear, wavy boundary. Horizon is 4 to 8 inches thick.

B21t—8 to 19 inches, red (2.5YR 4/8) heavy silty clay loam; moderate and strong, fine, subangular blocky structure; friable when moist, sticky and plastic when wet; roots fairly common; worm holes and root channels filled with dark-brown silt; abundant fine and medium pores; distinct red (2.5YR 4/6) clay films; a few angular fragments of white quartzite; very strongly acid; gradual, wavy boundary. Horizon is 9 to 13 inches thick.

B22t—19 to 34 inches, red (2.5YR 4/6) heavy clay loam; strong, fine and medium, blocky and subangular blocky structure; firm when moist, sticky and plastic when wet; few roots; many fine pores; continuous clay films, and some prominent, dark-red (2.5YR 3/6) clay flows; very strongly acid; gradual, irregular boundary. Horizon is 15 to 20 inches thick.

B23t—34 to 41 inches, red (2.5YR 4/6) heavy silty clay loam; moderate, medium, subangular blocky structure; friable when moist, sticky and plastic when wet; very few roots; distinct but discontinuous clay films; abundant fine mica flakes; some pieces of weathered schist, apparently identical with saprolite of C horizon; very strongly acid; gradual, irregular boundary. Horizon is 4 to 8 inches thick.

C—41 to 60 inches +, yellowish-red (5YR 4/8), highly micaceous saprolite of loam or silt loam texture; inherent schistose structure; very friable when moist, slightly sticky and slightly plastic when wet; no roots; very strongly acid to extremely acid.

In some places the profile includes a thin, transitional B1 horizon that normally is silty clay loam in texture. The B2t horizon generally is heavy silty clay loam, but it ranges from

heavy clay loam to light silty clay. The C horizon ranges from heavy loam to light silty clay loam. Remnant angular pebbles of quartzite can occur in any part of the profile and locally are numerous. The solum ranges from about 40 to nearly 60 inches in thickness. The depth to bedrock is 6 to 10 feet or more.

The A horizon ranges from 10YR to 5YR in hue. The A1 horizon generally has a value of 3 and a chroma of 2 or 3; the A2 horizon has a value of 4 or 5 and a chroma normally of 4. Except in severely eroded areas, the Ap horizon has a value of 4 or 5 and a chroma of 2, 3, or 4. Where the soils are severely eroded, the plow layer is generally 5YR or 2.5YR 4/4 to 5/6. The B2t horizon centers on a hue of 2.5YR but, in some places, approaches 5YR or 10R. This horizon has a value of 4 or rarely higher and a chroma of 6 or 8. In some places the C horizon has a single hue, ordinarily 5YR or 2.5YR, but in other places the horizon is variegated and has hues between 10YR and 10R. The value in the C horizon is generally 4 or 5, and the chroma ranges from 2 to 8. Variegation in the C horizon is inherent; it is not the result of wetness.

The Elioak soils are somewhat similar to the Birdsboro and Bucks soils in color, but they are more micaceous than those soils and their subsoil is finer textured and more clayey. Although the Elioak soils are not so brown as the Hagerstown soils, they are more micaceous and are much more acid. The Elioak soils developed over the same kind of rock as the yellower Chester and Glenelg soils, the moderately well drained Glenville soils, which have a fragipan, and the poorly drained Baile soils. But the Elioak soils have a finer textured, more clayey subsoil than all of those soils.

Elioak silt loam, 3 to 8 percent slopes, moderately eroded (ElB2).—This gently sloping soil can be cultivated regularly and is suited to many kinds of crops, but its use is moderately limited by the risk of erosion. Included with this soil are some nearly level spots, a number of gravelly areas and a few stony ones, some severely eroded spots that are cut by shallow gullies, and scattered areas where the soil is less red and more brownish than normal and is fairly shallow to bedrock. (Capability unit IIe–4; woodland suitability group 30)

Elioak silt loam, 8 to 15 percent slopes, moderately eroded (ElC2).—This sloping soil is suited to cultivated crops, pasture, and trees. The main limitation is the hazard of erosion. Included are some gravelly areas, a few shallow areas, and some severely eroded spots in which the plow layer consists mainly of subsoil material. (Capability unit IIIe–4; woodland suitability group 30)

Elioak silty clay loam, 15 to 25 percent slopes, severely eroded (EmD3).—This moderately steep soil has lost all or nearly all of its original surface layer through erosion. In some places a large part of the subsoil has been washed away. Shallow gullies are common, and in places they are close together. Included are some gravelly spots, some shallow spots, a few small areas having slopes of more than 25 percent, and a few spots that are only moderately eroded.

This soil should not be used for cultivated crops. It is suited to plants grown for permanent hay or for pasture that is carefully managed, to orchard trees that are protected by a permanent soil cover, or to trees grown in reestablished woodland. (Capability unit VIe–2; woodland suitability group 30)

Elsinboro Series

The Elsinboro series consists of deep, well-drained, level to sloping soils that occur on benches, terraces, and low bluffs above the flood plains along some of the major streams in the county. These soils have a surface layer of dark-brown silt loam and an upper subsoil of yellowish-red light silty clay loam that is sticky when wet. Generally, they contain a considerable amount of fine mica flakes. Some of the soils are gravelly. The native vegetation is mainly oaks but includes other kinds of hardwoods. Most areas have been cleared.

The Elsinboro soils are easily worked, but they should not be worked when too wet. In spring they warm up soon enough for all normal farming operations. These soils have high available moisture capacity and, under good management, produce a good growth of crops. Although they lie close to streams, they are seldom flooded.

Profile of an Elsinboro silt loam, located in an area recently rewooded, about one-half mile south of the end of Murphy Road, near Liberty Dam Reservoir:

Ap—0 to 6 inches, dark-brown (7.5YR 4/2) silt loam; moderate, fine, granular structure; friable when moist, slightly sticky and slightly plastic when wet; roots abundant; some fine waterworn gravel; medium acid (previously limed); abrupt, smooth boundary. Horizon is 6 to 8 inches thick.

A2—6 to 11 inches, dark-brown (7.5YR 4/4) silt loam; moderate, fine, granular structure; friable when moist, slightly sticky and slightly plastic when wet; roots plentiful; some fine waterworn gravel; dark yellowish-brown material in old root channels; medium acid; clear, smooth boundary. Horizon is 4 to 6 inches thick.

B21t—11 to 19 inches, yellowish-red (5YR 4/8) light silty clay loam; moderate, fine, blocky structure; firm when moist, sticky and plastic when wet; roots common; thin but distinct clay films; mica flakes common; some fine waterworn gravel; strongly acid; gradual, smooth boundary. Horizon is 7 to 10 inches thick.

B22t—19 to 38 inches, yellowish-red (5YR 4/6) light silty clay loam; moderate, fine and medium, blocky and subangular blocky structure; firm when moist, sticky and plastic when wet; very few roots; prominent dark reddish-brown (2.5YR 3/4) clay films and flows; mica flakes plentiful; some fine waterworn gravel; very strongly acid; gradual, smooth boundary. Horizon is 15 to 20 inches thick.

B3—38 to 46 inches, strong-brown (7.5YR 5/6) heavy silt loam; moderate, medium, subangular blocky structure; firm when moist, slightly sticky and slightly plastic when wet; no roots; some very faint clay films; mica flakes plentiful; some gravel and schist fragments; very strongly acid; clear, smooth boundary. Horizon is 0 to 10 inches thick.

C—46 to 60 inches +, variegated yellowish-red to light-gray (5YR 4/8 to 2.5Y 7/2), highly micaceous loam or light clay loam; structureless (massive); friable to firm when moist, slightly sticky and slightly plastic when wet; no roots; highly micaceous; some waterworn gravel and schist fragments; very strongly acid to extremely acid.

The A horizon is silt loam or gravelly loam. In some places the B2t horizon is clay loam. The C horizon is loam, silt loam, or clay loam. Fragments of schist may occur in any part of the profile. The fine waterworn gravel is mainly quartzite, and it is most common in the C or the A horizon. The solum ranges from 28 to 48 inches in thickness. Bedrock is at a depth of 6 to 20 feet or more.

The hue of the A horizon is 10YR or 7.5YR. The A1, or Ap, horizon generally has a value of 4 and a chroma of 2 or 3. In the A2 horizon the value is 4 to 6 and the chroma is normally 4. The B2t horizon has a hue of 7.5YR or 5YR and commonly is redder in the lower part. The value in the B2t horizon is 4 or 5 and the chroma is 6 or 8. The B3 horizon may be either more red or less red than the B2t horizon, but it has about the same value and chroma. The C horizon is of uniform color in some places. This horizon may be replaced or underlain at a moderate depth by a IIC horizon, which differs markedly in texture and most commonly is very gravelly.

The Elsinboro soils are similar to many other soils of the county in depth, drainage, suitability, and limitations. They are

most nearly like the Birdsboro soils, which also are deep and well drained and occupy terraces. Elsinboro soils are lighter red than the Birdsboro soils, however, and they contain a considerable amount of fine mica flakes. The Elsinboro soils lie on the same terraces as the moderately well drained Delanco soils.

Elsinboro gravelly loam, 3 to 8 percent slopes, moderately eroded (EnB2).—This gently sloping soil has lost a significant part of its original surface layer through erosion. Smooth, waterworn pebbles make up 15 percent or more of the plow layer, and in places the plow layer contains a small part of the subsoil. Included with this soil are a few nearly level areas, and scattered spots that are marked by shallow gullies.

Under good management, this soil can be used for crops, pasture, or woodland. It needs the protection of measures that check erosion. (Capability unit IIe–4; woodland suitability group 30)

Elsinboro gravelly loam, 8 to 15 percent slopes, moderately eroded (EnC2).—Erosion has removed a significant part of the original surface layer from this sloping soil. In some spots nearly all of the original surface layer is missing and shallow gullies are common.

This soil is suitable for limited cropping, pasture, and woodland. It also can be used for orchards if the trees are on the contour and if the surface is protected by a permanent cover. (Capability unit IIIe–4; woodland suitability group 30)

Elsinboro silt loam, 0 to 3 percent slopes (EsA).—This nearly level soil commonly occupies small areas and has the profile described as typical for the series.

This is among the better soils in the county, and it has few limitations for most uses. (Capability unit I–4; woodland suitability group 30)

Elsinboro silt loam, 3 to 8 percent slopes, moderately eroded (EsB2).—In most places this gently sloping soil has lost a good part of its original surface layer through erosion. It is cut by occasional gullies, a few of which are deep.

This is a good soil for farming. It can be used for crops, pasture, or trees. (Capability unit IIe–4; woodland suitability group 30)

Elsinboro silt loam, 8 to 15 percent slopes, moderately eroded (EsC2).—This sloping soil generally has lost a good part of its original surface layer through erosion. In places the subsoil is exposed. Shallow gullies are common, and a few deeper ones have been formed.

This soil is suited to cultivated crops, pasture, and trees, but practices are needed for controlling erosion. (Capability unit IIIe–4; woodland suitability group 30)

Glenelg Series

The Glenelg series consists of well-drained, nearly level to moderately steep soils that occupy uplands in all parts of the county except the northwestern. These soils are deep, but their solum is only moderately thick. They have a dark-brown surface layer and a brown to strong-brown, rather thin subsoil that is sticky when wet. Underlying the subsoil is a friable, micaceous material. The native vegetation is hardwoods, principally oaks. In Carroll County the Glenelg soils are extensive and are important to farming. Most of their acreage has been cleared.

The Glenelg soils are easily worked. In spring they warm up soon enough for all normal farming operations. Their available moisture capacity is moderate to high, and crops grow well on them.

Profile of Glenelg loam, 0 to 3 percent slopes, in a wooded area on the west side of Old Washington Road, about one-tenth mile south of Morgan Road:

A1—0 to 3 inches, dark-brown (10YR 4/3) loam; moderate, fine, granular structure; very friable when moist, slightly sticky and slightly plastic when wet; roots abundant; many pores of all sizes; mica flakes common; very strongly acid; clear, wavy boundary. Horizon is 2 to 3 inches thick.

A2—3 to 7 inches, brown (7.5YR 4/4) loam; moderate, fine, granular structure; very friable when moist, slightly sticky and slightly plastic when wet; roots plentiful; many pores of all sizes; a few fine schist fragments; mica flakes common; very strongly acid; clear, wavy boundary. Horizon is 3 to 8 inches thick.

B21t—7 to 12 inches, brown (7.5YR 4/4) heavy loam; weak, fine, subangular blocky structure; friable when moist, sticky and plastic when wet; roots common; many pores of all sizes; some thin, patchy clay films; a few fine schist fragments and many mica flakes; strongly acid; gradual, wavy boundary. Horizon is 5 to 10 inches thick.

B22t—12 to 28 inches, strong-brown (7.5YR 5/8) to yellowish-red (5YR 5/8) light silty clay loam; moderate to strong, fine and medium, subangular blocky structure; friable to firm when moist, sticky and plastic when wet; few roots; many fine and medium pores; distinct but discontinuous clay films; root channels filled with dark-brown silt; some angular quartzite and fine schist fragments, and many mica flakes; strongly acid; gradual, irregular boundary. Horizon is 8 to 18 inches thick.

C—28 to 50 inches, variegated red (2.5YR 5/8) and yellowish-red (5YR 5/8), highly micaceous saprolite of loam texture; inherent schistose structure; friable; no roots; some schist and angular quartzite fragments; strongly acid; clear, irregular boundary. Horizon is 20 to 40 inches thick.

R—50 inches +, fractured but unseparated hard mica schist, and some thin injections of hard white quartzite.

In places the texture of the A horizon is near the boundary that separates loam and silt loam. The B2t horizon centers on light silty clay loam but, in some places, is heavy silt loam or heavy loam. The C horizon ranges from silt loam to fine sandy loam. Chips or channery fragments of schist are few, common, or many in the profile. In addition, angular fragments of quartzite may be scattered throughout. The solum ranges from 18 to 40 inches in thickness, but in most places it is less than 34 inches thick. The depth to bedrock ranges from 4 to 10 feet. Generally, the depth is greatest in areas where the profile contains the fewest coarse fragments.

In the A horizon the value is 3 to 5 and the chroma is 2 to 4; both are lower in the A1 than in the A2 horizon. The B horizon has a hue approaching 10YR or 5YR in some places. The value in this horizon is 4 or 5, and the chroma is generally 6 or 8 but may be lower in some part. In places the C horizon is of uniform color. Where the C horizon is variegated, the colors are inherent and are not the result of wetness.

The Glenelg soils are somewhat similar to the Chester and Elsinboro soils, but their solum is generally thinner and is more micaceous. Glenelg soils commonly occur with the moderately well drained Glenville soils and the poorly drained Baile soils.

Glenelg channery loam, 3 to 8 percent slopes, moderately eroded (GcB2).—This gently sloping soil is extensive in Carroll County. About 20 percent or more of its surface layer is flat fragments of schist. Small included areas are severely eroded. Also included are some gullies, a few of them deep.

This soil is suited to cultivated crops, pasture, and trees. The fragments of schist are not very hard, and they are only a slight limitation to use and suitability, but they

make the soil a little more difficult to work, and they cause excessive wear on tillage implements. (Capability unit IIe–4; woodland suitability group 30)

Glenelg channery loam, 8 to 15 percent slopes, moderately eroded (GcC2).—This sloping soil has lost a large part of its original surface layer through erosion, and it is marked by a few gullies that are shallow and can be crossed by tillage implements. The present surface layer and the subsoil contain many schist fragments.

This soil is subject to severe erosion, but it can be used for limited cropping, and it is suited to pasture plants and trees. (Capability unit IIIe–4; woodland suitability group 30)

Glenelg channery loam, 8 to 15 percent slopes, severely eroded (GcC3).—Most of the original surface layer has been washed away from this sloping soil. The plow layer contains so many schist fragments that it appears covered by a sort of loose pavement in places. Generally, this layer is yellowish red and is sticky when wet. It is easily eroded but tends to crust over as it dries. Many gullies have been formed; some of them are deep. Channery fragments of schist occur throughout the soil.

This soil is suitable for permanent hay crops, pasture, woodland, and an occasional cultivated crop. Also, it can be used for orchards if the soil surface is protected from erosion. (Capability unit IVe–3; woodland suitability group 30)

Glenelg channery loam, 15 to 25 percent slopes, moderately eroded (GcD2).—This moderately steep soil is covered with many schist fragments. Included are small areas in which the surface layer is nearly free of coarse fragments, and scattered areas having slopes of more than 25 percent.

This soil is suited to trees, to plants grown for hay or pasture, to orchards if the surface is well protected, and to an occasional cultivated crop. Tillage is severely limited because of slope. (Capability unit IVe–3; woodland suitability group 30)

Glenelg channery loam, 15 to 25 percent slopes, severely eroded (GcD3).—This soil is too steep and too severely eroded for regular cultivation. In some places it is gullied. The soil is suited to hay crops, limited grazing, sodded orchards, and woodland. A permanent cover of plants will check soil losses and promote the intake of water. Included with this soil are small areas having a surface layer that is nearly free of coarse fragments, and spots where the slope exceeds 25 percent. (Capability unit VIe–2; woodland suitability group 30)

Glenelg loam, 0 to 3 percent slopes (GlA).—This soil has the profile described as typical for the Glenelg series. Included with it are a few spots where some of the original surface layer has been washed away, and small areas where the soil contains flat fragments of mica schist.

This soil is naturally fertile and has few if any characteristics that limit use. (Capability unit I–4; woodland suitability group 30)

Glenelg loam, 3 to 8 percent slopes, moderately eroded (GlB2).—This gently sloping soil is the most extensive of the Glenelg soils in the county. It is intensively used for farming and other purposes. In places it is cut by a few shallow gullies. (Capability unit IIe–4; woodland suitability group 30)

Glenelg loam, 3 to 8 percent slopes, severely eroded (GlB3).—This gently sloping soil has lost most or all of its original surface layer through erosion. The plow layer consists mainly of subsoil material that is commonly yellowish red, is sticky when wet, absorbs water slowly, is easily eroded, and forms a firm crust on the surface as it dries. In places there are shallow to deep gullies.

This soil is suitable for limited cropping or for use as pasture or woodland. The risk of erosion is the main limitation. (Capability unit IIIe–4; woodland suitability group 30)

Glenelg loam, 8 to 15 percent slopes, moderately eroded (GlC2).—This sloping soil is made up of layers that are thinner than those of the soil described in the typical profile. It is suitable for limited cultivation and for pasture and woodland. Erosion is a severe hazard because of slope. (Capability unit IIIe–4; woodland suitability group 30)

Glenelg loam, 8 to 15 percent slopes, severely eroded (GlC3).—Erosion has removed all or nearly all of the original surface layer from this sloping soil. In some places the soil is cut by deep gullies, and in spots most of the subsoil has been washed away.

This soil can be safely used for hay crops, carefully managed pasture, well-protected orchards, and an occasional row crop. The hazard of erosion is the main limitation. (Capability unit IVe–3; woodland suitability group 30)

Glenville Series

In the Glenville series are nearly level and gently sloping, moderately well drained soils that have a fragipan. These soils lie in upland depressions, as well as around the heads and along the upper courses of drainageways. Their surface layer is dark grayish-brown silt loam. The upper part of the subsoil is brownish or yellowish silty clay loam or clay loam, and the lower part is a dense, firm fragipan. Just above the fragipan the subsoil is mottled with gray, which indicates that the soils are somewhat wet and poorly aerated part of the year. Except in limed areas, they are strongly acid or very strongly acid. The native vegetation is mostly oaks but, in many places, includes tulip-poplar and maple.

The Glenville soils are easily worked if their moisture content is within the optimum range. Because they tend to be wet and warm up rather late, however, planting generally is somewhat delayed in spring. Adequate drainage must be provided for some crops, but draining the soils is not difficult. Movement of water through the profile is limited by the fragipan, and the available moisture capacity is only moderate. Under good management, crops grow moderately well. Some uses of these soils are limited by seasonal wetness, impeded drainage, the slow movement of moisture, the restricted depth to which roots can readily penetrate, and the susceptibility of sloping areas to erosion.

Profile of Glenville silt loam, 0 to 3 percent slopes, in a pastured area about one-fourth mile east of Hanover Pike and one-fourth mile south of North Carroll High School:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, granular structure; friable when moist, slightly sticky and slightly plastic when wet; roots abundant; many pores; some fine mica flakes and some shall schist fragments; neutral (limed); clear, smooth boundary. Horizon is 8 to 10 inches thick.

B21t—10 to 18 inches, brownish-yellow (10YR 6/6) light silty clay loam; moderate, fine and medium, subangular blocky structure; firm when moist, sticky and plastic when wet; few roots; many fine pores; some mica flakes and fine angular fragments of white quartzite; patchy clay films of light olive brown (2.5Y 5/4); slightly acid; clear, wavy boundary. Horizon is 7 to 10 inches thick.

B22t—18 to 24 inches, light yellowish-brown (10YR 6/4) light clay loam; a few, medium, distinct mottles of gray (N 6/0); moderate, medium, subangular blocky structure; firm when moist, sticky and plastic when wet; very few roots; some fine pores; mica flakes common; distinct but discontinuous, yellowish-brown (10YR 5/6) clay films; medium acid; clear, smooth boundary. Horizon is 6 to 10 inches thick.

Bx—24 to 48 inches, light-gray (10YR 7/2) light clay loam; common, medium, distinct mottles of yellowish brown (10YR 5/4); moderate to strong, medium to thick, platy structure and medium blocky structure; very firm when moist, sticky and plastic when wet; less firm with depth; no roots; much mica; prominent yellowish-brown (10YR 5/6) clay flows, which decrease in number with depth; strongly acid; clear, smooth boundary. Horizon is 20 to 24 inches thick.

C—48 to 60 inches +, light yellowish-brown (10YR 6/4), highly micaceous saprolite of loam texture; inherent schistose structure; very friable when moist, slightly sticky when wet; no roots; some remnants of thin quartzite veins; some schist fragments, many coated with black; very strongly acid.

The B horizon is light silty clay loam, light clay loam, heavy silt loam, or heavy loam. The C horizon is fine sandy loam, loam, or, in a few places, silt loam. Locally, there are colluvial pebbles or stones on or near the surface. The solum ranges from 30 to 50 inches in thickness. The depth to bedrock ranges from 5 to 10 feet or more.

In wooded areas these soils have a thin, dark grayish-brown A1 horizon and a light yellowish-brown (10YR 6/4 or 2.5Y 6/4) A2 horizon that is 5 to 8 inches thick. The hue throughout the solum is generally 10YR but may be 2.5Y or rarely 7.5YR in some part. In the B horizon the value ranges from 5 to 7 but is normally 6. The chroma is generally 4 or 6 in the B2t horizon and ranges from 2 to 6 in the Bx horizon. Mottling ranges widely in hue, value, and chroma. The range is from N 6/0 to 5YR 4/4 or 5/6, but mottles having a chroma of 2 or less occur everywhere within the upper 10 inches of the B2t horizon. The color in the C horizon ranges from 2.5Y 4/4 to 10YR 6/6. In places this horizon is mottled or streaked with colors that are grayer or brighter, or both, than the range just given.

The Glenville soils resemble the Abbottstown, Readington, Urbana, and Wiltshire soils in having a fragipan. They are not so red as the Abbottstown and Readington soils, and they lack the olive colors of the Urbana soils. The Glenville soils most closely resemble the Wiltshire soils, but they are less fertile and are much more strongly acid. Glenville soils formed in the same kind of materials as the poorly drained Baile soils and occupy similar positions in the landscape.

Glenville silt loam, 0 to 3 percent slopes (GvA).—This soil has the profile described as typical for the series. It occurs in all parts of the county except the northwestern.

Wetness is the main limitation that affects the use of this soil. Drainage must be improved if crops are to be planted early in spring. After the soil is drained by ditching or tiling (fig. 6), it is suited to many kinds of crops. In winter, however, alfalfa and other herbaceous perennials may be damaged by frost heaving. The soil also is suited to pasture plants and trees. (Capability unit IIw–2; woodland suitability group 46)

Glenville silt loam, 3 to 8 percent slopes (GvB).—This gently sloping soil is more susceptible to erosion than Glenville silt loam, 0 to 3 percent slopes. In a few included areas the soil is moderately eroded, and in spots the original surface layer is so thin that normal plowing turns up part of the subsoil. Locally, there are a few gullies, most of them shallow. Also included are a few small areas where the slope is slightly greater than 8 percent, and a few spots where stones on the surface interfere with normal cultivation.

This soil is suited to many kinds of crops, as well as to pasture and trees, but herbaceous perennials may be damaged by frost heaving in winter. Although the risk of erosion is the main limitation, improved drainage is needed for some uses. (Capability unit IIe–13; woodland suitability group 46)

Hagerstown Series

The Hagerstown series consists of deep, well-drained, level to sloping soils that occur on uplands, mostly in the west-central part of the county. These soils have a surface layer of dark-brown silt loam and a subsoil of yellowish-red to strong-brown silty clay loam, silty clay, or clay loam that is sticky when wet. The native vegetation is made up of hardwoods, dominantly oaks, but almost all areas in Carroll County have been cleared.

The Hagerstown soils warm up early in spring. They are fairly easy to work when they are not too wet or too dry, but clods are formed if the soils are worked when too wet. These soils have high available moisture capacity and produce well under good management. They are among the best soils for farming in the county.

Profile of Hagerstown silt loam, 0 to 3 percent slopes, in a cultivated area about 200 yards west of Wakefield Road and 200 yards south of New Windsor Road:

Ap—0 to 11 inches, dark-brown (7.5YR 4/2) silt loam; strong, medium, granular structure; friable when moist, slightly sticky and slightly plastic when wet; roots abundant; many fine and medium pores; neutral (limed); abrupt, smooth boundary. Horizon is 9 to 11 inches thick.

B21t—11 to 24 inches, strong-brown (7.5YR 5/6) heavy silty clay loam; moderate, fine, subangular blocky structure; firm when moist, sticky and plastic when wet; roots plentiful; many fine and medium pores; thin, almost continuous clay films; slightly acid; gradual, wavy boundary. Horizon is 12 to 18 inches thick.

B22t—24 to 40 inches, yellowish-red (5YR 5/6) silty clay; strong, medium, blocky and subangular blocky structure; firm when moist, sticky and plastic when wet; roots common in upper part; many fine and medium pores; prominent clay films and flows; some black films on block surfaces; medium acid; clear, wavy boundary. Horizon is 15 to 24 inches thick.

B23t—40 to 60 inches +, strong-brown (7.5YR 5/6) clay loam; weak, medium and coarse, blocky structure; very firm when moist, sticky and plastic when wet; few roots; many fine pores; thin, discontinuous, yellowish-red (5YR 5/6) clay films and some black films; medium acid to slightly acid.

The texture of the B2t horizon is mainly silty clay but includes heavy silty clay loam, clay loam, and clay. The average clay content in this horizon is more than 35 percent. In places there are fragments of relict chert or limestone, though their quantity is seldom significant. The solum ranges from 40 to more than 60 inches in thickness, and in some places a loamy or clayey C horizon occurs within a 5-foot depth. Limestone bedrock is at a depth of 5 to 7 feet or more.

The Ap horizon generally has a hue of 7.5YR, a value of 4 or 5, and a chroma of 2 to 4. In the B2t horizon the hue is mainly 5YR but includes 2.5YR and 7.5YR; the value is mostly 5 but may be 4; and the chroma is generally 6 but in places is 4 or 8. The C horizon, where present, has about the same color range as the B horizon. In some places the C horizon and the lower part of the B horizon are variegated. In unlimed areas the

profile is medium acid or slightly acid. The acidity normally decreases with depth, and the base saturation is greater than 35 percent in the lower horizons. The underlying rock is calcareous.

The Hagerstown soils are similar to the Bucks, Conestoga, and Elioak soils in some respects, but they developed from a different kind of material. In comparison with the Bucks soils, the Hagerstown soils are not so red, are less acid, have a more clayey subsoil, and overlie limestone instead of red shale. The Hagerstown soils have a more clayey, less micaceous subsoil than the yellower Conestoga soils. They have a clayey subsoil like that of the Elioak soils, but they are not so red as those soils and are much less acid. In some places the Hagerstown soils occur near the moderately well drained Wiltshire soils, which have a fragipan.

Hagerstown silt loam, 0 to 3 percent slopes (HaA).—This soil has the profile described for the series. It occurs on broad, nearly level ridgetops and is farmed intensively. The soil has few if any features that limit use. (Capability unit I–1; woodland suitability group 25)

Hagerstown silt loam, 3 to 8 percent slopes, moderately eroded (HaB2).—This gently sloping soil has a plow layer that includes subsoil material, but in other respects its profile is similar to the one described for Hagerstown silt loam, 0 to 3 percent slopes. In some fairly large areas the soil contains a few pebbles of limestone or other rock, and locally there are a few small gullies.

This soil is suited to cultivated crops, pasture, and trees. In places where gravel occurs, it does not limit use or productivity. (Capability unit IIe–1; woodland suitability group 25)

Hagerstown silt loam, 8 to 15 percent slopes, moderately eroded (HaC2).—This sloping soil has lost part of its original surface layer through erosion. Included with it are some severely eroded spots where the subsoil is nearly exposed. In addition, there are a few shallow gullies.

This soil is suitable for limited cropping and for pasture and woodland. All the common crops can be grown if erosion is controlled. (Capability unit IIIe–1; woodland suitability group 25)

Hatboro Series

The Hatboro series consists of deep, poorly drained, nearly level and gently sloping soils. These soils occupy the flood plains of streams in all parts of the county except the northwestern. They are dominantly gray; they have a surface layer of olive-gray silt loam and a subsoil of light brownish-gray silt loam that is mottled with shades of yellow, brown, and gray. Hatboro soils contain a considerable amount of fine mica flakes. They are subject to flooding and, in unlimed areas, are strongly acid or very strongly acid. The native vegetation consists of willow, alder, gum, and several kinds of maple and oak. These soils are extensive in the county, but most areas are long and narrow. A fairly large acreage has been cleared.

The Hatboro soils are fairly easy to work when they are not too wet, but excess moisture commonly delays plowing and planting until late in spring. In addition, these soils are frequently covered with water from heavy rainfall or rapid snowmelt. Artificial drainage is needed before the soils can be used intensively, and it lengthens the time that pasture can be grazed. Water moves moderately slowly through the surface layer and subsoil and slowly through the sandy clay loam beneath the subsoil.

Figure 6.—**Preparing a trench for laying tile in an area of Glenville silt loam, 0 to 3 percent slopes, near Manchester.**

Profile of Hatboro silt loam, in a level pastured area along Deep Run Road on the flood plain of Bear Branch, just east of Littlestown Pike:

Ap—0 to 12 inches, olive-gray (5Y 4/2) silt loam; weak, fine and medium, granular structure; friable when moist, slightly sticky and slightly plastic when wet; roots plentiful; many fine and medium pores; some fine specks of brown, apparently organic material, throughout; medium acid (limed); clear, smooth boundary. Horizon is 8 to 12 inches thick.

B2g—12 to 42 inches, light brownish-gray (2.5Y 6/2) heavy silt loam, variegated with light gray (5Y 6/1); common, medium, distinct mottles of olive yellow and yellowish brown (2.5Y 6/6 and 10YR 5/6); very weak, medium, blocky structure; friable to firm when moist, sticky and plastic when wet; a few roots in upper part; no clay films; slightly finer textured with depth; many mica flakes; some fine pores; strongly acid; gradual, irregular boundary. Horizon is 24 to 36 inches thick.

IICg—42 to 60 inches +, gray or light-gray (N 6/0), micaceous gravelly sandy clay loam; common, coarse, distinct mottles of olive (5Y 5/3) and common, coarse, prominent mottles of yellowish brown (10YR 5/6); structureless (massive); weakly stratified; firm when moist, sticky and plastic when wet; no roots; very strongly acid.

In some places the A horizon is light silt loam, and in places it is heavy silt loam. The B2g horizon ranges from silt loam to silty clay loam; its texture may be uniform or may vary with depth. In the B2g horizon there is no evidence of clay accumulation. In places the B2g horizon appears to have platy structure, generally weak, but this likely is stratification. The texture of the IICg horizon is variable but always is coarser than that of the overlying horizons. Some waterworn pebbles can occur in any part of the profile, though their quantity is significant only in the IICg horizon. Occasionally a few flat fragments of mica schist occur in the profile. The solum generally ranges from 30 to 48 inches in thickness. Bedrock is at a depth of 6 to 20 feet or more.

The hue in the solum is 10YR or yellower; in most places it is 2.5Y. The A1, or Ap, horizon has a value of 4 or 5 and a chroma normally of 2. In some places this horizon contains some fine, gray to reddish specks or mottles. In the B2g horizon the value is 5, 6, or, in a few places, 4; the matrix has a chroma of 0, 1, or 2; the mottles generally are redder, in some places as red as 5YR, and they have a chroma and a value of 4 to 6. In some parts of the B2g horizon, however, there may be some mottles of neutral gray. The IICg horizon is 5Y or neutral in hue, and it has a value of 4 to 6 and a chroma of 0 to 2. The mottles in this horizon may be of any contrasting hue; they have a value generally of 5 and a chroma that ranges from 3 to 8 but most commonly is 6.

The Hatboro soils are similar to the Bowmansville and Melvin soils in drainage and susceptibility to flooding. They are less gray than the Bowmansville soils and, unlike those soils, have a high mica content. The Hatboro soils are lighter gray and more acid than the Melvin soils. They occur on the same flood plains as the well drained Comus soils and the moderately well drained Codorus soils.

Hatboro silt loam (Ht).—This soil generally occupies lower areas and depressions on flood plains. It is nearly level in most places but is gently sloping in scattered areas. Just northeast of Westminster, there are small areas in which the surface layer is nearly black because it contains accumulated organic matter.

This soil has high available moisture capacity and produces fairly well if management is good. The risk of flooding is generally moderate, but in places it is severe. Where the soil is drained and protected from floods, it is well suited to corn, hay crops, and improved pasture. The use of areas subject to severe flooding is limited mainly to grazing or woodland. (Capability unit IIIw–7; woodland suitability group 22)

Klinesville Series

The Klinesville series consists of gently sloping to very steep, reddish-brown soils that are shallow and droughty. These soils occupy uplands in the northwestern part of the county. They contain a large amount of rock fragments—shale, sandstone, or siltstone—particularly in the subsoil and in the layer beneath it. The native vegetation is hardwoods, which commonly are small or scrubby. Many areas of Klinesville soils have been cleared in Carroll County, but a fairly large acreage remains wooded.

The Klinesville soils are not difficult to work in areas where the depth to bedrock permits normal plowing, but coarse fragments are abrasive to farm implements. In some places the soils are so shallow that these implements make contact with bedrock. Klinesville soils warm up quickly and can be planted to crops early in spring. Their available moisture capacity is low or very low, and little or no water is available to plants in periods when rainfall is poorly distributed. Droughtiness is the chief limitation that affects use of these soils for farming.

Profile of Klinesville gravelly loam, 3 to 8 percent slopes, moderately eroded, in a cultivated area on Bert Koontz Road, about one-fourth mile east of Sent Road:

Ap—0 to 9 inches, reddish-brown (5YR 4/3) gravelly loam; moderate, fine, granular structure; very friable when moist, very slightly sticky and slightly plastic when wet; roots common; about 30 percent of horizon is angular and subangular pebbles of sandstone; medium acid (limed); abrupt, smooth boundary. Horizon is 8 to 10 inches thick.

B2—9 to 15 inches, reddish-brown (2.5YR 4/4) very gravelly loam; very weak, medium, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; roots fairly common; no clay films; 60 to 70 percent of horizon is angular pebbles of dark-red sandstone and some shale; strongly acid; diffuse boundary. Horizon is 4 to 8 inches thick.

C—15 to 19 inches, about 80 percent angular fragments of dark-red sandstone; reddish-brown (2.5YR 5/4) loam or sandy loam in interstices; very friable; few roots; some shale or siltstone; very strongly acid; abrupt, broken boundary. Horizon is 0 to 7 inches thick.

R—19 inches +, reddish-brown (2.5YR 5/4), fractured but mostly unseparated sandstone and some seams of shale or siltstone.

The A horizon is loam or silt loam in texture and is shaly, channery, or gravelly. The B2 horizon contains no more clay than the A horizon, but in some places it contains less silt. Its content of coarse fragments is more than 50 percent and may be as much as 80 percent. In some places the C horizon is thinner than that in the typical profile. In uneroded areas both the thickness of the solum and the depth to bedrock may be as much as 20 inches. In severely eroded areas, however, the thickness and depth may be less than 10 inches.

The hue of the A horizon is 5YR or 2.5YR. In unplowed areas the soils have an A1 horizon that is generally less than 3 inches thick and is underlain directly by the B2 horizon. The A1, or the Ap, horizon has a value of 3 or 4 and a chroma of 2 to 4. In places the B2 horizon has a hue that approaches 10R or 5YR. In this horizon the value is 3 or 4 and the chroma is 3, 4, or, in a few places, 5. The C horizon and the R layer are much like the B2 horizon in color, but in some places their value is one unit higher than that in the B2 horizon. In unlimed areas the profile is strongly acid or very strongly acid, and the acidity generally increases with depth.

The Klinesville soils are the most shallow soils in Carroll County. They are about the same color as the Penn and Lewisberry soils, but they contain less silt than the Penn soils and less sand than the Lewisberry soils. In addition, the Klinesville soils lack the accumulation of clay that occurs in the subsoil of those soils.

Klinesville gravelly loam, 3 to 8 percent slopes, moderately eroded (KlB2).—This gently sloping soil has the profile described for the series. Practically all of the acreage has been cleared, and some of the original surface layer has been washed away. The soil is suitable for an occasional cultivated crop, as well as for pasture and woodland. Shallowness and the low available moisture capacity are the main limitations that affect use. Crops grow well if rainfall is adequate and well distributed, but in most years there are periods when moisture is insufficient. Supplemental irrigation is of benefit. (Capability unit IVs–32; woodland suitability group 57)

Klinesville soils, 8 to 25 percent slopes, very severely eroded (KsD4).—These soils are so severely eroded that the only part remaining in most places is a thin layer of soil material over bedrock. The soil material is typically 6 to 8 inches thick; it consists mainly of shale or sandstone gravel and includes only a little fine material. Included are small areas in which bedrock is exposed.

These soils have such severe limitations that they are of little use for farming. A permanent cover of plants is needed for reducing runoff and controlling erosion. Trees can be grown, and pasture is suitable if grazing is carefully managed. (Capability unit VIIs–32; woodland suitability group 58)

Klinesville soils, 15 to 65 percent slopes, severely eroded (KsF3).—These moderately steep to very steep soils ordinarily consist of about 1 foot of very shaly or gravelly soil material over bedrock. This material is chiefly the remaining part of the subsoil and C horizon, and it is cut by a few gullies that extend to bedrock. Included with these

soils are small wooded areas in which erosion has been less than severe.

These soils are not suited to cultivated crops. They are droughty and highly susceptible to erosion, and they should be kept under permanent vegetation. Trees can be planted in cleared areas, and sod plants can be grown for pasture if grazing is carefully managed. (Capability unit VIIs–32; woodland suitability group 58)

Lewisberry Series

The Lewisberry series consists of moderately deep or deep, gently sloping to moderately steep, reddish-brown soils on uplands, mainly northeast of Taneytown. The surface layer of these soils is fine sandy loam. It is darker colored than the loam or light loam subsoil, and both layers contain many angular pebbles of red sandstone. Lewisberry soils are somewhat excessively drained, and they tend to be droughty if rainfall is poorly distributed. The native vegetation is made up of hardwoods, chiefly oaks.

The Lewisberry soils are easy to work, but they contain gravel that is abrasive to tillage implements. In spring they warm up quickly enough for some of the earliest crops. These soils have moderate available moisture capacity, but at times their supply of available water is too limited for crops, especially if the weather is hot and dry. Under good management, including supplemental irrigation where needed, the soils produce fairly well. If they are kept supplied with plant nutrients, they are suited to many kinds of crops.

Profile of Lewisberry gravelly fine sandy loam, 3 to 8 percent slopes, in a cultivated area on Bert Koontz Road, about one-half mile east of Senet Road:

Ap—0 to 10 inches, dark reddish-brown (5YR 3/4) gravelly fine sandy loam; weak, fine, granular structure; very friable when moist; roots plentiful; medium acid (limed); clear, smooth boundary. Horizon is 8 to 10 inches thick.

B21t—10 to 16 inches, reddish-brown (2.5YR 4/4) gravelly light loam; weak to moderate, fine, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; roots common; a few thin clay films; about 15 percent of horizon is pebbles of red sandstone; strongly acid; gradual, wavy boundary. Horizon is 6 to 10 inches thick.

B22t—16 to 30 inches, reddish-brown (2.5YR 4/4) gravelly loam; weak to moderate, medium, subangular blocky structure; friable when moist, sticky and slightly plastic when wet; roots few to common; some thin clay films; about 30 percent is angular pebbles of red sandstone; very strongly acid; gradual, irregular boundary. Horizon is 10 to 20 inches thick.

C—30 to 42 inches, dark reddish-brown (2.5YR 3/4) very gravelly sandy loam; structureless (single grain); loose to very friable; a very few roots; about 60 percent of horizon is coarse angular pebbles of red sandstone, together with some angular cobblestones and stones; very strongly acid; gradual, irregular boundary. Horizon is 6 to 15 inches thick.

R—42 inches +, fractured but mostly unseparated, dusky-red to reddish-brown, coarse-grained sandstone.

The B2t horizon is heavy sandy loam or loam. The sand grains in the C horizon are coarser than those in the B2t horizon. Sandstone fragments make up the gravel in the profile. The content of these fragments is less than 50 percent in the solum but generally is more than 50 percent in the C horizon. Many of the fragments in the C horizon are cobblestones and stones. The solum ranges from 25 to 40 inches in thickness, but in most places it is about 30 inches thick. The depth to bedrock ranges from 42 to 60 inches in uneroded areas. In sloping, severely eroded spots, however, the depth is less than 40 inches.

In places the hue in the A horizon grades toward 7.5YR. In undisturbed areas the soils have an A1 horizon as much as 3 inches thick and an A2 horizon as much as 10 or 12 inches thick. In the A1 horizon, both the value and chroma normally are 2. Generally, the A2 horizon has a value of 4 and a chroma of 2 or 3. The B and C horizons have a hue of 2.5YR or redder, a value of 3 or 4, and a chroma of 4 or 6. Unlimed, the profile is strongly acid or very strongly acid, and the acidity generally increases with depth.

The Lewisberry soils occur with the Penn, Klinesville, and Steinsburg soils, but they are more sandy than all of those soils. In addition, the Lewisberry soils contain less silt than the Penn soils, they are deeper to bedrock than the Klinesville soils, and they are not so brown as the Steinsburg soils.

Lewisberry gravelly fine sandy loam, 3 to 8 percent slopes, moderately eroded (lbB2).—The profile of this gently sloping soil is the one described as typical for the series. Part of the original surface layer has been washed away, but the main features that restrict use are seasonal droughtiness, low natural fertility, and somewhat limited thickness of the solum. A few included spots are severely eroded. (Capability unit IIs–2; woodland suitability group 49)

Lewisberry gravelly fine sandy loam, 8 to 15 percent slopes, moderately eroded (lbC2).—This sloping soil is more erodible than Lewisberry gravelly fine sandy loam, 3 to 8 percent slopes, moderately eroded. Sandiness, droughtiness, and low fertility are other limitations. Nevertheless, the soil can be cropped, pastured, or used as woodland if it is well managed. Some included spots are severely eroded, and in places there are shallow gullies. (Capability unit IIIe–5; woodland suitability group 49)

Lewisberry gravelly fine sandy loam, 15 to 25 percent slopes (lbD).—Most of this moderately steep soil has remained wooded and is uneroded. In places, however, some of the original surface layer has been washed away, and shallow gullies are widely scattered.

This soil is suited to hay crops, pasture, sodded orchards, or trees. A tilled crop can be safely grown only occasionally. The hazard of erosion is a severe limitation. (Capability unit IVe–5; woodland suitability group 49)

Lindside Series

In the Lindside series are deep, nearly level soils that occur on the flood plains of streams in the west-central part of the county. These soils have a surface layer of dark grayish-brown silt loam. Their subsoil is brown or olive brown in the upper part and is dark gray to dark bluish gray and mottled in the lower part. Lindside soils are nearly neutral in reaction and generally require no lime. The native vegetation is hardwoods, principally oak, hickory, and maple, but almost all areas in the county have been cleared.

The Lindside soils are fairly easy to work if they are neither too wet nor too dry, but in spring they are commonly wet and late to warm up. In addition, they are subject to flooding, especially in winter and spring. For these reasons, plowing and planting are usually somewhat delayed. Draining the soils generally is beneficial, and it lengthens the grazing period on pasture. In areas where outlets are adequate, tile lines or open ditches can be used to improve drainage. These soils have high available moisture capacity, and water moves through them readily. If they are drained, the Lindside soils produce well and are suited to many kinds of crops.

Profile of Lindside silt loam, in a level pastured area on the flood plain of Turkeyfoot Run, near the intersection of New Windsor Road and Wakefield Valley Road:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, granular structure; friable when moist, slightly sticky and slightly plastic when wet; roots plentiful; neutral; clear, smooth boundary. Horizon is 8 to 10 inches thick.

B1—10 to 20 inches, brown (10YR 5/3) heavy silt loam; very weak, fine, subangular blocky structure; friable to firm when moist, sticky and slightly plastic when wet; roots common; slightly acid; gradual, wavy boundary. Horizon is 10 to 12 inches thick.

B2—20 to 30 inches, olive-brown (2.5Y 4/4) light silty clay loam; many, fine, faint mottles of olive gray (5Y 5/2) and fine prominent mottles of reddish brown (5YR 5/3); very weak, thick, platy structure and medium blocky structure; firm when moist, sticky and plastic when wet; no roots; some very fine pores; slightly acid; gradual, smooth boundary. Horizon is 8 to 14 inches thick.

B3g—30 to 40 inches, dark-gray (5Y 4/1) to dark bluish-gray (5B 4/1) silty clay loam; common, coarse, prominent mottles of dark yellowish brown (10YR 4/4); very weak, coarse, blocky structure; firm when moist, very sticky and very plastic when wet; no roots; slightly acid to neutral; abrupt, smooth boundary. Horizon is 10 to 12 inches thick.

IICg—40 to 60 inches +, light-gray (5Y 7/1), loose gravelly coarse sand; structureless (single grain); neutral to alkaline.

The texture of the B horizon ranges from silt loam to silty clay loam. Although the B horizon is finer textured than the A horizon in some places, it shows no evidence of clay accumulation, and any difference in texture is probably the result of stratification. The IICg horizon consists of any kind of unconforming material. Fine waterworn pebbles can occur in any part of the profile, but they are seldom common except in the IICg horizon.

The B1 horizon has a value of 4 or 5 and a chroma of 3 or 4. The A1, or Ap, horizon is commonly one unit lower in value and is generally one unit lower in chroma than the B1 horizon. The matrix of the B2 horizon has a hue of 10YR or 2.5Y, a value of 4 or 5, and a chroma of 4 to 6. Most mottles in the B2 horizon are redder than the matrix; their value is 3 to 5 and their chroma is 2 to 4; but in all parts of the horizon there is mottling with a chroma of 2 or less.

The B3g horizon has a hue of 5GY or 5G in some places. Its value is 3 to 5, and its chroma is 1, 2, or, in a few places, 3. Most of the mottles in the B3g horizon range from 10YR to 5YR in hue; they have a value of 4 or 5 and a chroma of 4 to 6; but in places there are mottles of neutral gray. The hue in the IICg horizon is neutral, 5Y, or 5GY; the value is 4 to 7; and the chroma is 0 to 2. This horizon is mottled in some places. The depth to unconforming bedrock ranges from 6 to 20 feet or more. The pH and base saturation commonly increase with depth.

The Lindside soils are similar to the Codorus and Rowland soils in drainage and susceptibility to flooding. They have about the same appearance as the Codorus soils but are considerably less acid. Lindside soils are not reddish or pink like the Rowland soils, and they are much less acid. The Lindside soils lie on the same flood plains as the poorly drained Melvin soils, which are grayer and wetter than Lindside soils and generally are more frequently flooded.

Lindside silt loam (le).—This soil is nearly level and generally has a smooth surface. In most places it is flooded only occasionally, but in small included areas flooding is a severe hazard. In addition, the soil has a high water table.

After this soil is drained and, where necessary, protected from overflow, it produces a good growth of hay crops, pasture, and row crops such as corn. In areas that are subject to severe flooding, use is limited mainly to grazing and woodland. (Capability unit IIw–7; woodland suitability group 29)

Linganore Series

The Linganore series consists of moderately deep, gently sloping to steep, somewhat excessively drained soils that occupy uplands, mostly in the eastern part of the county. These soils have a surface layer of dark-gray silt loam and a subsoil of light olive-brown light silty clay loam. Both layers contain a large amount of gray to dark-gray fragments of slaty schist. The native vegetation on these soils is hardwoods, chiefly oaks, but many areas have been cleared.

The Linganore soils warm up early in spring and are easy to work if they are not too wet or too dry. The coarse fragments do not hinder cultivation but are abrasive to farm implements. Moisture is held fairly well in these soils, but the available moisture capacity is only low to moderate. Linganore soils produce well under good management and are suitable for many uses. The main limitations are the erosion hazard and the limited depth to bedrock.

Profile of Linganore channery silt loam, 3 to 8 percent slopes, moderately eroded, in a cultivated area on Wine Road, about one-fourth mile south of Deep Run Road:

Ap—0 to 10 inches, dark-gray (10YR 4/1) channery silt loam; moderate, medium, granular structure; friable when moist, slightly sticky and slightly plastic when wet; roots plentiful; medium acid to slightly acid (limed); abrupt, smooth boundary. Horizon is 8 to 10 inches thick.

B2t—10 to 20 inches, light olive-brown (2.5Y 5/4) channery light silty clay loam; moderate, medium, subangular blocky structure; friable to firm when moist, sticky and plastic when wet; roots common; some thin, discontinuous clay films; 60 percent of horizon is schist fragments that are strongly coated; strongly acid; gradual, irregular boundary. Horizon 4 to 10 inches thick.

C—20 to 32 inches, about 90 percent channery fragments and 10 percent grayish-brown (10YR 5/2) to reddish-gray (5YR 5/2) silt and clay, variegated with gray and dark gray (10YR 5/1 and N 4/0); inherent schistose structure; very few roots; strongly acid; gradual, irregular boundary. Horizon is 10 to 15 inches thick.

R—32 inches +, hard, dark-gray, fractured but mostly unseparated slaty schist.

Fragments of hard schist make up 20 to 40 percent of the A horizon. The B2t horizon is heavy silt loam or light silty clay loam, and it has a content of schist fragments ranging from more than 50 percent to 80 percent. Locally, the soils contain angular pebbles, cobblestones, or small stones of quartzite. Hard schist crops out in some places. In uneroded areas the solum ranges from 12 to 24 inches in thickness. The depth to hard bedrock is 20 to 36 inches.

In undisturbed or wooded areas, the Linganore soils have an A1 horizon as much as 2 inches thick and an A2 horizon 4 to 6 inches thick. The A horizon generally is 10YR in hue. Normally, the A1 horizon has a value of 3 and a chroma of 1. The Ap, or A2, horizon generally has a value of 4 and a chroma of 1 or 2. In the B2t horizon the hue is 2.5Y or 10YR but locally approaches 7.5YR; the value is commonly 5 but may be 4; and the chroma is normally 4 but may be 3. In places the C horizon is variegated with hues of 5YR or neutral to 7.5YR and 5YR. Generally, however, this horizon is dominantly gray; its value is 4 or 5 and its chroma is 0, 1, 2, or, in spots, 4 to 6. The grayness and variegated colors are inherited from the parent rock; they are not caused by wetness or poor aeration.

The Linganore soils are similar to no other soils in Carroll County. They contain many rock fragments, like the Cardiff and Mt. Airy soils, but the Linganore soils have more clay in their subsoil, and they are underlain by a different kind of rock. They are not so deep to bedrock as the Cardiff soils. The Linganore soils formed over schist, just as the Urbana soils did, but they lack the dense hardpan of those soils and are not seasonally wet.

Linganore channery silt loam, 3 to 8 percent slopes, moderately eroded (LnB2).—This gently sloping soil has the profile described as typical for the series. Included are small areas that are nearly level, scattered spots that are severely eroded, and a few small areas that are slightly wet.

This soil is suited to cultivated crops, pasture, and trees. Although the soil is only moderately deep and is seasonally droughty, its use is limited mainly by the erosion hazard. (Capability unit IIIe–10; woodland suitability group 51)

Linganore channery silt loam, 8 to 15 percent slopes, moderately eroded (LnC2).—This sloping soil is the most extensive of the Linganore soils in Carroll County. Included with it are small wet spots.

This soil is suited to pasture, trees, and an occasional cultivated crop. The hazard of erosion is the main limitation. (Capability unit IVe–10; woodland suitability group 51)

Linganore channery silt loam, 8 to 15 percent slopes, severely eroded (LnC3).—This sloping soil has lost through erosion practically all of the original material above the subsoil and, in many places, part or all of the subsoil itself. Many rills and gullies have been formed, and some of the gullies extend to bedrock. Included are a few wet spots.

This soil is not suitable for regular cultivation, but it can be safely used for hay crops, pasture, sodded orchards, or woodland. The depth of the root zone is limited, however, and all plants show signs of too little moisture in dry periods. Even under the best management, crops fail to grow well. (Capability unit VIe–3; woodland suitability group 51)

Linganore channery silt loam, 15 to 25 percent slopes, moderately eroded (LnD2).—This moderately steep soil is still wooded in many areas. If it is well managed and protected, the soil is suitable for permanent hay, pasture, or orchards. It is not suitable for cultivation. (Capability unit VIe–3; woodland suitability group 52)

Linganore channery silt loam, 25 to 45 percent slopes (LnE).—This steep soil generally is wooded and uneroded. Included with it are areas that have been cleared and are severely eroded. Here, gullies are common and bedrock is exposed in some places. Some of the inclusions have slopes of a little less than 25 percent.

This soil is too steep and too erodible for cultivation. It should be protected by a permanent cover of grass, herbs, shrubs, vines, or trees, but vegetation may be difficult to establish and maintain. (Capability unit VIIe–3; woodland suitability group 52 on north-facing slopes, 58 on south-facing slopes)

Made Land

Made land (Md) consists of areas that have been so disturbed or modified by grading or filling that the soils cannot be classified. This land type occurs mainly in and near towns, where it is generally used for residential or commercial developments or other nonfarm purposes. (Capability unit and woodland suitability group not assigned)

Manor Series

The Manor series consists of deep, nearly level to very steep, somewhat excessively drained soils on uplands. These soils have a very thin, dark-brown surface layer and a rather thin, yellowish-red or reddish-brown subsoil. Both layers are very friable loam. Underlying the subsoil is very friable, highly micaceous material that extends to a great depth. The native vegetation is hardwoods, principally oaks, but pines have invaded in some places. The Manor soils are extensive; in some areas in the eastern and southeastern parts of the county, they are dominant in the landscape. They are important to farming, and large areas have been cleared.

The Manor soils warm up quickly in spring and are easy to work. In many places, however, they contain a large amount of hard quartzite fragments that are highly abrasive to plows and other farm implements, though they do not hinder cultivation. These soils have moderate to high available moisture capacity; the thick material beneath the subsoil can store a large amount of moisture and is easily penetrated by roots. Because the Manor soils are so micaceous, they are highly susceptible to erosion.

Profile of Manor loam, 8 to 15 percent slopes, moderately eroded, in a wooded area on Ridge Road, about one-half mile north of Marriottsville Road:

A1—0 to 2 inches, dark-brown (7.5YR 4/4) loam; weak, fine, granular structure; very friable when moist; roots abundant; many fine pores; strongly acid; abrupt, wavy boundary. Horizon is 1 to 4 inches thick.

B1—2 to 8 inches, reddish-brown (5YR 4/4) loam; weak, fine, granular structure; very friable when moist, slightly sticky and slightly plastic when wet; many roots; abundant pores; some angular fragments of white quartzite; strongly acid; clear, wavy boundary. Horizon is 5 to 10 inches thick.

B2—8 to 23 inches, yellowish-red (5YR 4/6) loam; weak, medium, granular structure and very weak, fine, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; roots common; many pores; no clay films; some fine chips of schist and fragments of quartzite; much fine mica; very strongly acid; gradual, wavy boundary. Horizon is 12 to 20 inches thick.

C—23 to 90 inches +, streaked and variegated, extremely micaceous saprolite of loam texture; colors include pale brown, yellowish brown, strong brown, yellowish red, weak red, red, and dark red; inherent schistose structure prominent; very friable; few roots; very porous; some thin veins of fractured quartzite, and some weathered soft schist fragments; very strongly acid.

The A horizon is loam, gravelly loam, or very stony loam. The coarse fragments are angular and consist of hard, white quartzite. In places the B horizon, particularly the B2 part of it, contains more silt than the A horizon and grades toward silt loam. In the B horizon, however, there is little or no increase in clay content and clay films are lacking. The solum ranges from 15 to 25 inches in thickness. The depth to bedrock is more than 6 feet in most places, and it may be 10 to 20 feet or more.

In cultivated areas the plow layer is yellowish brown, yellowish red, or reddish brown. In the B2 horizon the hue ranges from 7.5YR to 2.5YR, the value is 4 or 5, and the chroma is 6 or 8. The C horizon may be banded or variegated with almost any color, but the dominant color generally is yellowish red, red, or weak red. In unlimed areas the profile is strongly acid or very strongly acid.

The Manor soils are similar to no other soils in Carroll County. They resemble the Cardiff and Steinsburg soils in some respects, but they are underlain by a different kind of rock at a much greater depth. The Manor soils occur with other soils that developed in material from micaceous rock. Among these are soils of the Baile, Chester, Glenelg, Elioak, Glenville, and Mt. Airy series. All of these soils differ from the Manor soils in major characteristics.

Manor gravelly loam, 3 to 8 percent slopes, moderately eroded (MgB2).—Angular pebbles of hard, white quartzite make up 15 to 30 percent of the plow layer of

this gently sloping soil. The pebbles are less than 3 inches across and do not affect the suitability of the soil for use. Included are a few nearly level areas, and some widely scattered areas that are severely eroded.

This soil is suited to cultivated crops, pasture, and trees. The hazard of erosion is the main limitation. (Capability unit IIe–25; woodland suitability group 43)

Manor gravelly loam, 8 to 15 percent slopes, moderately eroded (MgC2).—This sloping soil has lost part of its original surface layer through erosion, and it is marked by a few shallow gullies. Cultivated crops, pasture, and woodland are suitable. The main limitation affecting use is the risk of erosion. (Capability unit IIIe–25; woodland suitability group 43)

Manor gravelly loam, 8 to 15 percent slopes, severely eroded (MgC3).—Erosion has removed almost all of the original surface layer from this sloping soil. So much of the fine soil material has been washed away that the plow layer has a high content of gravel, and in many places the surface appears paved with fragments of hard quartzite. These fragments cause excessive wear to farm implements, particularly plows and cultivators. Shallow gullies and some deep ones have been formed.

Suitable crops for this soil are ones that require little if any tillage. These include sodded orchards, hay crops, pasture, and trees. In addition, a cultivated crop can be grown occasionally. (Capability unit IVe–25; woodland suitability group 43)

Manor gravelly loam, 15 to 25 percent slopes, moderately eroded (MgD2).—Much of this moderately steep soil is still woodland. The soil is too steep for regular cultivation; it is suited to sodded orchards, deep-rooted crops for hay or pasture, and an occasional cultivated crop. Areas now in trees should be kept wooded. (Capability unit IVe–25; woodland suitability group 44)

Manor gravelly loam, 15 to 25 percent slopes, severely eroded (MgD3).—This moderately steep soil has lost all of its original surface layer and, in some places, most of its subsoil through erosion. The soil surface is covered with hard gravel. Gullies are common, and some of them are deep.

This soil is not suited to cultivated crops. It is suited to hay crops, pasture, trees, or other plants that provide a permanent cover. (Capability unit VIe–3; woodland suitability group 44)

Manor loam, 0 to 8 percent slopes, moderately eroded (MlB2).—This nearly level and gently sloping soil is the most extensive of the Manor soils in Carroll County. Generally, it has lost part of its original surface layer through erosion, and in a few places there are shallow gullies.

This soil is suited to most crops commonly grown in the county. The hazard of erosion is the main limitation. (Capability unit IIe–25; woodland suitability group 43)

Manor loam, 3 to 8 percent slopes, severely eroded (MlB3).—All of the original surface layer has been washed away from this gently sloping soil. The present surface layer is redder than the original one, and it is more easily eroded. The soil is cut by a few shallow gullies, by many rills, and in places by a few, deep, caving gullies.

This soil is suitable for limited cropping, and it can be safely used for pasture and woodland. (Capability unit IIIe–25; woodland suitability group 43)

Manor loam, 8 to 15 percent slopes, moderately eroded (MlC2).—This sloping soil has the profile described as typical for the series. Cultivated crops, pasture, and trees are suitable. The hazard of erosion is the main limitation. (Capability unit IIIe–25; woodland suitability group 43)

Manor loam, 8 to 15 percent slopes, severely eroded (MlC3).—Erosion has removed all of the original surface layer and part of the subsoil from this sloping soil. Few to many gullies have been formed, and some of them are deep.

This soil is suited to hay crops, pasture, sodded orchards, woodland, and an occasional row crop. Erosion is a severe hazard. (Capability unit IVe–25; woodland suitability group 43)

Manor loam, 15 to 25 percent slopes, moderately eroded (MlD2).—This moderately steep soil is cut by shallow gullies in some places. It is highly susceptible to erosion and is not suitable for regular cultivation. Pasture and woodland are among the suitable uses. Many areas have never been cleared. (Capability unit IVe–25; woodland suitability group 44)

Manor loam, 15 to 25 percent slopes, severely eroded (MlD3).—This moderately steep soil is highly erodible and cannot be safely used for crops. It is suitable for hay crops, pasture, woodland, or sodded orchards. (Capability unit VIe–3; woodland suitability group 44)

Manor loam, 25 to 45 percent slopes (MlE).—This steep soil is only slightly eroded in many places, because it has been protected by a stand of trees. Much of the acreage has been seriously damaged, however, and in some places erosion has been so severe that the soil can no longer be used for farming. Included are small areas where slopes are greater than 45 percent.

This soil is suited to plants that provide a permanent cover and are used for wildlife, recreation, and watershed protection. Among these plants are grasses, shrubs, vines, and trees. Small areas can be used for limited grazing. (Capability unit VIIe–3; woodland suitability group 44)

Manor very stony loam, 3 to 15 percent slopes (MnC).—This gently sloping and sloping soil is only slightly eroded, but it is so stony that it cannot be farmed with modern equipment. If some of the stones are removed, the soil can be used for hay or pasture. The soil also can be used as woodland or, in some places, for orchards. (Capability unit VIs–3; woodland suitability group 43)

Manor very stony loam, 15 to 25 percent slopes (MnD).—If some of the stones are removed, this moderately steep soil can be used for permanent hay or pasture or, in places, for orchards. Another suitable use is woodland. (Capability unit VIs–3; woodland suitability group 44)

Manor very stony loam, 25 to 45 percent slopes (MnE).—This soil is too steep and too stony for the satisfactory production of hay or pasture. It is more suitable as woodland or for recreation. (Capability unit VIIs–3; woodland suitability group 44)

Manor very stony loam, 45 to 75 percent slopes (MnF).—This soil is too steep and generally is too stony for farming, and it produces a poor growth of trees. It is suitable for use in watershed protection, for some kinds of wildlife, and for parks and recreation. Included are small areas where the soil contains fewer stones than this Manor soil. In these inclusions the soil is shallow to bedrock or has a high content of coarse fragments smaller than stones, or both. (Capability unit VIIs–3; woodland suitability group 45)

Melvin Series

The Melvin series consists of deep, poorly drained, nearly level soils on flood plains along the streams in the west-central part of the county. These soils are dominantly dark gray. They have a surface layer of dark grayish-brown silt loam and a subsoil of dark-gray or grayish silt loam or silty clay loam that is mottled with various shades of brown. The Melvin soils are subject to frequent flooding. They are slightly acid or neutral and require no lime. The native vegetation is made up of water-tolerant hardwoods, including willow, oak, and maple, but most areas have been cleared.

The Melvin soils are difficult to work if they are too wet or too dry. Excess moisture commonly delays plowing and planting until late in spring. Artificial drainage is needed if the soils are to be used intensively, and it lengthens the grazing period on pasture. Water moves fairly readily through the surface layer and the upper part of the subsoil, but it moves much more slowly through the lower subsoil and the clay beneath it. In areas where outlets are adequate, however, the soils can be drained by tiling or ditching.

Profile of Melvin silt loam, in a level pastured area on the flood plain of Little Pipe Creek, about two-tenths of a mile east of Union Bridge:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) heavy silt loam; moderate, fine, granular structure; friable when moist, sticky and plastic when wet; roots abundant; many fine and medium pores; slightly acid to neutral; clear, smooth boundary. Horizon is 8 to 10 inches thick.

B21g—9 to 18 inches, dark-gray (10YR 4/1) heavy silt loam; many, medium, distinct mottles of brown (10YR 5/3); weak, fine, granular structure and very weak, very thin, platy structure; friable to firm when moist, sticky and plastic when wet; a few roots in upper part; no clay films; many fine pores; slightly acid to neutral; clear, wavy boundary. Horizon is 8 to 10 inches thick.

B22g—18 to 36 inches, dark grayish-brown (2.5Y 4/2) light silty clay loam; many, medium, distinct mottles of yellowish brown (10YR 5/6); very weak, coarse, blocky structure; firm when moist, sticky and plastic when wet; no roots; no clay films; some very fine pores; slightly acid to neutral; gradual, wavy boundary. Horizon is 12 to 20 inches thick.

IICg—36 to 50 inches +, dark bluish-gray (5B 4/1) clay; common, coarse, distinct mottles of olive brown (2.5Y 4/4) and black (5Y 2/2); structureless (massive); weakly stratified; firm when moist, very sticky and very plastic when wet; no roots; neutral.

In most places the A horizon grades toward light silty clay loam. The B21g and B22g horizons range from silt loam to silty clay loam; they are commonly finer textured with increasing depth. The difference in the texture of these horizons is the result of differential sedimentation, not of translocation and accumulation of clay. The material in the IICg horizon is geologically much older than the material above it and possibly consists of sediments deposited in slack water. A few, fine, waterworn pebbles can occur in any part of the profile. Generally, the solum ranges from 30 to 40 inches in thickness. The depth to unconforming bedrock is 6 to 20 feet or more.

In undisturbed areas these soils have an A1 horizon less than 6 inches thick. The Ap, or A1, horizon has a value of 3 or 4 and a chroma of 2 or, in a few places, 1. The value in the Ap horizon is commonly one unit higher than that in the A1 horizon.

The B21g horizon has a matrix hue of 10YR or yellower, a value of 3 to 5, and a chroma of 1 or 2. The mottles in this horizon generaly have a hue of 10YR or redder, a value of 4 or 5, and a chroma of 2 to 4, though in places there are mottles of neutral gray. In the B22g horizon the hue is 2.5Y or 5Y, the value is normally 4 but may be higher, and the chroma is 1 or 2. Mottling in the B22g horizon is mostly 2.5 to 5 units less yellow in hue than the hue of the matrix. These mottles have a value of 4 to 7 and a chroma of 4 to 6. In the IICg horizon the hue is 5Y, 5GY, 5G, 5BG, or 5B; the value is 4 to 7; and the chroma is mostly 1. Mottling in this horizon has a hue of 5Y, 2.5Y, or 10YR; a value of 3 to 6; and a chroma generally of 4.

The Melvin soils are similar to the Bowmansville and Hatboro soils in drainage and susceptibility to flooding. They have a darker gray subsoil than the Bowmansville soils, and their surface layer is not reddish like the one in those soils. The Melvin soils lack the olive-gray surface layer and the fine mica flakes that characterize the Hatboro soils. In addition, the Melvin soils are much less acid than all of those soils. Melvin soils occupy the same flood plains as the moderately well drained Lindside soils.

Melvin silt loam (Mo).—This nearly level soil occurs on the lowest part of the flood plains, where it is subject to a moderate risk of flooding. In small included areas the hazard of flooding is severe.

This soil has high available moisture capacity and, if it is well managed, produces a good growth of crops. In areas that are drained and protected from floodwater, the soil is suited to corn, many kinds of plants grown for hay, and improved pasture. (Capability unit IIIw–3; woodland suitability group 22)

Mt. Airy Series

The Mt. Airy series consists of nearly level to steep, moderately deep, somewhat excessively drained soils. These soils have a surface layer of grayish-brown or light yellowish-brown loam and a subsoil of reddish-yellow light silt loam. They contain a large amount of flattish fragments of hard mica schist, the rock from which they were derived.

The Mt. Airy soils are the most extensive in the county and make up about one-third of the total acreage. They are widely distributed and occur in all parts of the county except the extreme northwestern, but they are not common in the extreme southeast. The native vegetation is hardwoods, dominantly oaks. Pines have invaded a few cutover areas. In some places the soils are still wooded, but a great part of their acreage has been cleared.

These soils warm up quickly enough in spring for all normal farming operations. They are not difficult to work, though their rock fragments cause excessive wear on farm implements. Mt. Airy soils have moderate available moisture capacity and produce a moderate growth of crops under good management. They are suitable for most uses. The major limitations are restricted depth, limited available moisture capacity, and the risk of erosion.

Profile of Mt. Airy channery loam, 0 to 3 percent slopes, in a wooded area just south of Nicodemus Road, about one-eighth mile west of Salem Bottom Road:

A1—0 to 2 inches, grayish-brown (10YR 5/2) channery heavy loam; moderate, fine, granular structure; very friable when moist, slightly plastic when wet; roots abundant; many pores of all sizes; strongly acid; clear, wavy boundary. Horizon is 1 to 2 inches thick.

A2—2 to 8 inches, light yellowish-brown (2.5YR 6/4) channery heavy loam; weak, medium, granular structure; friable when moist, slightly sticky and slightly plastic when wet; roots abundant; many pores of all sizes; strongly acid; clear, wavy boundary. Horizon is 4 to 7 inches thick.

B2—8 to 23 inches, reddish-yellow (7.5YR 6/6) channery light silt loam; moderate, very fine, subangular blocky structure; friable when moist, sticky and moderately plastic when wet; roots fairly common; many pores of all sizes; no clay films; about 60 to 75 percent of horizon is fragments of hard mica schist, and these increase in quantity with depth; strongly to very strongly acid; gradual, irregular boundary. Horizon is 12 to 18 inches thick.

C—23 to 36 inches, fragmented and separated schist that is coated with yellowish-red (5YR 5/6) silty material; few roots; strongly to very strongly acid; gradual, irregular boundary. Horizon is 10 to 20 inches thick.

R—36 inches +, hard, yellowish-brown mica schist; fractured but mostly unseparated and uncoated.

In texture the A horizon of Mt. Airy soils is commonly near the boundary that separates loam and silt loam. In some places the silt content of the B2 horizon is greater than that of the A horizon, but there are no visible clay films on structural aggregates in the B2 horizon. The content of schist fragments is 15 to 25 percent in the A horizon, but it increases markedly with depth, and the average content of these fragments throughout the profile is more than 50 percent. A few stones of hard schist and some angular fragments of hard white quartzite can occur in any part of the profile. The fragments range from pebbles to stones in size. The solum is 15 to 36 inches thick, and the depth to bedrock is 20 to 40 inches. Bedrock consists of hard mica schist (fig. 7).

The A horizon has a hue of 10YR or 2.5Y. In the A1 horizon the value is 3 to 5 and the chroma is 1 or 2. The A2 horizon has a value of 4 to 6 or, in some places, 7; and a chroma of 3, 4, or, in some places, 6. In the Ap horizon the value and chroma generally are intermediate between those of the A1 and the A2 horizons. In the B2 horizon the hue centers on 7.5YR but includes 10YR and 5YR; the value is 5 or 6; and the chroma is 4 or 6. The C horizon is similar to the B2 horizon in color, but its chroma may be somewhat lower. In unlimed areas the profile is strongly acid to extremely acid, and the acidity generally increases with depth.

The Mt. Airy, Cardiff, and Steinsburg soils all contain fragments of hard rock, but the rock is yellowish-brown mica schist in the Mt. Airy soils, gray slate in the Cardiff soils, and brown sandstone in the Steinsburg soils. Mt. Airy soils are a little deeper than Linganore soils, which have a more sticky, somewhat finer textured subsoil and are underlain by hard, dark-gray, slaty schist. The Mt. Airy soils occur with many other soils that developed on mica schist. These soils are of the Baile, Chester, Elioak, Glenelg, Glenville, and Manor series.

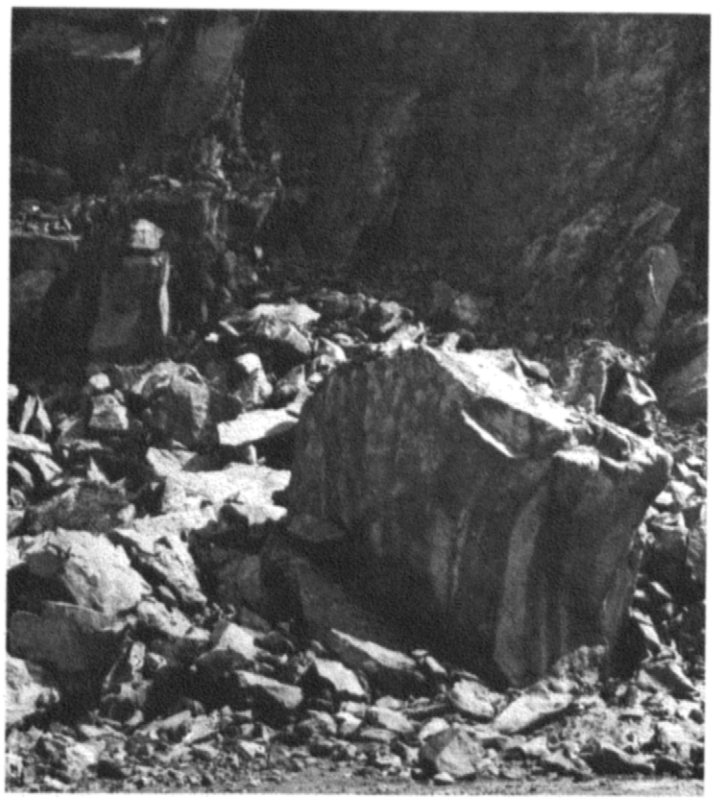

Figure 7.—**A quarry in an area of hard mica schist, the rock from which the Mt. Airy soils were derived. The white, almost vertical lines are injections of hard quartzite.**

Mt. Airy channery loam, 0 to 3 percent slopes (MtA).—This nearly level soil has the profile described for the series. Figure 8 shows a road cut through this soil, near the location of the typical profile. A few included areas are moderately eroded.

This soil is of limited use for crops but is suitable for pasture or woodland. Although erosion is only a slight hazard, restricted depth and moderate available moisture capacity are adverse features that affect use. (Capability unit IIIs–1; woodland suitability group 51)

Mt. Airy channery loam, 3 to 8 percent slopes, moderately eroded (MtB2).—This gently sloping soil is extensive in Carroll County. Most of it has lost a large part of the original surface layer through erosion. Included spots are severely eroded, and in places there are shallow gullies.

This soil is suited to cultivated crops but is better suited to pasture and trees. The hazard of erosion is the main limitation. Also affecting use are the limited depth to bedrock and seasonal droughtiness. (Capability unit IIIe–10; woodland suitability group 51)

Mt. Airy channery loam, 8 to 15 percent slopes, moderately eroded (MtC2).—This sloping soil is the most extensive soil in Carroll County. Generally, it has lost some of its original surface layer through erosion, and in a few places it is cut by shallow gullies.

This soil is suitable for pasture, woodland, and an occasional cultivated crop. In fields that are cropped, contour farming and contour stripcropping are among the measures needed to check soil losses. (Capability unit IVe–10; woodland suitability group 51)

Mt. Airy channery loam, 8 to 15 percent slopes, severely eroded (MtC3).—Most of the original surface layer has been washed away from this sloping soil, and in many places a good part of the rather thin subsoil is gone. Shallow gullies are common, and some deeper ones have been formed.

This soil is unsuitable for cultivation. It is fairly suitable, however, for sodded orchards, woodland, or the limited production of hay crops or pasture. (Capability unit VIe–3; woodland suitability group 51)

Mt. Airy channery loam, 15 to 25 percent slopes, moderately eroded (MtD2).—This moderately steep soil is still wooded in many places. Small included areas are severely eroded.

This soil has severe limitations for cultivated crops, but it is suited to permanent hay crops, carefully managed pasture, woodland, or orchards in which the soil surface is well protected by a cover of plants. (Capability unit VIe–3; woodland suitability group 52)

Mt. Airy channery loam, 25 to 45 percent slopes (MtE).—This soil is too steep for most farm uses, but it is suitable as woodland or wildlife habitat. Much of it is severely eroded. Management is needed that controls erosion and increases the intake of rainwater and melting

snow. (Capability unit VIIe–3; woodland suitability group 52 on north-facing slopes, 58 on south-facing slopes)

Penn Series

The Penn series consists of medium-textured, nearly level to moderately steep soils that are moderately deep and well drained. These soils occur on uplands in the northwestern part of the county. They are dominantly dark reddish brown and are underlain by dark-red shale. Their subsoil is a little finer textured than the surface layer, and some of the soils contain a large amount of rock fragments, mostly shale. The native vegetation is hardwoods, principally oaks, but most areas in the county have been cleared.

The Penn soils are not difficult to work. They warm up fairly early in spring but should not be worked when wet. Although they have low to moderate available moisture capacity, they produce well under good management and are suitable for many uses. The main limitations that affect use are restricted depth, limited available moisture capacity, and the hazard of erosion.

Profile of Penn silt loam, 3 to 8 percent slopes, moderately eroded, in a cultivated area on Francis Scott Key Highway, about one-fourth mile south of Teeter Road:

Ap—0 to 10 inches, dark reddish-brown (5YR 3/3) silt loam; moderate, fine, granular structure; friable when moist, slightly sticky and slightly plastic when wet; roots plentiful; abundant pores; some fine shale chips; slightly acid (limed); clear, smooth boundary. Horizon is 8 to 10 inches thick.

B2t—10 to 22 inches, reddish-brown or dark reddish-brown (2.5YR 4/4 or 3/4) silt loam that has a higher clay content than the Ap horizon; moderate, fine and medium, subangular blocky structure; friable when moist, sticky and slightly plastic when wet; roots common; many fine and medium pores; some thin clay films; some shale chips that are strongly coated with clay; slightly acid; gradual, wavy boundary. Horizon is 10 to 14 inches thick.

C—22 to 32 inches, about 90 percent shale fragments and 10 percent red (2.5YR 5/6) silty and clayey material; stratified; a very few roots; fragments coated with silty and clayey material; strongly acid; gradual, irregular boundary. Horizon is 6 to 15 inches thick.

R—32 inches +, dark-red (2.5YR 3/6), fractured but unseparated, hard shale.

The A horizon is loam or silt loam and, in some places, is shaly. The B2t horizon ranges from heavy loam to heavy silt loam; it contains significantly more clay than the A horizon. In places the A and B horizons have a fairly high content of coarse fragments, most comonly shale. The C horizon is more than 35 percent fragments of shale and, in some places, sandstone. The solum ranges from 15 to 30 inches in thickness, but its average thickness is about 20 inches. Bedrock is at a depth ranging from 20 to 40 inches.

In undisturbed or wooded areas, the Penn soils have an A1 horizon that is 1 or 2 inches thick and an A2 horizon that generally is 4 or 5 inches thick. The A horizon has a hue of 5YR or 2.5YR. In the A1 horizon the value is 2 or 3 and the chroma is normally 2. The Ap, or A2, horizon has a value and a chroma of 3 or 4. In the B2t and C horizons, the hue is 2.5YR or 10R; the value is 3 or 4; and the chroma is 2 to 4 or, in a small part of the B2t horizon, 6.

The Penn soils commonly occur with the Birdsboro, Bucks, and Lewisberry soils, and they are similar to those soils in that they are red or reddish and well drained. The Penn soils, however, are not so deep as the Birdsboro and Bucks soils; they have a thinner, less clayey subsoil than those soils; and they are less strongly acid. Penn soils are less sandy and contain more silt than the Lewisberry soils. They are deeper to bedrock than the Klinesville soils. In some places the Penn soils occur with the Steinsburg soils, which are browner than Penn soils and are underlain by brown sandstone.

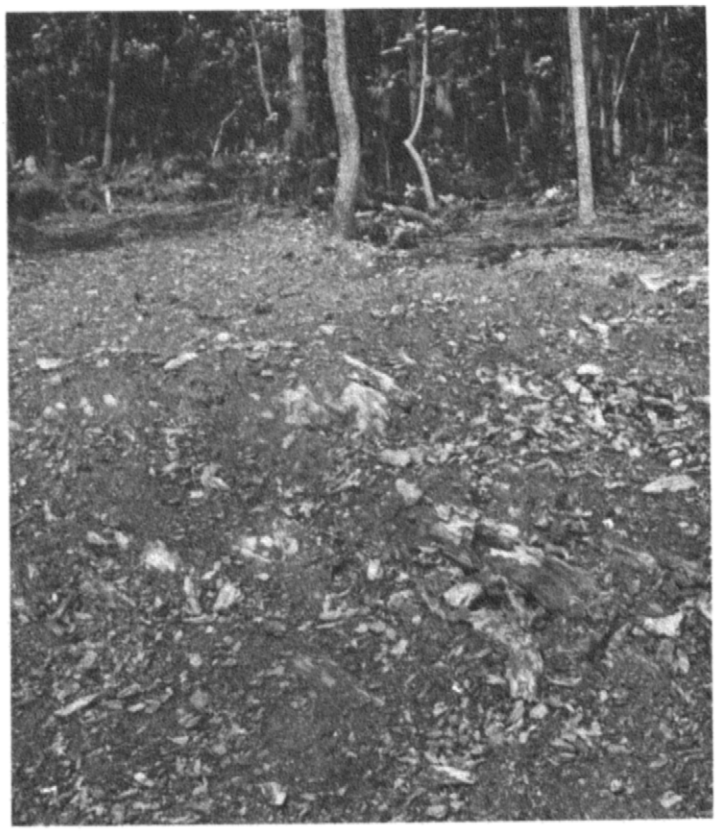

Figure 8.—**An exposed cut in Mt. Airy channery loam, 0 to 3 percent slopes. Flat fragments of hard schist can be readily seen.**

Penn loam, 0 to 8 percent slopes, moderately eroded (PeB2).—This nearly level and gently sloping soil has a plow layer that is more crumbly and more easily worked than that of other Penn soils. In most areas some of the original surface layer has been washed away, and there are a few shallow gullies.

This soil is suited to cultivated crops, pasture, and trees. The risk of erosion is the main limitation, but restricted depth also affects use. (Capability unit IIe–10; woodland suitability group 40)

Penn shaly silt loam, 3 to 8 percent slopes, moderately eroded (PhB2).—Fragments of soft red shale make up 15 to 20 percent of the plow layer of this gently sloping soil. In the lower part of the subsoil, the content of shale fragments may be more than 40 percent. This soil is a little shallower to bedrock than Penn loams and Penn silt loams. The depth to bedrock generally ranges from 20 inches to less than 30 inches. A few included areas are nearly level. Also included are some severely eroded spots, most of which are gullies.

This soil is of limited use for cultivated crops, but it is suited to pasture and woodland. Erosion is a severe hazard, and the depth to bedrock and the content of shale are other limitations. (Capability unit IIIe–10; woodland suitability group 51)

Penn shaly silt loam, 8 to 15 percent slopes, moderately eroded (PhC2).—This sloping soil is suitable for farming, but it should be protected by hay plants or pasture most of the time and used for a tilled crop only about 1 year in every 5. The soil also is suitable for pasture and woodland. Runoff is excessive at times and has formed a few gullies. (Capability unit IVe–10; woodland suitability group 51)

Penn shaly silt loam, 8 to 15 percent slopes, severely eroded (PhC3).—This sloping soil has been so severely damaged by erosion that the only part of it remaining is a foot or more of shaly red material over bedrock. In places there are gullies, most of which extend to bedrock.

This soil is not suitable for cultivation, but it can be used for hay crops or for pasture that is carefully managed. Some areas can be reforested, mainly for watershed protection. (Capability unit VIe–3; woodland suitability group 51)

Penn silt loam, 0 to 3 percent slopes, moderately eroded (PnA2).—The surface layer of this nearly level soil is almost free of rock fragments and has been thinned by erosion.

This soil is suited to cultivated crops, pasture, and trees. It is only moderately deep, however, and may hold too little moisture available to plants if rainfall is below normal or is poorly distributed. Conserving moisture is the main concern of management. (Capability unit IIs–11; woodland suitability group 40)

Penn silt loam, 3 to 8 percent slopes, moderately eroded (PnB2).—This gently sloping soil has the profile described for the series. It is the most extensive soil in the area known as red land in the northwestern part of the county. It has lost part of its original surface layer through erosion, and in some places it is gullied. Included are spots in which the subsoil is exposed.

This soil is suited to cultivated crops, pasture, and trees. The hazard of erosion is the main limitation. (Capability unit IIe–10; woodland suitability group 40)

Penn silt loam, 8 to 15 percent slopes, moderately eroded (PnC2).—This sloping, moderately eroded soil is cut by a few gullies. Included with it are small areas where the plow layer contains less silt and a little more sand than normal.

Because it is subject to severe erosion, this soil is of limited use for cultivated crops. It is suited to pasture and trees. Sodded waterways and other suitable measures are needed for controlling runoff and erosion in fields used for crops (fig. 9). (Capability unit IIIe–10; woodland suitability group 40)

Figure 9.—A grassed waterway that safely disposes of excess water in a field of Penn silt loam, 8 to 15 percent slopes, moderately eroded.

Penn silt loam, 8 to 15 percent slopes, severely eroded (PnC3).—This sloping soil has lost all of its original surface layer through erosion, and it is marked by few to many gullies. Included with it are a few spots where the soil is somewhat deeper than normal, and small areas in which the soil is less silty and more sandy than typical Penn soils.

This soil is suited to an occasional tilled crop that is grown in a long rotation, but it is better suited to permanent hay or pasture, well-protected orchards, or woodland. (Capability unit IVe–10; woodland suitability group 40)

Penn soils, 15 to 25 percent slopes (PoD).—These moderately steep soils have a surface layer of loam, silt loam, or shaly silt loam. Although a few shallow gullies occur, erosion generally is only slight or moderate because much of the acreage remains wooded.

These soils are not suitable for cultivation. If they were used for tilled crops, they would be permanently damaged by erosion. Among the suitable uses are permanent hay or pasture, woodland, and orchards in which the soil surface is well protected. (Capability unit VIe–3; woodland suitability group 40)

Penn-Steinsburg loams, 3 to 8 percent slopes, moderately eroded (PsB2).—The gently sloping soils that make up this complex occur in such an intricate pattern that they are not mapped separately. Both soils have a surface layer of loam and are alike in some other respects, but the Penn soil is mainly reddish instead of dark brown and is a little more sticky in the subsoil. In areas freshly plowed, the surface is spotted red and brown. Included with these soils are a few nearly level areas, and some scattered spots where the subsoil is exposed in shallow gullies.

These soils are suited to cultivated crops, pasture, and trees. The hazard of erosion is the main limitation, but restricted depth also affects use. (Capability unit IIe–10; woodland suitability group 40)

Penn-Steinsburg loams, 8 to 15 percent slopes, severely eroded (PsC3).—In most places nearly all of the original surface layer has been washed away from these sloping soils, and many shallow gullies have been formed. The soils can be used for an occasional cultivated crop, but they are better suited to permanent hay or pasture, sodded orchards, or woodland. (Capability unit IVe–10; woodland suitability group 40)

Raritan Series

In the Raritan series are nearly level and gently sloping, moderately well drained and somewhat poorly drained soils that lie on narrow, benchlike terraces just above the flood plains along some of the streams in the northwestern part of the county. These soils have a surface layer of reddish-brown silt loam. Their subsoil is mottled with reddish gray and strong brown, and in the lower part it

consists of a firm, brittle fragipan. The native vegetation is hardwoods, but nearly all areas have been cleared.

The Raritan soils are fairly easily worked within a narrow range of moisture content, but they are hard when dry and are sticky when a little too wet. Because they tend to be wet and warm up rather late, planting is commonly delayed in spring. These soils have moderate available moisture capacity and, if well managed, produce a moderate growth of crops. The main limitations are seasonal wetness, impeded drainage, a fragipan that retards the movement of water and the penetration of roots, and the susceptibility of sloping areas to erosion.

Profile of Raritan silt loam, 0 to 3 percent slopes, in a cultivated area on a terrace of Big Pipe Creek, about two-tenths of a mile northeast of Trevanion Road bridge.

Ap—0 to 9 inches, reddish-brown (5YR 4/4) silt loam; moderate, fine, granular structure; friable when moist, sticky and slightly plastic when wet; roots plentiful; many pores of all sizes; medium acid (limed); clear, smooth boundary. Horizon is 8 to 10 inches thick.

B21t—9 to 15 inches, strong-brown (7.5YR 5/6) light silty clay loam; moderate, fine, subangular blocky structure; friable to firm when moist, sticky and plastic when wet; few roots; many fine pores and some larger pores; discontinuous dark-brown (7.5YR 4/4) clay films; a few shale fragments; strongly acid; clear, smooth boundary. Horizon is 4 to 9 inches thick.

B22t—15 to 22 inches, strong-brown (7.5YR 5/6) light silty clay loam; a few, medium, distinct mottles of reddish gray (5YR 5/2); moderate, fine, subangular blocky structure; friable to firm when moist, sticky and plastic when wet; very few roots; some dark-brown (7.5YR 4/4) clay films; strongly acid; clear, smooth boundary. Horizon is 5 to 10 inches thick.

Bx—22 to 35 inches, light reddish-brown (5YR 6/3) light silty clay loam; common, medium, distinct mottles of strong brown (7.5YR 5/6) and a few, medium, faint mottles of reddish gray (5YR 5/2); moderate, medium, platy and subangular blocky structure; very firm and brittle when moist, sticky and plastic when wet; no roots; many fine pores; some shale fragments; distinct strong-brown (7.5YR 5/6) clay flows; very strongly acid; abrupt, smooth boundary. Horizon is 10 to 15 inches thick.

IIC—35 to 50 inches +, reddish-brown (5YR 4/3) gravelly sand; shale fragments abundant; loose; very strongly acid.

In some places the B horizon is heavy loam or heavy silt loam. The IIC horizon may be of any texture coarser than that of the B horizon. In places there are shale fragments or water-worn pebbles of sandstone in the profile, but these occur in significant quantity only in the IIC horizon. The solum ranges from 28 to more than 40 inches in thickness. Unconforming bedrock is at a depth of 6 to 20 feet or more.

In wooded areas these soils have a thin, dark grayish-brown or very dark grayish-brown A1 horizon and a light-brown (7.5YR 6/4) to light reddish-brown (5YR 6/3 or 6/4) A2 horizon 4 to 8 inches thick. The Ap horizon has a hue of 5YR or 7.5YR, a value of 4 or 5, and a chroma of 2 to 4. The B horizon has a matrix hue of 7.5YR to 2.5YR and a value of 4 to 6. The chroma is 4 to 6 in the B2t horizon and 2 to 6 in the Bx horizon. Mottles in the B22t horizon are fine or medium and, in some places, include colors other than gray. The IIC horizon varies in color but nearly everywhere has a hue of 5YR or redder.

The Raritan soils are somewhat similar to the Glenville, Urbana, and Abbottstown soils. They are redder than the Glenville and Urbana soils, and in many places they are less poorly drained than the Abbottstown soils. In addition, the Raritan soils overlie gravelly sand that contains shale fragments, whereas the Abbottstown soils overlie shale. Raritan soils commonly are a little more poorly drained than the Readington soils. The Raritan soils and the well-drained Birdsboro soils formed in similar materials, and soils of the two series occupy similar positions in the landscape.

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Raritan silt loam, 0 to 3 percent slopes (RaA).—This nearly level soil has the profile described as typical for the series. Included are small wet areas, indicated by wet-spot symbols on the soil map.

Erosion is only a slight hazard on this soil, but seasonal wetness is a major limitation. Improved drainage is needed for many crops, particularly those that normally are planted early in spring. Also, seepage and runoff from higher areas should be intercepted. After the soil is drained, it is suited to many kinds of crops, though it is subject to frost heaving that may damage alfalfa and other herbaceous perennials. The soil has moderate natural fertility and responds well to lime and fertilizer. (Capability unit IIIw–1; woodland suitability group 23)

Raritan silt loam, 3 to 8 percent slopes (RaB).—This gently sloping soil has more rapid runoff than Raritan silt loam, 0 to 3 percent slopes. Nevertheless, the soil generally is only slightly eroded, though in small areas it has lost much of its original surface layer. A few included spots are severely eroded.

The main limitation that affects use of this soil is drainage, which must be improved before some kinds of crops can be successfully grown. In addition, sodded waterways are needed for disposing of runoff. If the soil is drained, it is suited to many kinds of crops, but it is subject to frost heaving that may damage alfalfa and other herbaceous perennials. (Capability unit IIIw–1; woodland suitability group 23)

Readington Series

The Readington series consists of nearly level and gently sloping, reddish-brown, moderately well drained soils in which the lower part of the subsoil is dense and very firm. These soils occur in depressions and on upland flats in the northwestern part of the county. Their lower subsoil is mottled with gray to pinkish gray, which indicates that the soils are wet and poorly aerated at least part of the year. The native vegetation is mainly oaks, but maple and hickory are common.

Although these soils are sticky when wet, they are fairly easily worked within a narrow range of moisture content. Planting may be delayed in spring because the soils are wet and warm up rather slowly. Artificial drainage is needed for some crops and improves the growth of others. Drainage can be provided by tiling or ditching. The available moisture capacity is moderate, but the lower part of the subsoil retards the movement of water. If the soils are well managed, they are moderately productive. Their main limitations are seasonal wetness, impeded drainage, a restricted root zone, and, in sloping areas, the risk of erosion.

Profile of a Readington silt loam, located in a level cultivated area 300 yards south of the intersection of Hapes Mill Road and Mount Union Road:

Ap—0 to 10 inches, reddish-brown (5YR 4/3) silt loam; strong, fine, granular structure; friable when moist, sticky and slightly plastic when wet; roots abundant; many fine and medium pores; slightly acid (limed); clear, smooth boundary. Horizon is 9 to 11 inches thick.

B2t—10 to 20 inches, reddish-brown (2.5YR 4/4) light silty clay loam; moderate, fine and medium, subangular blocky structure; friable to firm when moist, sticky and plastic when wet; roots common; many fine pores; some thin, reddish-yellow (5YR 6/6) clay films; medium acid; clear, wavy boundary. Horizon is 10 to 12 inches thick.

IIBx—20 to 30 inches, reddish-brown (5YR 5/4) light clay loam; common, coarse, distinct mottles of pinkish gray (5YR 6/2); moderate, medium, platy and subangular blocky structure; very dense; very firm in place when moist, plastic and very sticky when wet; no roots; prominent reddish-yellow (5YR 6/6) clay films and flows that are thicker on vertical faces than on horizontal ones; some material from IIC horizon in lower part; strongly acid; gradual, irregular boundary. Horizon is 10 to 20 inches thick.

IIC—30 to 48 inches, dark reddish-brown (2.5YR 3/4), partially disintegrated shale and seams of disintegrated sandstone, with some silt and clay in interstices; structure inherited from the rock; firm and compact; medium acid; abrupt, irregular boundary. Horizon is 12 to 20 inches thick.

IIR—48 inches +, hard, dark reddish-brown, fractured but mostly unseparated shale, with some seams of sandstone.

The B2t and IIBx horizons are silty clay loam, clay loam, or heavy silt loam. The content of material coarser than fine sand is higher in the IIBx horizon than it is in the B2t horizon. The IIBx horizon developed mainly in residuum from shale and sandstone, but it has been influenced to some extent by the overlying silty material. In places the IIC horizon is gritty with sandstone residuum, and in places it contains fragments of hard sandstone. Few if any coarse fragments occur in the A and B2t horizons. The solum ranges from 28 to 40 inches or more in thickness. Bedrock (IIR layer) is generally at a depth below 4 to 5 feet, but in some places, especially in sloping eroded areas, it lies at a depth of about 40 inches.

In wooded areas the Readington soils have a dark-gray or dark grayish-brown A1 horizon 2 to 4 inches thick and an A2 horizon 3 to 6 inches thick. The color of the A2 horizon is generally 7.5YR 4/3 to 5/4, but the hue of this horizon is 5YR or 10YR in some places. The B2t horizon has a hue of 2.5YR or 5YR, a value of 3, 4, or 5, and a chroma of 3 or 4.

In the IIBx horizon the matrix hue normally is 5YR, the value is 4 or 5, and the chroma generally is 4 but, in some places, is only 2 or 3. Most mottles in the IIBx horizon are gray to pinkish gray (5YR 6/1, 6/2, or 7/2, or 7.5YR 6/2 or 7/2), but in some places there are mottles of red or dark red (2.5YR 3/6 to 5/8). In places where the B2t horizon is much more than 10 inches thick, it may be faintly mottled in the extreme lower part. The IIC horizon is red, dark red, or dark reddish brown (2.5YR 3/4 to 4/6). In some places it contains a few mottles or variegations. Unlimed, the profile generally is strongly acid or medium acid.

The Readington soils, like the Glenville, Urbana, and Wiltshire soils, are moderately well drained and have a fragipan. But the Readington soils are more reddish than all of those soils. The Readington soils are a little better drained than the Abbottstown and Raritan soils, which also are reddish and developed in a similar kind of material.

In Carroll County the Readington soils were not mapped separately. They were mapped only with the Abbottstown soils in undifferentiated units. For descriptions of these units, see the Abbottstown series.

Rowland Series

The Rowland series consists of deep, nearly level, somewhat poorly drained or moderately well drained soils that occupy flood plains along streams in the northwestern part of the county. These soils have a surface layer of silt loam. They are mainly reddish brown, but the lower part of their subsoil is lighter colored and is mottled with gray. Rowland soils are subject to occasional flooding, especially in winter and spring. They are strongly acid or very strongly acid unless they have been limed. The native vegetation is made up of hardwoods, chiefly oaks, but most areas in the county have been cleared.

The Rowland soils are fairly easy to work if they are not too wet or too dry. The plow layer, however, tends to form clods if it is worked when slightly too wet and sticky. Excess moisture commonly delays plowing and planting in spring. Providing artificial drainage and protection from floods improves these soils for most uses and lengthens the grazing period on pasture. The soils have high available moisture capacity, and water moves through them readily.

Profile of Rowland silt loam, located in a level pastured area on the flood plain of Big Pipe Creek, about one-third mile south of Stover Road:

Ap—0 to 12 inches, reddish-brown (5YR 4/3) silt loam; strong, medium, granular structure; friable when moist, sticky and plastic when wet; roots abundant; many pores of all sizes; medium acid (limed); clear, wavy boundary. Horizon is 9 to 12 inches thick.

B1—12 to 18 inches, reddish-brown (5YR 4/4) silt loam; weak, medium, granular structure, friable when moist, sticky and slightly plastic when wet; roots plentiful; many fine and medium pores; strongly acid; gradual, wavy boundary. Horizon is 4 to 10 inches thick.

B2—18 to 30 inches, pink (5YR 7/4) light silty clay loam; common, medium, distinct mottles of gray (N 5/0); structureless (massive) to weak, medium, blocky structure; friable to firm when moist, sticky and plastic when wet; very few roots; some very fine pores; no clay films; very strongly acid; clear, wavy boundary. Horizon is 5 to 15 inches thick.

Cg—30 to 64 inches +, gray (N 5/0) clay loam; structureless (massive) to very weak, medium, blocky structure; firm when moist, sticky and very plastic when wet; no roots; strongly acid.

The B horizon ranges from silt loam to clay loam and silty clay loam, and commonly it is finer textured with depth. The variation in texture is the result of stratification, not translocation and accumulation of clay. Locally, the profile includes an unconforming IIC2 horizon within a 5-foot depth. This horizon is coarser textured than the horizons above it and generally is sandy and gravelly. Fine waterworn pebbles can occur in any part of the profile, but they are seldom abundant except in the IIC2 horizon. In most places the solum is 20 to 36 inches thick. The depth to unconforming bedrock ranges from 6 to 20 feet or more.

In some places the solum has a hue of 2.5YR or 7.5YR. The Ap horizon has a chroma of 2 to 4. In unplowed areas there is a thin A1 horizon having a value of 3. In the B1 horizon the value is 4 to 6 and the chroma is 3 to 6. The matrix of the B2 horizon has a value of 4 to 7 and a chroma generally of 4. Mottling in the B2 horizon is faint in places where it is nearly masked by the inherent reddish color of the matrix. The mottles in the B2 horizon are at least 5 units less red in hue than the matrix, and they may be neutral. Their value is most commonly 5 or 6, and their chroma is 0, 1, or 2. The Cg horizon generally is neutral in hue, and in places it contains mottles of yellow to red in which both the value and the chroma are 4 to 6. The IIC2 horizon, where present, may be almost any color.

The Rowland soils are similar to the Lindside and Codorus soils in drainage and susceptibility to flooding. But the Rowland soils are more reddish than the Lindside soils, which are nearly neutral, and the Codorus soils, which are micaceous and very strongly acid or extremely acid. Rowland soils occupy the same flood plains as the well-drained Bermudian soils and the poorly drained Bowmansville soils.

Rowland silt loam (Ro).—This soil is nearly level in most places, but it is gently sloping in a few spots. Small included areas are subject to severe flooding, and here the use is limited mainly to improved pasture or woodland. Generally, however, this soil is suited to many kinds of crops and is extensively used for corn, hay, and pasture. If crops are well managed, their growth is moderate to good. (Capability unit IIw–7; woodland suitability group 29)

Steinsburg Series

Soils of the Steinsburg series are moderately deep, gently sloping to moderately steep, and somewhat excessively drained. They occur on uplands in the northwestern part of the county. These soils are dark brown and medium textured in their surface layer and subsoil, and they are underlain by hard, brown sandstone. The native vegetation is hardwoods, principally oaks, but most areas in the county have been cleared.

The Steinsburg soils generally are easy to work, even in areas where their plow layer includes material brought up from the subsoil. The soils are not very wet in spring, and they warm up soon enough for early planting. In most places, however, the surface layer contains many flat fragments of sandstone that wear away plow points and tillage implements. These soils have low to moderate available moisture capacity but, if well managed, produce a fairly good growth of crops. They are suited to most crops and to most other uses. They are limited by their available water capacity, restricted depth, and susceptibility to erosion.

Profile of Steinsburg channery loam, 3 to 8 percent slopes, moderately eroded, in a cultivated area 300 yards southwest of Basehores Mill:

Ap—0 to 11 inches, dark-brown (10YR 4/3) channery loam; moderate, fine, granular structure; friable when moist; roots abundant; many pores of all sizes; medium acid (limed); clear, smooth boundary. Horizon is 9 to 11 inches thick.

B2—11 to 18 inches, dark-brown (7.5YR 4/4) channery loam; moderate, fine, subangular blocky structure; friable when moist, slightly sticky when wet; roots common; pores of all sizes; some faint coatings, apparently of silt, not clay; strongly acid; clear, wavy boundary. Horizon is 6 to 11 inches thick.

C—18 to 30 inches, variegated yellowish-brown and light yellowish-brown (10YR 5/4 and 6/4), partially decomposed sandstone; no roots; very strongly acid; gradual, irregular boundary. Horizon is 5 to 15 inches thick.

R—30 inches +, hard, brown (10YR 5/3), fractured but mostly unseparated sandstone.

The A horizon is loam or channery loam. The channery fragments are flat pieces of sandstone. The B2 horizon is heavy loam, loam, or heavy sandy loam. In places there are traces of films, but these are apparently of silt. The content of sandstone fragments is normally less than 50 percent in the B2 horizon but is as much as 75 percent in the C horizon. Generally, the solum ranges from 15 to 25 inches in thickness. In most places the depth to bedrock is 20 to 40 inches.

The hue is dominantly 10YR throughout, but it may be 7.5YR in the B2 horizon. The A horizon has a value of 3, 4, or 5 and a chroma of 2, 3, or 4. In the B2 horizon the value is 4 or 5 and the chroma generally is 4 but, in some places, is 5. The C horizon has a chroma of 4 to 6.

The Steinsburg soils resemble the Cardiff and Mt. Airy soils in depth and drainage and, to some degree, in content of rock fragments. But the Steinsburg soils formed over brown sandstone, whereas the Cardiff soils formed over gray slate and the Mt. Airy soils, over mica schist. In addition, the Steinsburg soils contain fewer rock fragments than all of those soils, especially in the solum. The Steinsburg soils occur most commonly within or adjoining areas of Penn and Klinesville soils. Generally, they are less silty and, when wet, are less sticky than the dark reddish-brown Penn soils. Steinsburg soils are not red or reddish like the Klinesville soils, and they are not so shallow as those soils.

Steinsburg channery loam, 3 to 8 percent slopes, moderately eroded (StB2).—This gently sloping soil has the profile described as typical for the series. Generally, a large part of the original surface layer has been removed through erosion, and in some places shallow gullies have been formed. Included with this soil are a few severely eroded spots, a few nearly level areas, and small areas in which the soil is somewhat sandy and contains fewer sandstone fragments than normal.

This soil is suited to cultivated crops, pasture, and trees. Controlling erosion and conserving moisture are the main concerns of management, but limited depth also affects use. Supplemental irrigation would be of benefit in dry periods. (Capability unit IIe–10; woodland suitability group 40)

Steinsburg channery loam, 8 to 25 percent slopes, severely eroded (StD3).—This sloping to moderately steep soil is suitable for hay crops, carefully managed pasture, sodded orchards, or woodland. It is not suitable for cultivation. Some included spots are a little sandy, some are redder than normal, particularly in the subsoil, and some are only slightly or moderately eroded. (Capability unit VIe–3; woodland suitability group 40)

Urbana Series

The Urbana series consists of level to gently sloping, moderately well drained soils on uplands. These soils have a surface layer of brown or dark-brown silt loam. Their subsoil, in the upper part, is somewhat olive colored and, in the lower, is a dense fragipan. The fragipan contains gray mottles, which indicate that the soils are wet and poorly aerated at least part of the year. Oaks make up most of the native vegetation, but hickory and other trees are common.

The Urbana soils are easily worked if they are not too wet, but excess moisture may delay working and planting in spring. Artificial drainage is required for the production of some crops, and it improves the growth of others. The available moisture capacity is moderate in these soils, but water moves slowly in the fragipan. Crops grow moderately well under good management. Some uses are restricted by seasonal wetness, impeded drainage, the limited depth to which roots can readily penetrate, and, in sloping areas, the erosion hazard.

Profile of Urbana silt loam, 0 to 3 percent slopes, in a cultivated area near the intersection of Marston Road and New Windsor Road:

Ap—0 to 9 inches, brown or dark-brown (10YR 4/3) silt loam; moderate, medium, granular structure; friable when moist, sticky and slightly plastic when wet; roots plentiful; medium to slightly acid (limed); clear, wavy boundary. Horizon is 7 to 10 inches thick.

B2t—9 to 18 inches, light olive-brown (2.5Y 5/4) light silty clay loam; moderate, fine and medium, subangular blocky structure; friable when moist, sticky and plastic when wet; roots common; some thin, yellowish-brown (10YR 5/4) clay films and a few flows of olive-brown (2.5Y 4/4) clay or silt; some bluish-green schist fragments; strongly acid; gradual, wavy boundary. Horizon is 5 to 9 inches thick.

Bx—18 to 29 inches, light yellowish-brown (2.5Y 6/4) heavy silt loam; a few, medium, distinct mottles of gray (10YR 6/1) and common, medium, prominent mottles of strong brown (7.5YR 5/6); strong, medium, platy structure; compact; very firm and brittle when moist, sticky and plastic when wet; no roots; prominent, light olive-brown (2.5Y 5/6) clay films and flows; 10 to 20 percent of horizon is schist fragments; strongly acid; gradual, wavy boundary. Horizon is 6 to 15 inches thick.

Cx—29 to 54 inches, variegated olive (5Y 5/4), dark-brown (10 YR 3/3), dark olive-gray (5Y 3/2), and greenish-gray (5BG 5/1), fractured and separated schist fragments; these are infiltrated with light yellowish-brown (10YR 6/4) silty material; very compact; medium platy structure, or laminar structure from bedrock; very firm and brittle; no roots; a few very thin coatings of dark olive-gray (5Y 3/2) silt or clay; medium acid; clear, irregular boundary. Horizon is 15 to 30 inches thick.

R—54 inches +, bluish-gray, gray, and olive, fractured but mostly unseparated, hard actinolite schist.

The B2t and Bx horizons are light silty clay loam, heavy silt loam, clay loam, or heavy silty clay loam. The schist fragments in the Cx horizon are partially decomposed or disintegrated. In spots the Cx horizon is friable. Generally, the solum contains hard fragments of actinolite schist or remnant angular fragments of quartzite. In addition, there are a few stones and a few outcrops of hard schist. The solum ranges from 20 to 36 inches in thickness. The Cx horizon is commonly as thick as the solum, and in places it is thicker. Bedrock occurs at a depth ranging from 3½ to 7 feet.

In wooded areas these soils have a thin, dark grayish-brown to olive-gray A1 horizon and an A2 horizon 4 to 8 inches thick. Generally, the color is 2.5Y 5/4 or 6/4 in both the A2 and the B2t horizons. In the Bx horizon the matrix has a hue ranging from 2.5Y to 7.5YR, a value of 4 to 6, and a chroma of 2 to 6. The mottles normally have the same range in hue and value as the matrix, and their chroma is 1 to 6. In the Cx horizon the colors are even more variable and variegated than they are in the Bx horizon. The B2t horizon may be faintly mottled in the *lower* part.

The Urbana soils resemble the Abbottstown, Glenville, and Raritan soils in that they are moderately well drained and have a fragipan. The Urbana soils, however, are not reddish like the Abbottstown and Raritan soils. They are less strongly acid than the Glenville soils, and they lack the mica flakes of those soils. Urbana soils have olive colors that are absent in Glenville soils. The Urbana soils developed in the same general kind of rock material as the well-drained Linganore soils.

Urbana silt loam, 0 to 3 percent slopes (UrA).—This nearly level soil has the profile described for the series. Included are a few stony areas, which are indicated by symbol on the soil map.

The use of this soil is limited mainly by seasonal wetness. Runoff is slow and erosion is only a slight hazard. Tile lines or ditches can be used to improve drainage, and measures are needed in some places for diverting runoff or seepage that comes from adjoining higher areas. After the soil is drained, it is suited to many kinds of crops. Because it is usually wet in winter, however, it is subject to frost heaving that may damage alfalfa and other herbaceous perennials. The soil responds well to liming and fertilization, but less lime is needed on this soil than on many other soils in the county. (Capability unit IIw-2; woodland suitability group 46)

Urbana silt loam, 3 to 8 percent slopes, moderately eroded (UrB2).—In most places this gently sloping soil has lost some of its original surface layer through erosion. The plow layer commonly includes material from the subsoil, and it is more sticky and more difficult to work than the original surface layer.

The hazard of erosion is the main limitation that affects the use of this soil. Improved drainage is needed for some uses, and, where necessary, measures should be used to intercept runoff that moves down from higher areas. Frost heaving may damage some kinds of perennial plants. (Capability unit IIe–13; woodland suitability group 46)

Wiltshire Series

The Wiltshire series consists of nearly level, moderately well drained soils that have a fragipan. These soils lie in upland depressions, generally around the heads of drains. They have a surface layer of dark grayish-brown silt loam. The upper part of their subsoil is light yellowish-brown or brown silt loam or silty clay loam, and the lower part is a dense fragipan that is mottled with gray. These mottles indicate that the soils are wet and poorly aerated at least part of the year. The native vegetation consists mainly of oak, maple, hickory, and dogwood, but nearly all areas of Wiltshire soils in this county have been cleared.

The Wiltshire soils are easily worked if they are neither too wet nor too dry. In spring, however, they are wet and warm up fairly late. Planting dates may be several days to a few weeks later than they are on most of the better drained soils. Artificial drainage is generally required for some crops, but drainage is fairly difficult to improve. Although the Wiltshire soils have only moderate available moisture capacity, they are fertile and produce well under good management. Less lime is needed on these soils than on many other soils in the county. Some uses are limited by impeded drainage, seasonal wetness, and restricted depth to the fragipan, which hinders the movement of water and roots.

Profile of Wiltshire silt loam, located in a depressional area used for pasture, about one-fourth mile east of Uniontown Road, just south of Clear Ridge:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable when moist, slightly sticky and slightly plastic when wet; roots abundant; many pores; frequent worm channels; slightly acid (limed); abrupt, smooth boundary. Horizon is 6 to 8 inches thick.

A2 —7 to 12 inches, light brownish-gray (10YR 6/2) silt loam; moderate, fine and medium, granular structure; friable when moist, slightly sticky and slightly plastic when wet; roots plentiful to abundant; many pores; slightly acid; clear, smooth boundary. Horizon is 4 to 6 inches thick.

B1—12 to 16 inches, light yellowish-brown (10YR 6/4) heavy silt loam; moderate, fine, subangular blocky structure; friable when moist, sticky and slightly plastic when wet; roots common; many fine pores; medium acid; gradual, smooth boundary. Horizon is 4 to 6 inches thick.

B2t—16 to 26 inches, brown (10YR 5/3) silty clay loam; moderate to strong, medium, blocky and subangular blocky structure; firm when moist, sticky and plastic when wet; roots common; distinct but discontinuous clay films; medium to strongly acid; gradual, smooth boundary. Horizon is 10 to 12 inches thick.

Bx—26 to 37 inches, variegated pale-brown (10YR 6/3) and light yellowish-brown (2.5Y 6/4) light silty clay loam; common, medium, distinct mottles of gray or light gray (10YR 6/1); weak prismatic structure and strong, medium, platy structure; very firm when moist, plastic and sticky when wet; very few roots; prominent, discontinuous clay films and flows of brown (10YR 5/3); strongly acid; abrupt, wavy boundary. Horizon is 10 to 20 inches thick.

C—37 to 50 inches +, light brownish-gray (2.5Y 6/2) silt loam to silty clay loam; texture is finer with depth; variegated with strong brown (7.5YR 5/6) in upper part and with reddish brown (5YR 5/4) in lower part; structureless (massive); firm when moist, sticky and moderately plastic when wet; no roots; some medium angular gravel; medium acid to slightly acid.

The B2t horizon is silty clay loam or heavy silt loam. In some places the Bx horizon is heavy silt loam in the upper part.

Angular gravel can occur in any part of the profile. In places where the gravel is on or near the surface, it may be colluvial in origin. The thickness of the solum ranges from 30 to 50 inches. Bedrock generally occurs at a depth of 5 to 8 feet and consists of calciferous schist, limestone, or marble.

In unplowed areas there is a dark grayish-brown or very dark grayish-brown A1 horizon, generally about 4 inches thick. Here, the A2 horizon is thicker than the one described in the typical profile. The A horizon has a hue ranging from 10YR to 2.5Y; the Ap horizon has a value of 3 or 4; and the A2 horizon has a value of 4, 5, or 6, and a chroma of 2, 3, or 4. In the B1 and B2t horizons, the value is 5 or 6 and the chroma is 3 or 4. The Bx horizon has a value of 5 or 6 and a chroma of 3 or 4. In this horizon the mottles have a hue of 10YR or 2.5Y; a value of 5, 6, or 7; and a chroma of 1 or, in a few places, 2. Generally, in the C horizon the value is high and the chroma is low, but there are variegations or mottles having a hue of 10YR to 5YR and a value and a chroma both of 4 to 6. The solum is medium acid or strongly acid unless the soil has been limed, and it has a high base status. The C horizon normally is less acid than the solum.

The Wiltshire soils are similar to the Glenville, Readington, and Urbana soils in that they have a fragipan and are moderately well drained. Wiltshire soils are less acid than the Glenville soils; they are not reddish like the Readington soils; and they lack the olive colors of the Urbana soils. The Wiltshire soils commonly occur with the Conestoga and Hagerstown soils, but they are less well drained than those soils and have a fragipan.

Wiltshire silt loam (Ws).—This soil generally is nearly level, but in a few places it is gently sloping. Commonly, the surface is slightly concave. Runoff is very slow or ponded, and there is little or no risk of erosion. Seasonal wetness is the main limitation. If suitable outlets are available, drainage can be improved by tiling or ditching. In addition, measures are needed in some places for intercepting seepage and runoff from adjacent areas. Many kinds of crops can be grown on this soil, but herbaceous perennials may be damaged by frost heaving. (Capability unit IIw–2; woodland suitability group 46)

Use and Management of Soils

The first part of this section explains how soils are grouped according to their capability and describes the capability units in Carroll County. The second part deals with practices of management that are suitable for all the soils in the county. In the third part there are estimates of average yields of common crops grown under two levels of management. Other parts tell about the use of soils as woodland, discuss wildlife, describe engineering uses of soils, and discuss nonfarm and recreational uses.

Capability Groups of Soils

Capability classification is a grouping of soils to show, in a general way, their suitability for most kinds of farming. It is a practical classification based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment. The classification does not apply to most horticultural crops, or to rice and other crops that have their own special requirements. The soils are classified according to degree and kind of permanent limitation, but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soils; and without consideration of possible but unlikely major reclamation projects.

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 some limitations that reduce the choice of plants or require moderate conservation practices.

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

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

Class V. Soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife food and cover.

Class VI. Soils have severe limitations that generally make them unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife food and cover.

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

Class VIII. Soils and landforms have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes. There are no class VIII soils in Carroll 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 Carroll County, shows that the chief limitation is climate that is too cold or too dry.

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 the management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–4 or VIIs–3. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation, and the small letter indicates the subclass, or kind of limitation as defined in the foregoing paragraph. The Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages, the capability units in Carroll County are described and suggestions for the use and management of the soils are given. The units are not numbered consecutively, because a statewide system is used for numbering the capability units in Maryland and not all of the units in the system are represented in this county. To find the names of the soils in any given capability unit, refer to the "Guide to Mapping Units" at the back of this soil survey.

CAPABILITY UNIT I–1

This unit consists of deep, nearly level, well-drained soils on uplands. These soils have a naturally high content of plant nutrients, especially calcium, and they retain moisture and plant nutrients well. They have a loamy, friable plow layer and generally are easy to work.

The soils in this unit are well suited to general crops, forage crops, pasture, orchards, and truck crops. If they are well managed, the soils can be farmed intensively. Management is needed that keeps the supply of plant nutrients high, provides adequate applications of lime, and includes legumes and green-manure crops in the rotation. Neither artificial drainage nor special practices for controlling erosion are needed.

CAPABILITY UNIT I–4

In this unit are nearly level, medium-textured soils on uplands that are deep and well drained. These soils retain moisture well and are fairly easy to work.

The soils in this unit are well suited to general crops, forage crops, pasture, orchards, and truck crops. If the soils are well managed, they can be cultivated intensively. They can be kept productive if they are adequately supplied with plant nutrients and if they are farmed in a rotation that includes legumes and green-manure crops. Minimum tillage and the use of all crop residues are other practices of good management. More lime is required on these soils than on the soils in capability unit I–1. Neither artificial drainage nor special practices for controlling erosion are needed.

Figure 10.—**Contour stripcropping on Glenelg and Chester soils near Manchester. These soils are in capability unit IIe–4.**

CAPABILITY UNIT I–6

The soils in this unit are deep, nearly level, well drained, and medium textured throughout. Infrequent flooding is a hazard in most areas.

These soils are nearly as good for farming as the soils in capability units I–1 and I–4. They are well suited to corn, forage crops, and pasture. Most areas lack the good air drainage necessary for orchards, however, and early truck crops may be ruled out by the hazard of flooding. Minimum tillage and good management of crop residues are among the practices needed. Locally, the channels of streams need improvement and streambanks should be stabilized.

CAPABILITY UNIT IIe–1

The only soil in this unit is Hagerstown silt loam, 3 to 8 percent slopes, moderately eroded. This deep, well-drained soil occurs on uplands. It is fertile, and in most places it has a naturally high content of lime. The hazard of erosion is moderate.

This soil is used mainly for corn, small grains, hay, and pasture. It is especially well suited to alfalfa, various clovers, and other legumes. Contour tillage and stripcropping generally are needed, together with a suitable crop rotation. Runoff should be diverted into natural waterways, and these should be well sodded. Keeping tillage to a minimum, liming and fertilizing as needed, and returning crop residues and available manure to the soil are other measures that help to maintain fertility and control erosion.

CAPABILITY UNIT IIe–4

This unit consists of gently sloping, medium-textured soils on uplands. These soils are deep and well drained. They are moderately eroded, and their susceptibility to erosion is moderate.

The soils in this unit are well suited to general crops, forage crops, pasture, orchards, and truck crops. Generally, they have better air drainage that makes them more desirable for orchards than the soils in capability unit I–4. Contour tillage, contour stripcropping (fig. 10), a suitable crop rotation, minimum tillage, and use of crop residues are practices that reduce runoff and control erosion.

CAPABILITY UNIT IIe–6

The only soil in this unit is Comus silt loam, local alluvium, 3 to 8 percent slopes. This soil is deep, well drained, and medium textured throughout. It occurs on foot slopes and in upland depressions. The hazard of erosion is moderate, but that of flooding is only slight.

This soil is suited to nearly all crops grown in the county. In some areas it is not suited to orchards, because air drainage is inadequate. Soil losses can be checked by using contour tillage and a suitable crop rotation. In places runoff from adjacent higher soils should be diverted to prevent excessive washing during periods of heavy rainfall or rapid snowmelt.

CAPABILITY UNIT IIe–10

This unit consists of moderately deep, medium-textured, well-drained or somewhat excessively drained soils on uplands. These soils are gently sloping and moderately eroded. They are moderately susceptible to erosion.

The soils in this unit are suited to most of the common crops. They are well suited to sodded orchards. Contour stripcropping, minimum tillage, and a suitable cropping system are effective in erosion control. If a small grain is grown in a rotation that includes corn, it should be seeded in fall after the corn crop is harvested.

CAPABILITY UNIT IIe–13

This unit consists of gently sloping, medium-textured, moderately well drained soils in which the subsoil contains a fragipan that is slowly permeable. On these soils runoff is rapid enough that erosion is a hazard, and some areas are moderately eroded.

These soils are too wet at times and are too dry at others. Excess water is a limitation, especially in spring, and planting dates may be delayed. Nevertheless, controlling soil losses is more important than improving drainage. If erosion is controlled and drainage is improved, the soils are well suited to corn, soybeans, some hay crops, and pasture. They are not well suited to crops that may be damaged by frost heaving in winter. Lime and a good supply of plant nutrients are needed in fields used for crops.

CAPABILITY UNIT IIe–16

The only soil in this unit is Delanco silt loam, 3 to 8 percent slopes, moderately eroded. This soil is moderately well drained and has a moderately slowly permeable subsoil.

The soil in this unit is much more easily drained and managed than the soils in capability unit IIe–13. Tile drains work better in this soil than they do in those, and tile lines or ditches can be more widely spaced. Even so, controlling erosion is more important than improving drainage. If erosion is controlled and drainage is improved, this soil is well suited to corn, soybeans, some hay crops, and pasture. It is not well suited to crops that are subject to damage by frost heaving in winter.

CAPABILITY UNIT IIe–24

Conestoga silt loam, 3 to 8 percent slopes, moderately eroded, is the only soil in this unit. This deep, well-drained soil occurs on uplands. It developed in limy micaceous material and is more susceptible to erosion than other deep, well-drained soils in subclass IIe.

The soil in this unit is fertile and, in most places, has a naturally high content of lime. But it needs the protection of close-growing vegetation as much of the time as possible. A suitable rotation is one that is at least 3 years long. Contour stripcropping is among the practices that control erosion, and the strips should be narrower than those used on most other soils. Minimum tillage and sodded waterways also are effective in reducing soil losses.

CAPABILITY UNIT IIe–25

This unit consists of somewhat excessively drained, medium-textured, gently sloping soils on uplands. These soils are moderately eroded and are underlain by loose micaceous material.

The soils in this unit are easily eroded. If they are well managed, however, they can be used for all the common crops and are well suited to orchards. Erosion can be controlled by using a suitable cropping system, keeping tillage to a minimum, stripcropping on the contour, properly managing crop residues, and carefully disposing of excess water. Orchards should be well sodded, and the trees should be on the contour.

CAPABILITY UNIT IIw–1

Delanco silt loam, 0 to 3 percent slopes, is the only soil in this unit. This soil occurs on stream terraces and is moderately well drained. Permeability in the subsoil is moderately slow.

This soil is similar to the soil of capability unit IIe–16, but it is nearly level and only slightly susceptible to erosion. The soil has a seasonally high water table and is moderately wet. If it is adequately drained, however, it is suited to most crops, and it is not difficult to drain. Tile lines or open ditches can be used for disposing of excess water, but planting dates may be somewhat delayed in spring. Some perennial crops are likely to be damaged by frost heaving in winter.

CAPABILITY UNIT IIw–2

This unit consists of nearly level, medium-textured, moderately well drained soils on uplands. These soils have a slowly permeable subsoil that contains a fragipan. Water enters and moves through them slowly.

The soils in this unit can be cultivated only within a narrow range of moisture content. They tend to form clods if they are worked when too wet, and they harden as they dry. Inadequate drainage is the major limitation, but properly spaced tile lines or V-type ditches generally are adequate for removing excess water. Tile lines should be placed above the fragipan and back filled with porous material. If the soils are drained and otherwise are well managed, they produce a good growth of most crops common in the county, though they are not well suited to crops that may be damaged by frost heaving in winter. Lime should be applied as indicated by soil tests.

CAPABILITY UNIT IIw–7

This unit consists of nearly level, medium-textured, moderately well drained soils that lie on flood plains throughout the county. These soils have a seasonally high water table and, in most places, are subject to infrequent flooding.

If drainage is improved, these soils are suited to many kinds of crops, though planting of some crops may be delayed. Most of the acreage is in pasture, but some is cropped and some is still wooded. To improve drainage, V-type ditches can be used, and runoff from adjacent higher areas should be intercepted and diverted. The main channels of streams should be kept clean, and some of them need to be deepened and straightened.

CAPABILITY UNIT IIs–2

The only soil in this unit is Lewisberry gravelly fine sandy loam, 3 to 8 percent slopes, moderately eroded. This gravelly soil is deep, but it is somewhat droughty, and its main restriction is the limited capacity to retain moisture and plant nutrients.

This soil warms up early in spring and can be used for crops that normally are planted early. Turning under crop residues, as well as using cover crops and green-manure crops, adds organic matter to the soil and thereby increases its capacity to hold moisture. Runoff can be reduced and erosion controlled by tilling and stripcropping

on the contour. Supplemental irrigation is desirable in fields used for truck crops or other crops of high value.

CAPABILITY UNIT IIs–11

Only one soil, Penn silt loam, 0 to 3 percent slopes, moderately eroded, is in this unit. This well-drained soil occurs on uplands. It is somewhat droughty because it is only 20 to 40 inches deep over shale bedrock. Management is needed that conserves moisture and controls erosion. To increase the capacity for holding moisture, all organic material available should be returned to the soil. Crop growth can be increased through the use of irrigation.

CAPABILITY UNIT IIe–1

The only soil in this unit is Hagerstown silt loam, 8 to 15 percent slopes, moderately eroded. This deep, well-drained soil is on uplands, where it developed in material weathered from limestone. It is fertile and has a naturally high content of lime. The hazard of erosion is severe.

This soil is suited to most crops grown in the county. Erosion can be controlled by using a rotation that includes hay or other close-growing vegetation much of the time, keeping tillage to a minimum, stripcropping on the contour, using buffer strips of sod, and constructing diversion terraces and well-sodded waterways that safely dispose of runoff. In orchards the trees should be on the contour and the surface protected by sod or by cover crops or green-manure crops most of the time.

CAPABILITY UNIT IIIe–4

This unit is made up of deep, medium-textured, well-drained soils on uplands. These soils are sloping and moderately eroded. They are highly susceptible to erosion.

The soils in this unit are fertile and are well suited to most crops grown in the county. They are more strongly acid than the soil in capability unit IIIe–1, and they need larger amounts of lime. In other respects, however, the soils of the two units are used and managed in about the same way.

CAPABILITY UNIT IIIe–5

Lewisberry gravelly fine sandy loam, 8 to 15 percent slopes, moderately eroded, is the only soil in this unit. This soil can hold less moisture available to plants than the soils in capability units IIIe–1 and IIIe–4, and it is more open and sandy and more easily worked. In most other respects, however, it is used and managed in about the same way as those soils. If the supply of plant nutrients is kept high and if adequate moisture is maintained through irrigation, early truck crops and other crops grow well on this soil. Conserving moisture is especially important.

CAPABILITY UNIT IIIe–10

This unit consists of deep and moderately deep, medium-textured, well-drained and somewhat excessively drained soils on uplands. These soils are gently sloping or sloping and are moderately eroded. Most of them contain coarse fragments of rock. Erosion is a severe hazard.

The soils of this unit are similar to those of capability unit IIe–10, but they are either more sloping or shallower to hard bedrock, and they tend to be droughty. The soils are used for most kinds of cultivated crops and for pasture. If they are adequately limed and fertilized, they are well suited to clover, mixed hay, bluegrass, or mixed pasture plants. Crops should be grown in a suitable rotation and planted in fairly narrow strips on the contour. If runoff is diverted to the sodded strips, most of the water can be absorbed by the soils. Any excess water can be channeled through well-sodded waterways that lead to carefully prepared outlets. Supplemental irrigation is of value in dry periods.

Pasture on these soils ought to be well established before it is grazed. Thereafter, grazing needs to be carefully regulated, according to the carrying capacity of the pasture.

CAPABILITY UNIT IIIe–24

The only soil in this unit is Conestoga silt loam, 8 to 15 percent slopes, moderately eroded. This deep, well-drained soil occurs on uplands. Because it developed in material weathered from calciferous schist, it is fairly high in natural content of lime. Moreover, it contains a large amount of mica and is highly erodible.

This soil can be cultivated regularly if it is well managed. Most of the common crops grow well. Erosion can be controlled by using a rotation that includes hay or other close-growing vegetation much of time, keeping tillage to a minimum, stripcropping on the contour, using buffer strips of sod, and constructing diversion terraces and well-sodded waterways that safely dispose of runoff. In fields used for orchards, the trees should be on the contour and the surface protected by sod or by cover crops or green-manure crops most of the time.

CAPABILITY UNIT IIIe–25

This unit consists of somewhat excessively drained, medium-textured, sloping soils on uplands. These soils are underlain by loose micaceous material. They are moderately or severely eroded and are highly susceptible to erosion. Some areas are gravelly.

The soils in this unit are suited to crops and pasture, but they are seriously in need of good management. Some of the practices that reduce runoff and check soil losses are minimum tillage, a suitable crop rotation, and contour stripcropping. The picture on the cover of this survey shows contour stripcropping on soils of capability unit IIIe–25 near Manchester. The most extensive soil in the field shown is Manor loam, 8 to 15 percent slopes, moderately eroded.

In some places it is desirable to grow only hay and to plow and reseed only if the surface soil becomes sodbound. Because the hazard of erosion is so severe, special care is needed in disposing of excess water.

CAPABILITY UNIT IIIw–1

This unit consists of moderately well drained and somewhat poorly drained, medium-textured, level to gently sloping soils on uplands. The subsoil in these soils contains a fragipan and is moderately slowly or slowly permeable.

Unless these soils are artificially drained, their use for crops is limited. Shallow ditches or tile lines can be used for disposing of excess water if outlets are adequate. In sloping areas runoff should be intercepted and diverted to safe disposal areas. After drainage is improved, the soils are suited to most crops grown in the county, but herbaceous perennials may be severely damaged by frost heaving in winter. Figure 11 shows a pond constructed on two soils of this unit.

CAPABILITY UNIT IIIw–3

Melvin silt loam is the only soil in this unit. This nearly level, poorly drained soil lies on flood plains and is subject to flooding.

Although this soil is nonacid and fertile, its use for crops is seriously limited unless artificial drainage is provided. Drainage can be improved by using V-type ditches or tile. In areas not frequently flooded, the soil is well suited to corn and other row crops and to improved pasture, but it is little used for hay or small grains. Where flooding is frequent, use is severely limited. In some areas the channels of streams need to be deepened or otherwise improved and the banks should be stabilized.

CAPABILITY UNIT IIIw–7

This unit consists of nearly level, poorly drained, medium-textured soils that are strongly acid or very strongly acid. Unlike the soil in capability unit IIIw–3, these soils are not naturally well supplied with lime, and they are less productive than that soil unless lime and fertilizer are applied in amounts indicated by soil tests. Otherwise, the soils in this unit are used and managed in about the same way as the soil in unit IIIw–3.

CAPABILITY UNIT IIIs–1

Only Mt. Airy channery loam, 0 to 3 percent slopes, is in this unit. This soil is moderately deep and is somewhat excessively drained. More than 50 percent of its subsoil is hard, mainly flattened fragments of rock. In many places such fragments make up nearly as much of its plow layer. Because the content of coarse fragments is so high and because the depth to bedrock is limited, the soil has only a moderate capacity to hold moisture that plants can use. It is so nearly level, however, that erosion is only a minor hazard.

Most crops grow well on this soil if rainfall is adequate and well distributed, but they show a lack of sufficient moisture during extended periods when the weather is hot and dry. In addition, the soil generally occupies ridgetops where conserving moisture may be difficult. To increase the capacity for holding moisture, all organic material available should be returned to the soil. Supplemental irrigation should be especially helpful in producing crops.

CAPABILITY UNIT IVe–1

The only soil in this unit is Conestoga silt loam, 8 to 15 percent slopes, severely eroded. This soil is deep, well drained, and fertile. It occupies uplands, where it developed in material weathered from calciferous schist. It has a fairly high natural content of lime, but it contains a large amount of mica and is highly erodible. Gullies are common, and some of them are so deep that they cannot by crossed by farm equipment.

This soil is marginal for tilled crops. A safer use is permanent hay, pasture, or contoured orchards that are protected by a permanent cover of plants. Contour stripcropping is needed in fields where cultivated crops are grown.

CAPABILITY UNIT IVe–3

This unit consists of deep, well-drained, medium-textured soils that are sloping to moderately steep. These soils are moderately or severely eroded.

The soils in this unit are marginal for tilled crops. In many respects they are similar to the soil in capability unit IVe–1, but they are much more acid, require more lime, and, in some places, need more fertilizer. Otherwise, the soils of the two units are used and managed in much the same way.

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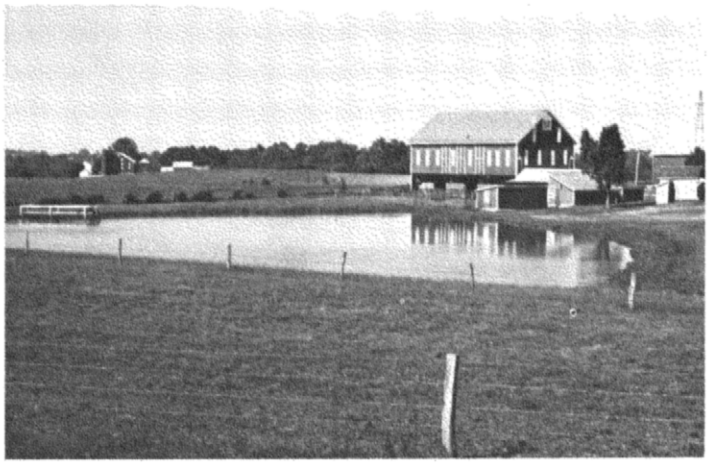

Figure 11.—**An impounded pond in an area of Abbottstown and Readington silt loams, 3 to 8 percent slopes, moderately eroded, near Taneytown. These soils are in capability unit IIIw–1. The pond furnishes water for livestock, recreation, and fire protection.**

CAPABILITY UNIT IVe–5

Only Lewisberry gravelly fine sandy loam, 15 to 25 percent slopes, is in this unit. This soil, though deep, is somewhat droughty. It remains wooded in most places, but it is subject to severe erosion in cleared areas. An occasional tilled crop can be grown if it is planted in contour strips. A safer use for this soil is permanent hay, permanent pasture, or contoured orchards in which the soil surface is well protected. Moisture should be conserved and all measures needed to control erosion should be applied. Irrigation is beneficial but may not be economically feasible.

CAPABILITY UNIT IVe–10

This unit consists of moderately deep, medium-textured, sloping to moderately steep soils that are well drained or somewhat excessively drained. These soils are moderately or severely eroded, and they are highly susceptible to erosion. Some of them contain coarse fragments of rock.

An occasional tilled crop can be grown on these soils if it is planted in narrow strips on the contour (fig. 12) and if other suitable measures are used for controlling erosion. Safer uses are hay, carefully managed pasture, and sodded orchards.

CAPABILITY UNIT IVe–25

This unit consists of somewhat excessively drained, medium-textured, sloping to moderately steep soils that are highly erodible. These soils are underlain by loose micaceous material. Some of them are moderately eroded, and others are severely eroded. Some of the soils are gravelly.

The soils in this unit can be used for an occasional tilled crop if they are managed in such a way that soil losses are controlled, but a safer use is pasture, permanent hay, or sodded orchards. Any cultivation should be on the contour. A dense cover of vegetation is needed in terraces, and

Figure 12.—**Contour stripcropping on Mt. Airy channery loam, 8 to 15 percent slopes, moderately eroded, in a field just off New Windsor Road. This soil is in capability unit IVe-10.**

water that accumulates in the channels should be safely removed through sodded waterways that lead to adequate outlets.

CAPABILITY UNIT IVs-32

The only soil in this unit is Klinesville gravelly loam, 3 to 8 percent slopes, moderately eroded. This soil is less than 20 inches deep to bedrock and is somewhat excessively drained. More than 50 percent of its volume is coarse fragments of sandstone, shale, or both.

The use of this soil for farming is severely limited by droughtiness. The growth of crops is especially poor in seasons when rainfall is below normal or poorly distributed. Consequently, the soil is marginal for cultivated crops and is not well suited to pasture, which is difficult and expensive to establish and maintain. Corn or other field crops can be grown occasionally, and grasses such as little bluestem or other drought-resistant plants can be used for grazing or forage. Conserving moisture is of major concern on this soil, and any runoff should be trapped and spread over vegetated areas. Irrigation generally is not economically feasible.

CAPABILITY UNIT Vw-1

Baile silt loam, 0 to 3 percent slopes, is the only soil in this unit. This soil is poorly drained, has a slowly permeable subsoil, and is too difficult to drain well enough for cultivated crops. It occupies upland flats, depressions, and areas around and above the heads of drains.

Most cleared areas of this soil are idle or are used for improved or partly improved pasture. Many areas are in stands of water-tolerant trees and other plants. Corn or hay crops are grown in a few places, but the soil is commonly too wet for tillage and is difficult to work at any time except when the weather is exceptionally dry. Generally, improved pasture is the most intensive suitable use.

Drainage should be improved as much as feasible by intercepting runoff from higher areas and by using open ditches to dispose of surface water. Tile drains ordinarily do not function well in this tight soil.

CAPABILITY UNIT VIe-1

The only soil in this unit is Conestoga silt loam, 15 to 25 percent slopes, severely eroded. This deep, well-drained soil developed from calciferous schist.

Although the soil in this unit is fertile, it is too steep and too erodible for clean-tilled crops. Hay crops are suitable if the plants are well managed and are protected from overgrazing. Another good use is contoured orchards having a permanent ground cover.

CAPABILITY UNIT VIe–2

In this unit are dominantly deep, well-drained soils that developed from noncalcareous rock. These soils are moderately steep and severely eroded.

The soils in this unit are less fertile than the soil in capability unit VIe–1. Where they are used for improved pasture or for sodded orchards on the contour, they require more intensive management than that soil. Any areas now wooded should probably remain in trees, and some areas might well be reforested.

CAPABILITY UNIT VIe–3

This unit consists of moderately deep or deep, sloping or moderately steep soils that are somewhat excessively drained. Most of these soils contain rock fragments, and most of them are either moderately or severely eroded.

The soils in this unit are too steep or too eroded for cultivation. Most of their acreage has been cleared, but the steepest, least eroded areas are still in trees. The cleared areas generally are pastured, idle, or in some nonfarm use.

Pasture can be established on these soils by liming, fertilizing, and seeding, but it should not be grazed until it is well sodded and then only moderately. Controlling brush and weeds commonly is difficult. In areas that are too steep or too rough for mowing, the brush and weeds must be controlled by hand or by chemicals. Terraces constructed in pastures will slow runoff and permit water to soak in.

Woodland is a better use for these soils than poorly managed pasture. Many areas are suitable for trees and could be reforested.

CAPABILITY UNIT VIw–2

The only soil in this unit is Baile silt loam, 3 to 8 percent slopes. This poorly drained soil is so wet and its drainage is so difficult that use for cultivation is not feasible. Another limitation is the hazard of erosion. The surface layer is hard when dry, tough when moist, and sticky when wet. In addition, the subsoil is slowly permeable.

Some areas of this soil are wooded, some are idle, and others are grazed. Areas used for grazing can be improved by ditching, seeding, applying fertilizer and lime, and controlling brush and weeds.

CAPABILITY UNIT VIs–3

This unit consists of somewhat excessively drained, gently sloping to moderately steep soils that are medium textured and very stony.

These soils are too stony or too steep for cultivation. They can be used for pasture, or for the limited production of hay, but either of these uses requires that the soils be partly cleared of stones, limed and fertilized, and seeded with an appropriate mixture. After pasture is established grazing should be carefully managed. Overgrazing or overtrampling weakens the pasture and exposes the soil to erosion. Controlling weeds and brush may be difficult because of stones.

Wooded areas should remain in trees, and some areas could be reforested. Moderate return can be obtained from properly managed woodland.

CAPABILITY UNIT VIIe–3

This unit is made up of steep, somewhat excessively drained soils that commonly are severely eroded and thin over bedrock. These soils are highly susceptible to erosion. Cultivation of these soils is not safe or feasible, and grazing is severely limited, even under the most intensive management. In most cleared areas a large amount of soil material has been washed away. The less eroded areas are wooded.

Much of the cleared acreage needs to be reforested. Livestock should be kept out of wooded or reforested areas, and fires should be prevented.

CAPABILITY UNIT VIIs–3

The soils in this unit are somewhat excessively drained, steep or very steep, and very stony. These soils are of little use in farming. Most of the acreage is too steep and too stony, even for grazing. The soils are suited to trees, and they can be used for watershed protection, wildlife habitat, and some kinds of recreation. Returns from woodland products are fairly good, though timber operations or tree farming may not be economically feasible on the steeper slopes.

CAPABILITY UNIT VIIs–32

This unit consists of shallow, stony soils that are sloping to very steep and are severely eroded or very severely eroded. In many areas so much soil material has been washed away that scarcely any of it remains, and in places bedrock is exposed. The soils have low available moisture capacity and are of little use in farming. If they are revegetated with grasses, shrubs, vines, or trees, they can be used for watershed protection, limited grazing, and habitat for some kinds of wildlife. In areas planted to trees, some woodland products should eventually be produced.

General Management Requirements

Some of the management practices needed to obtain a good growth of crops and, at the same time, to control erosion can be conveniently summarized for all the soils in the county. Among these practices are the drainage of wet soils, irrigation of soils in dry years, use of adequate soil amendments, and proper tillage.

Drainage

Many farms in Carroll County are located mostly or entirely on well-drained soils. Only about 13 percent of the acreage needs artificial drainage.

Soils that require no artificial drainage are those of the Bermudian, Birdsboro, Bucks, Cardiff, Chester, Comus, Conestoga, Elioak, Elsinboro, Glenelg, Hagerstown, Klinesville, Lewisberry, Linganore, Manor, Mt. Airy, Penn, and Steinsburg series. These soils make up about 87 percent of the total area in the county.

Soils that require moderate artificial drainage are those of the Abbottstown, Codorus, Delanco, Glenville, Lindside, Raritan, Readington, Rowland, Urbana, and Wiltshire series. These soils make up about 8 percent of the county.

Soils that require intensive artificial drainage are those of the Baile, Bowmansville, Hatboro, and Melvin series. These soils make up about 5 percent of the county.

The kinds of drainage systems that are suitable for the soils of this county are explained in the "Drainage Guide for Maryland" (*6*).

The Bermudian, Bowmansville, Codorus, Comus, Hatboro, Lindside, Melvin, and Rowland soils occur on flood plains, where the severity of the flood hazard varies from

place to place. Records of flooding are the best guides to the need for protection.

Irrigation

The amount and distribution of rainfall in Carroll County generally are adequate for crops, but there are extended dry periods when irrigation could be the means of sustaining crop yields. Information concerning irrigation is given in the "Maryland Guide for Sprinkler Irrigation," which can be obtained from the Maryland Agricultural Extension Service or the Maryland Agricultural Experiment Station. Features that affect the suitability of individual soils for irrigation are given in table 6, "Engineering Interpretations," in the subsection "Engineering Uses of Soils."

Soil amendments

Because most soils in the county are acid, and only a few of them are naturally high in plant nutrients, additions of lime and fertilizer are needed for most crops. The amount of lime and the kinds and amounts of fertilizer needed can be judged by learning how well crops have responded in the past, by determining the yield level the farmer desires, and by studying records of previous management, especially the results of soil tests. Assistance in determining the specific requirement of each soil can be obtained from the county agricultural agent, who will arrange to have soils tested at the Soil Testing Laboratory of the University of Maryland.

Lime is seldom if ever needed on soils that are neutral or only slightly acid. In Carroll County these soils are of the Conestoga, Hagerstown, Lindside, Melvin, and Wiltshire series.

On soils where lime is needed, it generally is applied about once every 3 years. Lewisberry and other sandy soils require only 1 to 1½ tons per acre. Most of the other soils need 2 to 3 tons per acre, but wet soils that are very acid, such as the Baile, Bowmansville, and Hatboro soils, need 3 to 5 tons.

Manure furnishes large amounts of nitrogen and organic matter and smaller amounts of other plant nutrients.

Tillage

On all soils in the county, tillage should be limited to that needed for the quick germination of seeds, the adequate growth of seedlings, and the maturing of a normal crop. Keeping tillage to a minimum is effective in reducing erosion and the breakdown of soil structure.

By plow planting or by wheel-track planting at the time of plowing, the number of cultivations, or trips over a field with heavy machinery, are reduced. Another such trip is eliminated if a harrow is placed behind the plow and ahead of the seeder. Properly using the appropriate herbicides can eliminate still another cultivation.

The continued use of heavy machinery compacts many kinds of soils and makes them difficult to work. This damage is more likely to occur on the Baile, Bowmansville, Hatboro, Melvin, and other poorly drained, medium-textured soils. Compaction decreases the rate at which water infiltrates into the soil and the degree of aeration. If a sloping soil is compacted, the amount and rate of runoff are accelerated and the erosion hazard is increased. In such a soil, replenishing organic matter and growing sod crops help to restore good structure.

Sloping soils that are cultivated intensively and are susceptible to erosion should be tilled and stripcropped on the contour. In a single field, a suitable rotation can be used if the crops making up the rotation are alternated, or staggered, on the various strips. The strips should be narrower in the steeper areas than in the less sloping ones. Assistance in planning and laying out the cropping strips can be obtained through the local office of the Soil Conservation Service.

Estimated Yields

Table 2 shows the estimated average yields per acre of specified crops grown on soils of the county under two levels of management. In columns A are shown the estimated yields of these crops under management commonly used in the county. In columns B are the estimated yields that can be expected under improved management.

To obtain the yields listed in columns B, all or nearly all of the following practices are needed:

1. Contour tillage stripcropping, terracing, minimum tillage, and similar practices are used to control erosion on soils that are suitable for cultivation but susceptible to erosion; the soils that need drainage are drained; excess water is disposed of safely; and irrigation water is supplied to soils and crops that need it.
2. Crop rotations are of adequate length. They generally consist of a tilled crop that helps to control weeds, a deep-rooted crop that improves soil permeability, legumes for 1 or more years to help maintain or improve fertility, and a close-growing crop or a green-manure crop. A close-growing crop or a green-manure crop helps to improve structure and tilth, supplies organic matter, and reduces erosion.
3. Manure and crop-residues are turned under to supply organic matter, as well as nitrogen and other plant nutrients. This also improves tilth and helps to control losses from erosion.
4. Fertilizer and lime are applied according to needs indicated by soil tests.
5. Suitable methods of plowing, preparing the seedbed, and cultivating are used, but tillage is kept to a minimum.
6. Planting, cultivating, and harvesting are done at the right time and in the right way.
7. Weeds, diseases, and insects are controlled.
8. Crop varieties suited to the soils are selected for planting.

The yields shown in columns B are not presumed to be the highest yields obtainable, but they set a goal that is practical for most farmers to reach if they use good management. Yields on the same soils can be expected to vary because of differences in management, in the weather, in the crop varieties grown, and in the numbers and kinds of insects, diseases, and weeds.

More information about management practices needed to obtain good yields can be found in the subsections "Capability Groups of Soils" and "General Management Requirements."

TABLE 2.—*Estimated average acre yields of specified crops under two levels of management*

Estimated yields in columns A are those obtained under management commonly used in the county; estimated yields in columns B are those obtained under improved management. Absence of a yield figure indicates that the crop is not commonly planted on the soil, or that the soil is not considered suitable for the crop, or that inadequate information is available upon which to base an estimate. Made land is not used for farming and is not included in the table]

Soil	Corn		Wheat		Oats or barley		Alfalfa-grass hay		Tall-grass and clover hay		Bluegrass pasture		Tall-grass pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Cow-acre-days* [1]	*Cow-acre-days* [1]	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Abbottstown and Readington silt loams, 0 to 3 percent slopes	40	75	14	27	22	41	1. 4	3. 0	1. 3	3. 0	60	145	80	180
Abbottstown and Readington silt loams, 3 to 8 percent slopes, moderately eroded	40	80	14	27	22	41	1. 4	3. 2	1. 3	3. 1	60	150	80	180
Baile silt loam, 0 to 3 percent slopes	-----	-----	-----	-----	-----	-----	-----	-----	-----	2. 3	40	85	65	105
Baile silt loam, 3 to 8 percent slopes	-----	-----	-----	-----	-----	-----	-----	-----	-----	2. 5	50	100	80	130
Bermudian silt loam	85	135	27	43	39	62	3. 0	4. 8	2. 1	3. 3	80	140	120	270
Birdsboro silt loam, 0 to 3 percent slopes	60	125	23	43	33	62	2. 5	4. 8	1. 8	3. 3	70	140	100	270
Birdsboro silt loam, 3 to 8 percent slopes, moderately eroded	60	120	22	42	31	60	2. 4	4. 7	1. 7	3. 2	70	140	95	270
Bowmansville silt loam	-----	100	-----	33	-----	47	-----	-----	1. 8	2. 8	70	115	95	155
Bucks silt loam, 0 to 3 percent slopes	60	125	23	43	33	62	2. 5	4. 8	1. 8	3. 3	70	140	100	270
Bucks silt loam, 0 to 8 percent slopes, moderately eroded	60	120	22	42	31	60	2. 4	4. 7	1. 7	3. 2	70	140	95	270
Cardiff channery silt loam, 3 to 15 percent slopes, moderately eroded	20	70	12	24	18	36	1. 1	2. 8	1. 0	2. 7	45	110	60	130
Chester silt loam, 0 to 3 percent slopes	60	125	23	43	33	62	2. 5	4. 8	1. 8	3. 3	70	140	100	270
Chester silt loam, 3 to 8 percent slopes, moderately eroded	60	120	22	42	31	60	2. 4	4. 7	1. 7	3. 2	70	140	95	270
Chester silt loam, 8 to 15 percent slopes, moderately eroded	60	115	21	40	30	57	2. 3	4. 6	1. 7	3. 1	65	140	95	260
Chester silt loam, 8 to 15 percent slopes, severely eroded	50	105	18	37	26	53	2. 1	4. 3	1. 5	3. 0	60	130	85	240
Codorus silt loam	75	120	24	38	35	56	2. 6	4. 1	1. 9	3. 1	75	140	115	260
Comus silt loam	85	135	27	43	39	62	3. 0	4. 8	2. 1	3. 3	80	140	120	270
Comus silt loam, local alluvium, 0 to 3 percent slopes	85	135	27	43	39	62	3. 0	4. 8	2. 1	3. 3	80	140	120	270
Comus silt loam, local alluvium, 3 to 8 percent slopes	85	135	27	43	39	62	3. 0	4. 8	2. 1	3. 3	80	140	120	270
Conestoga silt loam, 0 to 3 percent slopes	80	130	27	45	39	65	3. 0	5. 0	2. 1	3. 5	85	150	125	280
Conestoga silt loam, 3 to 8 percent slopes, moderately eroded	75	125	25	44	37	63	2. 9	4. 9	2. 0	3. 4	85	150	120	280
Conestoga silt loam, 8 to 15 percent slopes, moderately eroded	70	120	23	43	35	62	2. 7	4. 8	1. 8	3. 3	80	145	110	270
Conestoga silt loam, 8 to 15 percent slopes, severely eroded	60	110	20	40	31	58	2. 5	4. 5	1. 6	3. 1	70	135	95	255
Conestoga silt loam, 15 to 25 percent slopes, severely eroded	-----	-----	-----	-----	-----	-----	2. 3	4. 4	1. 5	2. 9	65	130	90	245
Delanco silt loam, 0 to 3 percent slopes	60	110	21	39	29	56	2. 2	4. 1	1. 7	3. 1	70	130	95	260
Delanco silt loam, 3 to 8 percent slopes, moderately eroded	60	115	21	40	29	57	2. 3	4. 5	1. 7	3. 2	70	130	95	270
Elioak silt loam, 3 to 8 percent slopes, moderately eroded	60	120	22	42	31	60	2. 4	4. 7	1. 7	3. 2	70	140	95	270
Elioak silt loam, 8 to 15 percent slopes, moderately eroded	60	115	21	40	30	57	2. 3	4. 6	1. 7	3. 1	65	140	95	260
Elioak silty clay loam, 15 to 25 percent slopes, severely eroded	-----	-----	-----	-----	-----	-----	2. 0	4. 1	1. 4	2. 8	60	120	80	235
Elsinboro gravelly loam, 3 to 8 percent slopes, moderately eroded	60	120	22	42	31	60	2. 4	4. 7	1. 7	3. 2	70	140	95	270
Elsinboro gravelly loam, 8 to 15 percent slopes, moderately eroded	60	115	21	40	30	57	2. 3	4. 6	1. 7	3. 1	65	140	95	260
Elsinboro silt loam, 0 to 3 percent slopes	60	125	23	43	33	62	2. 5	4. 8	1. 8	3. 3	70	140	100	270
Elsinboro silt loam, 3 to 8 percent slopes, moderately eroded	60	120	22	42	31	60	2. 4	4. 7	1. 7	3. 2	70	140	95	270
Elsinboro silt loam, 8 to 15 percent slopes, moderately eroded	60	115	21	40	30	57	2. 3	4. 6	1. 7	3. 1	65	140	95	260
Glenelg channery loam, 3 to 8 percent slopes, moderately eroded	60	120	22	42	31	60	2. 4	4. 7	1. 7	3. 2	70	140	95	270
Glenelg channery loam, 8 to 15 percent slopes, moderately eroded	60	115	21	40	30	57	2. 3	4. 6	1. 7	3. 1	65	140	95	260
Glenelg channery loam, 8 to 15 percent slopes, severely eroded	50	105	18	37	26	53	2. 1	4. 3	1. 5	3. 0	60	130	85	240

See footnote at end of table.

TABLE 2.—*Estimated average acre yields of specified crops under two levels of management*—Continued

Soil	Corn		Wheat		Oats or barley		Alfalfa-grass hay		Tall-grass and clover hay		Bluegrass pasture		Tall-grass pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Cow-acre-days* [1]	*Cow-acre-days* [1]	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Glenelg channery loam, 15 to 25 percent slopes, moderately eroded	55	110	20	38	27	54	2.2	4.4	1.6	3.0	65	140	90	250
Glenelg channery loam, 15 to 25 percent slopes, severely eroded							2.0	4.1	1.4	2.1	60	120	80	235
Glenelg loam, 0 to 3 percent slopes	60	125	23	43	33	62	2.5	4.8	1.8	3.3	70	140	100	270
Glenelg loam, 3 to 8 percent slopes, moderately eroded	60	120	22	42	31	60	2.4	4.7	1.7	3.2	70	140	95	270
Glenelg loam, 3 to 8 percent slopes, severely eroded	55	110	20	38	27	54	2.2	4.4	1.6	3.0	65	140	90	250
Glenelg loam, 8 to 15 percent slopes, moderately eroded	60	115	21	40	30	57	2.3	4.6	1.7	3.1	65	140	95	260
Glenelg loam, 8 to 15 percent slopes, severely eroded	50	105	18	37	26	53	2.1	4.3	1.5	3.0	60	130	85	240
Glenville silt loam, 0 to 3 percent slopes	40	75	14	27	22	41	1.4	3.0	1.3	3.0	60	145	80	180
Glenville silt loam, 3 to 8 percent slopes	40	80	14	27	22	41	1.4	3.2	1.3	3.1	60	150	80	180
Hagerstown silt loam, 0 to 3 percent slopes	80	130	27	45	39	65	3.0	5.0	2.1	3.5	85	150	125	280
Hagerstown silt loam, 3 to 8 percent slopes, moderately eroded	75	125	25	44	37	63	2.9	4.9	2.0	3.4	85	150	120	280
Hagerstown silt loam, 8 to 15 percent slopes, moderately eroded	70	120	23	43	35	62	2.7	4.8	1.8	3.3	80	145	110	270
Hatboro silt loam	-----	100	-----	33	-----	47	-----	-----	1.8	2.8	70	115	95	155
Klinesville gravelly loam, 3 to 8 percent slopes, moderately eroded	20	30	13	24	20	38	.9	1.6	1.0	1.8	30	60	40	100
Klinesville soils, 8 to 25 percent slopes, very severely eroded	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Klinesville soils, 15 to 65 percent slopes, severely eroded	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Lewisberry gravelly fine sandy loam, 3 to 8 percent slopes, moderately eroded	25	45	14	26	20	39	1.2	2.3	1.1	2.1	35	75	45	115
Lewisberry gravelly fine sandy loam, 8 to 15 percent slopes, moderately eroded	20	40	12	24	18	36	1.1	2.1	1.0	2.0	35	70	40	110
Lewisberry gravelly fine sandy loam, 15 to 25 percent slopes	20	40	11	22	16	33	1.1	2.1	1.0	1.9	35	70	40	105
Lindside silt loam	100	130	32	40	48	64	3.5	4.4	2.6	3.3	90	140	125	240
Linganore channery silt loam, 3 to 8 percent slopes, moderately eroded	25	75	14	26	20	39	1.2	2.9	1.1	2.8	45	90	65	115
Linganore channery silt loam, 8 to 15 percent slopes, moderately eroded	20	70	12	24	18	36	1.1	2.8	1.0	2.7	45	85	60	110
Linganore channery silt loam, 8 to 15 percent slopes, severely eroded	-----	-----	-----	-----	-----	-----	.9	2.4	.9	2.4	25	50	50	85
Linganore channery silt loam, 15 to 25 percent slopes, moderately eroded	-----	-----	-----	-----	-----	-----	1.0	2.6	1.0	2.6	30	60	50	95
Linganore channery silt loam, 25 to 45 percent slopes	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	25	50	40	85
Manor gravelly loam, 3 to 8 percent slopes, moderately eroded	50	120	20	42	29	60	2.2	4.7	1.5	3.2	60	140	85	270
Manor gravelly loam, 8 to 15 percent slopes, moderately eroded	50	115	19	40	28	57	2.1	4.6	1.5	3.1	55	140	85	260
Manor gravelly loam, 8 to 15 percent slopes, severely eroded	40	105	16	37	24	53	1.9	4.3	1.3	3.0	50	130	75	240
Manor gravelly loam, 15 to 25 percent slopes, moderately eroded	45	110	18	38	25	54	2.0	4.4	1.4	3.0	55	140	80	250
Manor gravelly loam, 15 to 25 percent slopes, severely eroded	-----	-----	-----	-----	-----	-----	1.8	4.1	1.2	2.8	50	120	70	235
Manor loam, 0 to 8 percent slopes, moderately eroded	50	120	20	42	29	60	2.2	4.7	1.5	3.2	60	140	85	270
Manor loam, 3 to 8 percent slopes, severely eroded	45	110	18	39	26	56	2.0	4.4	1.4	3.1	55	130	80	260
Manor loam, 8 to 15 percent slopes, moderately eroded	50	115	19	40	28	57	2.1	4.6	1.5	3.1	55	140	85	260
Manor loam, 8 to 15 percent slopes, severely eroded	40	105	16	37	24	53	1.9	4.3	1.3	3.0	50	130	75	240
Manor loam, 15 to 25 percent slopes, moderately eroded	45	110	18	38	25	54	2.0	4.4	1.4	3.0	55	140	80	250
Manor loam, 15 to 25 percent slopes, severely eroded	-----	-----	-----	-----	-----	-----	1.8	4.1	1.2	2.8	50	120	70	235
Manor loam, 25 to 45 percent slopes	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	40	100	60	200

See footnote at end of table.

TABLE 2.—*Estimated average acre yields of specified crops under two levels of management*—Continued

Soil	Corn		Wheat		Oats or barley		Alfalfa-grass hay		Tall-grass and clover hay		Bluegrass pasture		Tall-grass pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Cow-acre-days* [1]	*Cow-acre-days* [1]	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Manor very stony loam, 3 to 15 percent slopes	-----	-----	-----	-----	-----	-----	-----	3. 5	-----	2. 5	45	115	65	220
Manor very stony loam, 15 to 25 percent slopes	-----	-----	-----	-----	-----	-----	-----	3. 5	-----	2. 5	40	110	60	210
Manor very stony loam, 25 to 45 percent slopes	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	30	100	50	200
Manor very stony loam, 45 to 75 percent slopes	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Melvin silt loam	-----	120	-----	35	-----	55	-----	-----	2. 5	3. 1	90	140	125	240
Mt. Airy channery loam, 0 to 3 percent slopes	30	80	16	30	23	44	1. 3	2. 9	1. 2	2. 8	50	120	70	150
Mt. Airy channery loam, 3 to 8 percent slopes, moderately eroded	25	75	15	28	22	42	1. 3	2. 9	1. 2	2. 8	50	120	70	150
Mt. Airy channery loam, 8 to 15 percent slopes, moderately eroded	20	70	12	24	18	36	1. 1	2. 8	1. 0	2. 7	45	110	60	130
Mt. Airy channery loam, 8 to 15 percent slopes, severely eroded	-----	-----	-----	-----	-----	-----	. 9	2. 4	. 9	2. 5	30	80	55	110
Mt. Airy channery loam, 15 to 25 percent slopes, moderately eroded	-----	-----	-----	-----	-----	-----	1. 0	2. 6	1. 0	2. 6	30	85	50	115
Mt. Airy channery loam, 25 to 45 percent slopes	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	25	60	40	95
Penn loam, 0 to 8 percent slopes, moderately eroded	35	90	18	33	27	50	1. 6	3. 4	1. 4	3. 1	55	130	80	170
Penn shaly silt loam, 3 to 8 percent slopes, moderately eroded	25	75	15	28	22	42	1. 3	2. 9	1. 2	2. 8	50	120	70	150
Penn shaly silt loam, 8 to 15 percent slopes, moderately eroded	20	70	12	24	18	36	1. 1	2. 8	1. 0	2. 7	45	110	60	130
Penn shaly silt loam, 8 to 15 percent slopes, severely eroded	-----	-----	-----	-----	-----	-----	. 9	2. 4	. 9	2. 5	30	80	55	110
Penn silt loam, 0 to 3 percent slopes, moderately eroded	35	90	18	33	27	50	1. 6	3. 4	1. 4	3. 1	55	130	80	170
Penn silt loam, 3 to 8 percent slopes, moderately eroded	35	90	18	33	27	50	1. 6	3. 4	1. 4	3. 1	55	130	80	170
Penn silt loam, 8 to 15 percent slopes, moderately eroded	35	85	17	32	24	47	1. 5	3. 2	1. 4	3. 0	55	25	80	160
Penn silt loam, 8 to 15 percent slopes, severely eroded	30	80	15	28	21	42	1. 3	2. 9	1. 2	2. 8	50	110	70	150
Penn soils, 15 to 25 percent slopes	-----	-----	-----	-----	-----	-----	1. 4	3. 0	1. 3	2. 9	50	115	75	155
Penn-Steinsburg loams, 3 to 8 percent slopes, moderately eroded	35	90	18	33	27	50	1. 6	3. 4	1. 4	3. 1	55	130	80	170
Penn-Steinsburg loams, 8 to 15 percent slopes, severely eroded	30	80	15	28	21	42	1. 3	2. 9	1. 2	2. 8	50	110	70	150
Raritan silt loam, 0 to 3 percent slopes	40	75	14	27	22	41	1. 4	3. 0	1. 3	3. 0	60	145	80	180
Raritan silt loam, 3 to 8 percent slopes	40	80	14	27	22	41	1. 4	3. 2	1. 3	3. 1	60	150	80	180
Rowland silt loam	75	120	24	38	35	56	2. 6	4. 1	1. 9	3. 1	75	140	115	260
Steinsburg channery loam, 3 to 8 percent slopes, moderately eroded	35	90	18	33	27	50	1. 6	3. 4	1. 4	3. 1	55	130	80	170
Steinsburg channery loam, 8 to 25 percent slopes, severely eroded	-----	-----	-----	-----	-----	-----	1. 2	2. 8	1. 1	2. 7	45	105	65	140
Urbana silt loam, 0 to 3 percent slopes	40	75	14	27	22	41	1. 4	3. 0	1. 3	3. 0	60	145	80	180
Urbana silt loam, 3 to 8 percent slopes, moderately eroded	40	80	14	27	22	41	1. 4	3. 2	1. 3	3. 1	60	150	80	180
Wiltshire silt loam	50	95	18	35	25	48	2. 1	4. 0	1. 5	3. 7	65	165	90	210

[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. For example, an acre of pasture that provides 30 days of grazing for two cows has a carrying capacity of 60 cow-acre-days.

Woodland [2]

Only about 11 percent of Carroll County was forested in 1959. Woodland products sold from farms were valued at $32,311 in 1954 and $65,299 in 1959.

Just as soils are placed in capability classes, subclasses, and units according to their suitability for crops and pasture, they are also grouped according to their suitability for woodland use. Each woodland suitability group is made up of soils that are suitable for about the same kinds of trees, require similar practices for conserving soil and moisture, and have similar potential productivity for wood crops.

The potential productivity of soils for forest trees is measured by the site index. The site index is the average height, in feet, of the dominant trees in the stand at 50 years of age. For example, if the site index for white oak

[2] A. R. BOND, assistant State forester Maryland Department of Forests and Parks, and SILAS LITTLE, JR., forester, Northeastern Forest Experiment Station, helped to prepare this subsection.

is 65 on a given soil, this means that the dominant trees in a stand of white oak on that soil have an average height of 65 feet when the trees are 50 years old. In this subsection, all comparisons of soils are made on the basis of their estimated productivity for suitable species of oak. These are called mixed oaks, but the species commonly vary from place to place. The estimated site indexes are based on information obtained in Maryland, Pennsylvania, and Virginia.

Woodland suitability groups

Described in the following pages are the woodland suitability groups in Carroll County. All the soils in one woodland group have about the same site index for mixed oaks, and they are similar in their suitability for different species of trees. Also, the soils are similar with respect to the hazards and limitations that affect management: plant competition, limitations on the use of logging and other heavy equipment, seedling mortality, and the hazards of windthrow and erosion.

Competition from other plants is the invasion or growth of undesirable species when openings are made in the canopy. In Carroll County, competition is generally more severe for pines than for hardwoods.

Limitations on the use of equipment vary according to slope and characteristics of the soils that restrict or prohibit the use of equipment commonly employed in tending and harvesting trees.

Seedling mortality refers to the expected loss of naturally occurring or planted seedlings as influenced by kinds of soil.

The hazard of erosion refers to erodibility when the soils are not fully protected by a woodland cover. Soils are not well protected during the seedling and juvenile stages of tree growth after more or less clean harvesting of woodland crops.

The rating for hazard of windthrow is based on soil characteristics that influence the development of tree roots.

In the following discussion, the woodland groups are not numbered consecutively, because they are part of a system of grouping that is used throughout Maryland, and only a comparatively few of all the groups are represented in this county. To find the names of the soils in any given woodland group, refer to the "Guide to Mapping Units" at the back of this survey. Made land, a miscellaneous land type, has not been placed in a woodland group.

WOODLAND SUITABILITY GROUP 22

This group consists of poorly drained soils on flood plains, where the water table generally is high. These soils have a surface layer of silt loam. They may be flooded one or more times each year, but floodwater seldom remains for long periods, and ponding is unlikely.

The soils of this group are among the most productive in the county. The site index for mixed oaks is 95 or more. In addition to oaks, the soils are well suited to white pine, and also to yellow-poplar on natural levees and in other areas where surface drainage is adequate. White pine is preferred for planting for wood crops. Scotch pine and white pine are suitable for Christmas trees.

Plant competition is severe for young conifers and moderate for most kinds of hardwoods. Limitations on the use of equipment are severe because of wetness and seasonal flooding. Seedling mortality is moderate, also because of flooding. Windthrow is only a slight hazard, and there is little risk of erosion, except for some scouring during periods when the soils are flooded.

WOODLAND SUITABILITY GROUP 23

This group consists of somewhat poorly drained and moderately well drained soils that have a fragipan in their subsoil. Tree roots penetrate the fragipan in only a few places. These soils have a surface layer of silt loam, and they are affected by a seasonally perched water table.

The soils of this group are well suited to oaks, yellow-poplar, and white pine. For mixed oaks the average site index is between 85 and 94. White pine is suitable for planting for wood crops. Scotch pine and Norway spruce make good Christmas trees.

Plant competition is moderate for hardwoods but is severe for conifers. Seedling mortality is only slight. Because the soils are wet for long periods, however, limitations on the use of equipment are severe. The risk of erosion is only slight, but windthrow is a moderate to severe hazard because most trees on these soils have shallow roots.

WOODLAND SUITABILITY GROUP 25

In this group are deep, level to gently sloping, well-drained soils that developed in material weathered from limestone. These soils have a silt loam surface layer and a silty clay to clay loam subsoil. They retain moisture and plant nutrients especially well.

The soils of this group are excellent for trees, but all their acreage has been cleared, and none of the original forest remains. The average site index for mixed oaks is between 85 and 94. A suitable tree to plant for wood crops is white pine. Among the species that grow well as Christmas trees are Scotch pine, Norway spruce, Austrian pine, white pine, and blue spruce.

Seedling mortality and equipment limitations are only slight. Plant competition is severe for young conifers and moderate for hardwoods. The hazard of erosion is moderate, but that of windthrow is only slight.

WOODLAND SUITABILITY GROUP 29

This group consists of somewhat poorly drained to well-drained soils on flood plains and on accumulations of local alluvium. These soils have a surface layer of silt loam. Some of them are flooded occasionally, but floodwater rarely stays long enough to stagnate.

The soils of this group are excellent for hardwoods, especially oaks and yellow-poplar. The site index for mixed oaks ranges between 75 and 84. White pine is of first priority in plantations for wood crops, but valuable hardwoods in existing stands should be well managed until they are ready for harvesting. Douglas-fir, Scotch pine, and white pine are suitable as Christmas trees, and so are Norway spruce and Austrian pine.

Seedling mortality is only slight. Plant competition is severe for young conifers and is moderate for most kinds of hardwoods. The use of equipment is moderately limited because some of the soils are seasonally wet and most of them are subject to flooding. The hazard of windthrow is only slight, and there is little risk of erosion except at times when floodwater may cause some scouring.

WOODLAND SUITABILITY GROUP 30

The soils in this group are deep, nearly level to moderately steep, acid, and well drained. They occupy uplands and old stream terraces. Most of them are only slightly or moderately eroded, but small areas are severely eroded. These soils are extensive in the county and make up about 20 percent of the total acreage.

The soils of this group are among the best in the county for trees, particularly hardwoods. The average site index for mixed oaks is between 75 and 84. In addition to oaks, the suitable trees include yellow-poplar, white pine, and shortleaf pine. Yellow-poplar is probably the most rapid growing of the commercial hardwoods, but pines are more suitable in plantations (fig. 13). Species that do well as Christmas trees are Scotch pine, Norway spruce, Austrian pine, white pine, and blue spruce.

Plant competition is moderate for hardwoods and is severe for conifers. Seedling mortality is slight. Equipment limitations and the erosion hazard are slight on slopes of less than 15 precent, but they are moderate on slopes of 15 percent or more. Windthrow is only a slight hazard.

WOODLAND SUITABILITY GROUP 38

This group consists of all the poorly drained soils on uplands in the county. These soils have a silt loam surface layer. Their subsoil is finer textured than the surface layer, and it is sticky when wet. Locally, small areas of these soils lie in depressions where they may be temporarily ponded in wet periods.

The site index for mixed oaks ranges between 65 and 74. Species to favor in existing stands are oaks, yellow-poplar, and white pine. For planting for wood crops, white pine is suitable. Scotch pine and Norway spruce make good Christmas trees, and white pine also can be used.

Plant competition is severe for conifers and is moderate for most kinds of hardwoods. Equipment limitations are severe because the soils are wet for such long periods. Seedling mortality is slight. Erosion is only a slight hazard, but there is a moderate hazard of windthrow, particularly for species that do not root deeply in these normally wet, sticky soils.

WOODLAND SUITABILITY GROUP 40

This group consists of level to moderately steep, well-drained or somewhat excessively drained soils on uplands that are deep or moderately deep to bedrock. These soils occur mostly in the northern and northwestern parts of the county.

The soils in this group are considerably less productive than deeper soils on uplands. The average site index for mixed oaks is between 65 and 74. In addition to oaks, the species suitable for wood crops include yellow-poplar, white pine, and shortleaf pine. White pine grows well in plantations. Suitable as Christmas trees, in order of priority, are Scotch pine, Norway spruce, Austrian pine, white pine, and Virginia pine.

Competition from undesirable plants is moderate for hardwoods and is severe for conifers. Equipment limitations and the erosion hazard are only slight on slopes of less than 15 percent, but they are moderate on slopes of 15 percent or more. Seedling mortality and the hazard of windthrow are slight.

Figure 13.—**White pine in a plantation on Glenelg loam, 3 to 8 percent slopes, moderately eroded. This soil is in woodland suitability group 30. The trees were planted to protect the watershed above the town of New Windsor.**

WOODLAND SUITABILITY GROUP 43

Soils of this group are deep, level to sloping, well drained, and micaceous. In sloping areas they are highly erodible. These soils occupy about 16 percent of the county, mainly in the eastern part but also in the general area of New Windsor. In a few places they are stony.

The soils in this group are generally less productive than deeper soils that can hold more moisture available to trees. The average site index for mixed oaks is between 65 and 74. Yellow-poplar and oaks are the more valuable hardwoods to favor in natural stands. White pine and shortleaf pine are suitable for planting for wood crops. Among the species that can be grown for Christmas trees are Scotch pine, Norway spruce, Austrian pine, white pine, blue spruce, and Virginia pine.

Plant competition is moderate for hardwoods and is severe for conifers. Although the slopes are not steep, the hazard of erosion is moderate because micaceous soils are easily eroded. Equipment limitations, seedling mortality, and the hazard of windthrow are slight.

WOODLAND SUITABILITY GROUP 44

The soils in this group are more strongly sloping than those in woodland group 43, but in other respects they are similar to them. Slopes generally range from 15 to 45 percent. In some places the soils are stony.

Soils in this group are generally less productive of trees than deeper soils that can hold more available moisture. For mixed oaks the average site index is between 65 and 74. Yellow-poplar and oaks are the preferred hardwoods in natural stands. White pine and shortleaf pine are suitable for planting for wood crops. The species that grow well as Christmas trees include Scotch pine, Norway spruce, Austrian pine, white pine, blue spruce, and Virginia pine.

Plant competition is moderate for hardwoods and is severe for conifers. Limitations on the use of heavy equipment are moderate, and the erosion hazard is severe. Seedling mortality and the hazard of windthrow are slight.

WOODLAND SUITABILITY GROUP 45

Soils of this group are very stony and very steep, but in other respects they are similar to those in woodland groups 43 and 44.

The soils in this group are generally less productive than deeper soils that can hold more moisture available to trees. The average site index for mixed oaks is between 65 and 74. The more valuable hardwoods to favor in natural stands are yellow-poplar and oaks. For planting for wood crops, white pine and shortleaf pine are suitable. Species that grow well as Christmas trees are Scotch pine, Norway spruce, Austrian pine, white pine, blue spruce, and Virginia pine.

These soils are so steep and so stony that the use of heavy equipment is severely limited. Some practices of management, particularly planting and harvesting, may be economically impractical. Erosion is a severe hazard. Plant competition is moderate for hardwoods and is severe for conifers. Seedling mortality and the hazard of windthrow are slight.

WOODLAND SUITABILITY GROUP 46

This group consists of level to gently sloping, moderately well drained soils having a fragipan or a clayey subsoil that is not readily penetrated by water and roots. These soils occur throughout the county except in the northwestern part.

Generally, the average site index for mixed oaks is between 65 and 74. In small included areas where fertility is higher, the average site index for these oaks is 75 to 84. White pine is of first priority in new plantings for wood crops. Suitable as Christmas trees are Scotch pine, Norway spruce, Austrian pine, and white pine.

Competition from unwanted plants is severe for hardwoods and for conifers. The use of equipment is moderately limited by seasonal wetness. Seedling mortality is only slight. Windthrow is a moderate hazard because of the restricted root zone above the fragipan or the clayey subsoil. The erosion hazard is slight.

WOODLAND SUITABILITY GROUP 49

This group consists of gently sloping to moderately steep, somewhat excessively drained, gravelly and sandy soils of the uplands. These soils occur only in the northwestern part of the county.

The average site index for mixed oaks is between 65 and 74. In most places, however, the soils are better suited to pines than they are to hardwoods. For this reason, white pine and shortleaf pine should be favored in existing stands and in new plantations for wood crops. Scotch pine and white pine make good Christmas trees, and so does red pine.

Plant competition is slight for hardwoods and is moderate for conifers. Limitations on the use of equipment generally are only slight, but they are moderate on slopes of more than 15 percent. Seedling mortality, the risk of windthrow, and the hazard of erosion are slight.

WOODLAND SUITABILITY GROUP 51

This group consists of nearly level to sloping, well-drained or somewhat excessively drained soils that are moderately deep to bedrock. These soils are stony in most places. The woodland group is the most extensive in Carroll County. It occurs in most parts of the county and occupies about one-fourth of the total acreage.

Trees on these soils grow more slowly than they do on the soils of woodland group 40, and they grow considerably more slowly than on the deep soils of group 30. The average site index for mixed oaks is between 55 and 64. Oaks are generally the trees to favor in natural stands, but pines or other conifers are more suitable in plantations for wood crops. Suitable as Christmas trees are Scotch pine, white pine, Norway spruce, and Virginia pine. Figure 14 shows a plantation of Norway spruce and white pine.

Competition from undesirable plants is slight for hardwoods but is moderate for pines and other conifers. Seedling mortality is moderate because the soils are somewhat droughty, at least seasonally. Erosion and windthrow are only slight hazards, and there is little or no limitation on the use of equipment.

WOODLAND SUITABILITY GROUP 52

This group consists of soils that, except for slope, are much like those in woodland group 51. Slopes generally range from 15 to 25 percent, but the group includes soils having north-facing slopes of 25 to 45 percent. The soils in steep north-facing areas are shaded much of the time. Consequently, they lose less moisture through evaporation and hold more moisture available to trees than soils that are exposed to the sun. The shaded areas facing north occupy somewhat less than half of the total acreage in the group.

On the soils of this group, the average site index for mixed oaks is between 55 and 64. Oaks are generally the preferred trees in natural stands, but pines or other conifers are more suitable for planting for wood crops. Suitable as Christmas trees are Scotch pine, white pine, Norway spruce, and Virginia pine.

Plant competition is slight for hardwoods and is moderate for pines and other hardwoods. Equipment limitations and the erosion hazard are moderate in most places, but they are severe locally, particularly in steeper areas facing north. Seedling mortality is moderate because the soils are somewhat droughty, at least seasonally. Windthrow is only a slight hazard.

WOODLAND SUITABILITY GROUP 57

This group consists of gently sloping, somewhat excessively drained, stony soils that are less than 20 inches deep to bedrock. In Carroll County the bedrock is mainly sandstone but includes some shale.

These soils are among the least productive in the county. The average site index for mixed oaks is between 45 and 54. Oaks and shortleaf pine are the trees to favor in natural stands. Virginia pine is most suitable for planting, either for wood crops or for Christmas trees, though Scotch pine also does fairly well. On these droughty soils, however, producing Christmas trees may not be profitable.

Plant competition is moderate for pines but is only slight for hardwoods. Seedling mortality is moderate because of droughtiness and possible sunscald. Equipment

Figure 14.—**Norway spruce and white pine in a mixed plantation on Mt. Airy channery loam, 3 to 8 percent slopes, moderately eroded. This soil is in woodland suitability group 51. Most of the spruce will be harvested as Christmas trees, but the pine will be left for timber and as protection for the watershed.**

limitations, as well as the hazards of erosion and windthrow, are only slight.

WOODLAND SUITABILITY GROUP 58

In this group are the south-facing slopes of the same soils as those in woodland group 52 having slopes of 25 to 45 percent. The group also includes soils that are much like those in woodland group 57 but have slopes of more than 8 percent. All of these soils are thin and droughty, and they furnish little moisture for trees.

Trees grow slowly on these soils. Generally, the only species that make satisfactory growth are Virginia pine and some kinds of upland oaks. The average site index for mixed oaks is between 45 and 54. Planting is mainly for the protection of the watershed or for esthetic improvement. Suitable for such purpose is Virginia pine. This species also can be grown for Christmas trees, and so can Scotch pine in areas not severely eroded.

Competition from unwanted plants is slight for hardwoods but is moderate for pines. Limitations on the use of equipment are moderate on slopes of 45 percent or less and are severe on slopes of more than 45 percent. Seedling mortality is moderate because of droughtiness and possible sunscald. Erosion is a moderate hazard. The risk of windthrow is only slight in areas that are not severely eroded, but it is severe in many severely eroded areas where the soil material remaining over bedrock is very thin.

Wildlife

Although much of the natural habitat for wildlife has been drastically changed or disturbed in Carroll County, many areas are suitable for various kinds of upland game birds and mammals. For wetland wildlife, however, the amount of suitable habitat is much less.

About 54 percent of the land area is potentially fair or better as habitat for open-land wildlife, which includes rabbit, quail, pheasant, other upland birds, and, to some extent, deer. More than 63 percent of the county is potentially fair or better as habitat for woodland wildlife, including deer, squirrel, and turkey. But only about 1 percent is potentially fair or better as habitat for wetland

wildlife, which includes raccoon, woodcock, muskrat, and waterfowl.

Table 3 lists the soils of the county and rates their suitability for eight elements of wildlife and for three classes, or groups, of wildlife. The elements of wildlife habitat are discussed in the following paragraphs.

Grain and seed crops.—These include corn, sorghum, millet, soybeans, buckwheat, cowpeas, wheat, oats, barley, rye, and other crops that produce grain or grainlike seeds used by wildlife.

Grasses and legumes.—Making up this group are grasses and legumes commonly planted for forage. Among the plants valuable for wildlife are lespedeza, alfalfa, alsike clover, Ladino clover, red clover, tall fescue, bromegrass, bluegrass, and timothy.

Wild herbaceous upland plants.—These are annuals or other herbaceous plants that generally are established naturally. They include panicgrass and other native grasses, partridgepea, beggartick, lespedeza, and other native herbs that wildlife use for food or cover.

Hardwood woody plants.—These plants are trees and shrubs that grow vigorously and produce heavy crops of seeds or other fruits. They are established naturally or are planted. Included are sumac, dogwood, persimmon, sassafras, hazelnut, multiflora rose, autumn-olive, wild cherry, various kinds of oak and hickory, huckleberry, highbush cranberry, blackhaw, and holly.

Coniferous woody plants.—This group consists of coniferous trees and shrubs that are native or are planted. Among them are Virginia pine, shortleaf pine, red pine, Scotch pine, Norway spruce, redcedar, and Atlantic whitecedar.

Wetland food and cover plants.—Making up this group are plants that provide food and cover for waterfowl and furbearing animals. They include barnyard grass, bulrush, cattail, waterwillow, smartweed, duckweed, arrow-arum, and sedges.

Shallow water developments.—These are impoundments in which shallow water can be maintained at a desired level. On soils suitable for these impoundments, the water can be controlled at a level ranging from the natural water table to within 2 feet above it.

Excavated ponds.—These are excavated, or dug-out, ponds that depend on ground water, not runoff. The level of water in the ponds normally fluctuates with the level of ground water. Migrating waterfowl may be especially attracted to such ponds.

Farm ponds of the impounded type are not included in table 3, but they can be important in producing fish. If fish are to be produced, part of the pond should be at least 6 feet deep. Table 6 in the subsection "Engineering Uses of Soils" gives features of each soil in the county that affect the selection of sites for ponds.

Engineering Uses of Soils

In this subsection the physical properties of the soils in the county are related to problems of engineering. The properties of the soils were estimated on the basis of information obtained (1) by examining the soils closely in the field and evaluating their characteristics as they apply to engineering needs and (2) by testing samples taken from horizons of soils in selected series that are represented in Carroll County. Also considered were the results of tests made on samples of similar soils taken from Frederick County, Md.; Fairfax County, Va.; and York, Lancaster, Chester, and Delaware Counties, Pa. On the basis of the estimated physical properties, interpretations were made that will be helpful to those who use the soils of Carroll County for engineering purposes.

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

This survey contains information that can be used by engineers to—

1. Make soil and land use studies that will aid in selecting and developing industrial, business, residential, recreational, and other sites.
2. Make preliminary estimates of the engineering properties of soils in planning drainage and irrigation systems, diversion terraces, farm ponds and and reservoirs, and structures for soil and water conservation or for other purposes.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways, airports, pipelines, and cables and in planning detailed investigations at the selected locations.
4. Locate probable sources of sand and gravel for use in construction.
5. Correlate performance of engineering structures with kinds of soil and thus develop information that will be useful in designing and maintaining engineering structures and installations.
6. Determine the suitability of soils for cross-country movement of vehicles and construction equipment.
7. Supplement information obtained from other sources that can be readily used by engineers.
8. Develop other preliminary estimates for design and construction purposes pertinent to a particular area.

Much of the information in this subsection is in tables 4, 5, and 6. Table 4 lists engineering data that were obtained when selected soils in the county were tested. In table 5 are estimated properties of all the soils in the county, and in table 6 are engineering interpretations of the soils.

Some of the terms used by soil scientists may be unfamiliar to engineers, and some words have a special meaning in soil science. Many of these terms are defined in the Glossary at the back of this publication.

Engineering test data

Samples that represent nine soil series were taken from 17 locations in Carroll County and were tested by the Bureau of Public Roads (BPR) according to standard procedures of the American Association of State Highway Officials (AASHO) (*1*). The data obtained from these tests are given in table 4.

TABLE 3.—*Suitability of soils for elements of wildlife habitat and kinds of wildlife*

[For the elements of wildlife habitat, a rating of 1 denotes well suited or above average; 2 denotes suited or average; 3, poorly suited or below average; and 4, not suited]

Soil series and map symbols	Elements of wildlife habitat								Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants	Wetland food and cover plants	Shallow water developments	Excavated ponds	Open-land	Woodland	Wetland
Abbottstown:											
ArA	2	1	1	1	3	3	3	3	Good	Good	Poor.
ArB2	1	1	1	1	3	4	4	4	Good	Good	Not suited.
Baile:											
BaA	3	2	2	1	2	1	2	2	Fair	Good	Good.
BaB	3	2	2	1	3	3	4	4	Fair	Good	Not suited.
Bermudian:											
Be	1	1	1	1	3	4	4	4	Good	Good	Not suited.
Birdsboro:											
BrA, BrB2	1	1	1	1	3	4	4	4	Good	Good	Not suited.
Bowmansville:											
Bs	3	2	2	1	2	2	3	4	Fair	Good	Poor.
Bucks:											
BuA, BuB2	1	1	1	1	3	4	4	4	Good	Good	Not suited.
Cardiff:											
CaC2	2	2	2	2	2	4	4	4	Fair	Fair	Not suited.
Chester:											
CeA, CeB2, CeC2	2	1	1	1	3	4	4	4	Good	Good	Not suited.
CeC3	3	2	1	1	3	4	4	4	Fair	Good	Not suited.
Codorus:											
Ch	2	1	1	1	3	3	3	4	Good	Good	Poor.
Comus:											
Cm, CnA, CnB	1	1	1	1	3	4	4	4	Good	Good	Not suited.
Conestoga:											
CoA, CoB2, CoC2	1	1	1	1	3	4	4	4	Good	Good	Not suited.
CoC3	3	2	1	1	3	4	4	4	Fair	Good	Not suited.
CoD3	4	3	1	1	3	4	4	4	Poor	Good	Not suited.
Delanco:											
DeA	2	1	1	1	3	3	3	3	Good	Good	Poor.
DeB2	2	1	1	1	3	4	4	4	Good	Good	Not suited.
Elioak:											
ElB2, ElC2	2	1	1	1	3	4	4	4	Good	Good	Not suited.
EmD3	4	3	1	1	3	4	4	4	Poor	Good	Not suited.
Elsinboro:											
EnB2, EnC2, EsA, EsB2, EsC2.	2	1	1	1	3	4	4	4	Good	Good	Not suited.
Glenelg:											
GcB2, GcC2, GlA, GlB2, GlB3, GlC2.	2	1	1	1	3	4	4	4	Good	Good	Not suited.
GcC3, GcD2, GlC3	3	2	1	1	3	4	4	4	Fair	Good	Not suited.
GcD3	4	3	1	1	3	4	4	4	Poor	Good	Not suited.
Glenville:											
GvA	2	1	1	1	3	3	3	3	Good	Good	Poor.
GvB	2	1	1	1	3	4	4	4	Good	Good	Not suited.
Hagerstown:											
HaA, HaB2, HaC2	1	1	1	1	3	4	4	4	Good	Good	Not suited.

TABLE 3.—*Suitability of soils for elements of wildlife habitat and kinds of wildlife*—Continued

Soil series and map symbols	Elements of wildlife habitat								Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants	Wetland food and cover plants	Shallow water developments	Excavated ponds	Open-land	Woodland	Wetland
Hatboro:											
Ht	3	2	2	1	2	2	3	4	Fair	Good	Poor.
Klinesville:											
KlB2	3	3	3	3	2	4	4	4	Poor	Poor	Not suited.
KsD4, KsF3	4	4	3	3	2	4	4	4	Not suited.	Poor	Not suited.
Lewisberry:											
LbB2, LbC2, LbD	3	2	2	2	2	4	4	4	Fair	Fair	Not suited.
Lindside:											
Le	2	1	1	1	3	3	3	3	Good	Good	Poor.
Linganore:											
LnB2, LnC2	3	3	3	3	1	4	4	4	Poor	Poor	Not suited.
LnC3, LnD2	4	3	3	3	1	4	4	4	Not suited.	Poor	Not suited.
LnE	4	4	3	3	1	4	4	4	Not suited.	Poor	Not suited.
Manor:											
MgB2, MgC2, MgC3 MgD2, MlB2, MlB3, MlC2, MlC3, MlD2.	2	2	2	2	2	4	4	4	Fair	Fair	Not suited.
MgD3, MlD3, MlE	4	3	2	2	2	4	4	4	Poor	Fair	Not suited.
MnC, MnD, MnE, MnF.	4	3	1	1	2	4	4	4	Poor	Good	Not suited.
Melvin:											
Mo	3	2	2	1	2	2	3	4	Fair	Good	Poor.
Mt. Airy:											
MtA, MtB2, MtC2, MtC3, MtD2.	3	3	3	3	1	4	4	4	Poor	Poor	Not suited.
MtE	4	4	3	3	1	4	4	4	Not suited.	Poor	Not suited.
Penn:											
PeB2, PnA2, PnB2; PnC2, PnC3, PsB2, PsC3.	2	2	2	2	2	4	4	4	Fair	Fair	Not suited.
PhB2, PhC2, PhC3; PoD.	3	3	2	2	2	4	4	4	Poor	Fair	Not suited.
Raritan:											
RaA	2	1	1	1	3	3	3	3	Good	Good	Poor.
RaB	1	1	1	1	3	4	4	4	Good	Good	Not suited.
Readington:											
ArA	2	1	1	1	3	3	3	3	Good	Good	Poor.
ArB2	1	1	1	1	3	4	4	4	Good	Good	Not suited.
Rowland:											
Ro	2	1	1	1	3	3	3	3	Good	Good	Poor.
Steinsburg:											
PsB2, PsC3, StB2	2	2	2	2	2	4	4	4	Fair	Fair	Not suited.
StD3	3	3	2	2	2	4	4	4	Poor	Fair	Not suited.
Urbana:											
UrA	2	1	1	1	3	3	3	3	Good	Good	Poor.
UrB2	1	1	1	1	3	4	4	4	Good	Good	Not suited.
Wiltshire:											
Ws	2	1	1	1	3	3	3	3	Good	Good	Poor.

Table 4 also gives two systems of engineering classification for each soil sample—the AASHO system and the Unified system (*8*). These classifications are based on data obtained by mechanical analyses and by tests made to determine the liquid limit and the plastic limit.

The tests for the liquid limit and plastic limit measure the effect of water on the consistence of the 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 state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the material passes from a semisolid to a plastic state. The liquid limit is the moisture content at which a soil 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 a soil material is in a plastic condition. Some silty and sandy soils are nonplastic; that is, they do not become plastic at any moisture content.

Estimated properties of the soils

Table 5 shows some estimated soil properties that are important in engineering, and it gives estimated AASHO and Unified classifications for the soils. The textural terms used to describe the soil material in the main horizons are those used by the U.S. Department of Agriculture. Made land, a miscellaneous land type, has such variable characteristics that it is not listed in the table.

Depth to seasonally high water table refers to the highest level at which the ground water stands for a significant period of time.

The thickness and other properties given in table 5 are those that actually exist in specific soil profiles, the ones describes in the section "Descriptions of the Soils." In table 5, however, horizons have been combined and do not coincide with those in "Descriptions of the Soils." In table 5, the thickness of the surface layer applies only to soils that are slightly or moderately eroded. The surface layer of severely eroded soils is thinner or may be completely removed, and the underlying horizons are closer to the surface than is indicated in the table.

The permeability of a soil horizon is the rate at which water moves through undisturbed soil material. It depends largely on the texture and structure of the soil.

Available water capacity is approximately the moisture held in the range between field capacity and the wilting point. It is expressed in table 5 as inches of water per inch of soil.

Reaction refers to the acidity or alkalinity of the soil, expressed in terms of pH. A pH of 7.0 is neutral; values of less than 7.0 indicate acidity, and values of more than 7.0 indicate alkalinity. The reaction given in table 5 is the normal one for that soil when it is unlimed. In fields that have been limed, the pH value is higher, particularly in the surface layer and in the layer just beneath it.

Corrosion potential refers to the deterioration of concrete or untreated steel pipelines as a result of exposure to oxygen and moisture and of chemical and electrolytic reactions.

Shrink-swell potential is an indication of the volume changes that can be expected with changes in moisture content. It depends largely on the amount and type of clay in the soil. In general, soils classified as CH or A–7 have a high shrink-swell potential, and clean sands and gravel have a low shrink-swell potential.

Optimum moisture is the moisture content at which the soil can be compacted to maximum dry density. The estimated percentages in table 5 are averages and, for each soil horizon, can be expected to vary a little.

Maximum dry density is the greatest amount of soil, by weight, that can be compacted into a given unit of volume, under controlled conditions and by standard procedures.

Engineering interpretations

Table 6 rates the soils in Carroll County according to their suitability for earthwork, susceptibility to frost action, and suitability as sources of topsoil and road fill.

Only a few soils in the county are suitable as a source of sand and gravel. Locally, the Birdsboro soils are fairly suitable below a depth of 3 feet. In small areas the Codorus soils are a fair source of gravel below a depth of 4 feet. The Delanco soils are a good source of both sand and gravel. Locally, the Raritan soils are a fair source of sand and gravel below a depth of 3 feet.

Also listed in table 6 are soil features that affect different kinds of engineering work. The features shown are those that affect the construction of pipelines; location of roads and highways; sites for ponds and reservoirs; use of soil materials for dikes, levees, dams, and other embankments; drainage systems; irrigation practices; and the construction of terraces, diversions, and waterways. The interpretations are based on information in tables 4 and 5 and on the experience of engineers in the county.

The choice of a soil suitable for laying a pipeline is determined primarily by the height of the water table, by the depth to and kind of bedrock, and by the natural stability of the soil. For example, if the water table is high, laying a line for sewer, water, or gas in wet soils is difficult and frustrating because ditchbanks are likely to collapse.

The choice of a soil on which to locate a road or highway is affected primarily by the height and fluctuation of the water table; by the hazard of flooding; by the stability of the soil materials, particularly under heavy load or pressure; and by the expected severity of frost action.

The choice of a site for a pond or reservoir depends largely on the amount or rate of seepage that can be expected, particularly at the bottom of the reservoir. The amount of seepage depends on whether the reservoir floor consists of subsoil material or substratum material, for these layers may differ greatly in seepage characteristics. The most nearly ideal soil material for a reservoir floor is one that permits very little seepage and has a high water table. The material should be deep to any kind of bedrock that might allow additional water to seep away. Also desirable is a constant or reliable source of water from the ground water, from impounded runoff, or from a stream. Figure 15 shows an impounded pond that is used for recreation at Westminster. (Soil features that affect outdoor recreation are discussed in the subsection "Recreational Uses of Soils.")

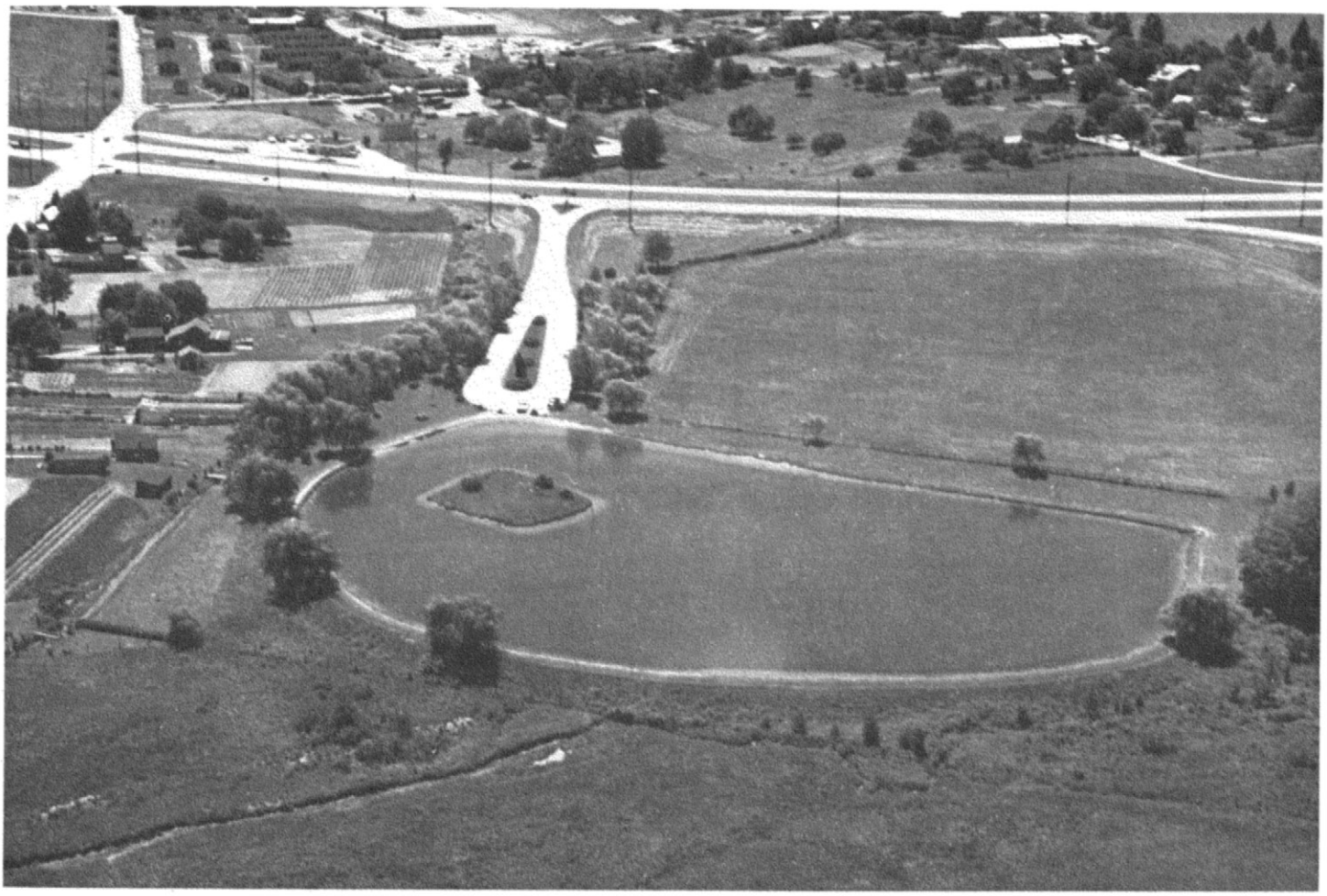

Figure 15.—**Aerial view of an impounded pond in a small park at Westminster. This pond is mainly on a Glenville silt loam but partly on a Baile silt loam. It is used for various kinds of recreation, among which are fishing and ice skating.**

TABLE 4.—*Engineering test data for*

[Tests performed by the Bureau of Public Roads (BPR) in accordance with standard

Soil series and location	BPR report number	Depth	Horizon	Mechanical analyses			
				Percentage passing sieve			
				3-in.	1½-in.	¾-in.	No. 4 (4.7 mm.)
Bucks:	S46-	Inches					
0.5 mile north of Fringer Road on Ruggles Road. (Modal profile)	934	2–8	A2	----------	----------	100	98
	935	16–28	B21t	----------	----------	100	99
Chester:							
On State Route 30, in Greenmount. (Modal profile)	936	0–8	Ap	100	98	96	90
	937	26–35	B22t	----------	100	99	95
	938	42–60	C	----------	----------	100	98
0.5 mile east of Deer Park Road on north side of Kays Mill Road. (Solum thinner than in modal)	939	4–10	A2	----------	100	98	96
	940	18–34	B22t	----------	----------	100	99
	941	37–42	C	100	98	98	95

See footnote at end of table.

Stability, erodibility, permeability, and compaction characteristics affect the choice of a soil for building dikes, levees, dams, and other embankments. The maximum density to which soil material can be compacted affects the strength and permeability of the structure. Generally, soils that can be compacted to the greatest maximum dry density have not only the least seepage losses but also the greatest strength and stability. Soils in which the greatest maximum density can be obtained when compacted by ordinary methods are those that contain well-graded sand, gravel of various sizes, and sufficient fine material to fill all voids between sand grains and pebbles.

The ease or difficulty with which a soil can be drained artificially is determined mainly by the least permeable layer, by the height and fluctuation of the water table, and by the erodibility of the bottom and banks of drainage ditches.

Features that affect the kind and design of an irrigation system are the rate at which water can move through the soil, the capacity of the soil to retain moisture, and the height of the water table.

In planning and designing terraces and diversions (fig. 16), the features of special concern are the stability and erodibility of the soil, the height of the water table, and the depth to bedrock. These features, as well as the water-holding capacity and natural fertility of the surface layer, strongly influence the design of waterways and the kinds of vegetation needed for stabilizing the waterways.

The interpretations in table 6 are not a substitute for onsite investigation.

***Figure 16.*—This diversion terrace has just been built for disposing of excess water on a Penn silt loam near Taneytown. The diversion is ready for seeding to a suitable grass.**

Nonfarm Uses of Soils

Carroll County is still a rural area, but its population is growing and in recent years there has been an increase in residential and commercial uses of the land. In the near future the population is likely to increase rapidly.

Accompanying the spread of residential and industrial developments is a growing need for information about soil conditions that affect nonfarm uses. The most common need is for information about the limitations of soils for disposing of sewage effluent from septic tanks. Less common are requests for information about the use of soils for building foundations, streets and parking lots, and the like.

Table 7 rates the limitations of each soil in the county as *slight*, *moderate*, *severe*, *or very severe*, according to the degree that the soil is limited in its specified nonfarm uses. A rating of slight may indicate that a soil has no limitations at all, though most soils in the county are at least slightly limited in use.

soil samples taken from 17 soil profiles

procedures of the American Association of State Highway Officials (AASHO) (*1*)]

Mechanical analyses [1]—Continued							Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Con.			Percentage smaller than—						AASHO	Unified [2]
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.				
94	89	76	72	54	31	18	31	6	A-4(8)	ML
98	92	74	68	57	36	28	33	9	A-4(8)	ML-CL
86	79	59	58	48	28	22	33	8	A-4(5)	ML-CL
92	86	67	64	59	42	35	37	11	A-6(7)	ML-CL
95	88	42	37	31	18	14	[3] NP	NP	A-4(1)	SM
95	89	77	74	64	37	22	42	11	A-7-5(9)	ML
98	93	81	78	70	47	36	51	17	A-7-5(13)	MH
92	81	58	53	47	35	27	42	12	A-7-5(6)	ML

TABLE 4.—*Engineering test data for soil*

Soil series and location	BPR report number	Depth	Horizon	Mechanical analyses [1]			
				Percentage passing sieve—			
				3-in.	1½-in.	¾-in.	No. 4 (4.7 mm.)
Conestoga:							
0.7 mile south of Uniontown. (Modal profile)	942	0–8	Ap	100	99	97	87
	943	24–40	B22t	----------	100	98	89
	944	40–60	C	100	99	97	89
1.4 miles south of Uniontown. (Solum thinner than in modal)	945	0–12	Ap	----------	100	99	94
	946	20–30	B22t	----------	----------	100	95
	947	30–46	C	100	99	97	89
Elioak:							
1.75 miles northeast of Eldersburg, off Oklahoma Road. (Modal profile)	948	3–8	A2	----------	100	97	95
	949	19–34	B22t	----------	----------	100	98
	950	41–60	C	----------	----------	----------	----------
Glenelg:							
0.1 mile south of Morgan Run on Old Washington Road. (Modal profile)	951	3–7	A2	100	98	98	94
	952	12–28	B22t	----------	----------	100	99
	953	28–50	C	----------	100	99	97
North side of Millers Station Road, 50 yards east of Rorbaugh Road. (Channery profile)	954	0–11	Ap	100	90	84	75
	955	16–25	B2t	100	91	85	82
2 miles northeast of Finksburg at the east end of Lawndale Road. (Shallow profile)	956	2–8	A2	----------	100	98	93
	957	8–22	B2t	100	99	96	89
	958	22–36	C	100	99	99	93
Glenville:							
0.25 mile east of Hanover Pike and 0.25 mile south of North Carroll High School, Greenmount. (Modal profile)	959	0–10	Ap	----------	----------	100	98
	960	18–24	B22t	----------	----------	100	98
	961	24–48	Bx	100	99	94	80
0.25 mile south of Louisville on State Route 32. (Subsoil thicker than in modal)	962	0–11	Ap	----------	----------	----------	----------
	963	21–36	B22t	----------	----------	----------	----------
	964	36–50	Bx	----------	----------	100	96
Hatboro:							
0.1 mile east of State Route 140 on Deep Run Road. (Modal profile)	975	0–12	Ap	----------	----------	----------	----------
	976	12–42	B2g	----------	----------	100	98
	977	42–60	IICg	----------	100	99	94
300 yards east of State Route 140, 200 yards north of Deep Run Road. (Over a buried soil)	978	0–12	Ap	----------	----------	----------	----------
	979	12–35	B2g	----------	----------	100	98
	980	35–50	A1b	----------	100	99	95
Linganore:							
0.25 mile south of Deep Run Road on Wine Road. (Modal profile)	965	0–10	Ap	100	93	90	83
	966	10–20	B2t	100	97	90	81
	967	20–32	C	100	99	93	78
0.25 mile south of Deep Run Road, on the north side of Wine Road. (Eroded soil)	968	0–11	Ap	[4] 95	90	83	73
	969	11–20	C	----------	100	93	83
Manor:							
0.5 mile north of Marriottsville Road on Ridge Road. (Modal profile)	970	2–8	B1	----------	----------	100	99
	971	8–23	B2	----------	----------	100	98
	972	23–90	C	----------	----------	100	99
End of Murray Road at the Liberty Reservoir line. (Thin solum)	973	2–12	B2	100	99	97	92
	974	12–50	C1	100	98	96	91

[1] Mechanical analyses according to the AASHO Designation T 88 (*1*). Results by this procedure frequently differ 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 diamter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes of soil.

samples taken from 17 soil profiles—Continued

Mechanical analyses [1]—Continued							Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Con.			Percentage smaller than—						AASHO	Unified [2]
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.				
81	74	66	65	56	38	26	50	16	A–7–5(10)	ML or MH
80	64	51	49	44	28	20	38	11	A–6(4)	ML
82	71	64	62	55	43	31	49	18	A–7–5(10)	ML
89	83	75	73	63	43	27	50	16	A–7–5(12)	ML or MH
91	84	76	74	69	48	34	46	17	A–7–6(12)	ML
81	70	61	58	51	34	23	43	15	A–7–6(8)	ML–CL
95	91	72	69	60	35	25	34	9	A–4(7)	ML–CL
98	94	78	76	68	57	47	51	20	A–7–5(14)	MH
100	99	65	58	51	37	32	47	8	A–5(6)	ML
90	83	67	63	53	34	23	38	8	A–4(6)	ML
97	93	80	80	72	48	34	46	14	A–7–5(11)	ML
94	84	53	47	38	21	15	37	5	A–4(4)	ML
71	62	50	48	40	25	16	40	8	A–4(3)	GM–SM
73	68	48	47	43	30	23	36	12	A–6(3)	SM–SC
86	78	55	52	42	29	20	32	7	A–4(4)	ML–CL
78	67	53	50	43	26	20	34	9	A–4(4)	ML
88	77	56	52	42	25	18	31	6	A–4(4)	ML
96	91	72	69	60	39	26	38	11	A–6(8)	ML
96	92	75	73	64	37	27	38	13	A–6(9)	ML–CL
74	64	42	39	32	18	11	31	7	A–4(1)	SM–SC
100	99	78	73	59	37	24	44	12	A–7–5(8)	ML
100	99	77	71	59	34	23	40	10	A–4(8) or A–6	ML
93	84	60	56	46	30	20	35	9	A–4(5) or A–7	ML–CL
----------	100	95	93	78	46	24	58	20	A–7–5(16)	MH
97	94	82	78	68	45	29	45	15	A–7–5(11)	ML
91	86	69	66	57	37	24	46	14	A–7–5(8)	ML
----------	100	95	94	84	55	34	68	23	A–7–5(17)	MH
97	95	84	80	68	46	29	47	16	A–7–5(12)	ML
94	91	80	77	64	41	28	39	11	A–6(8)	ML
79	73	62	61	53	35	22	46	13	A–7–5(7)	ML
74	63	50	48	44	31	23	44	16	A–7–6(5)	SM–SC or ML
63	44	29	28	24	17	12	42	14	A–2–7	SM
68	60	51	50	45	31	22	49	16	A–7–5(12)	ML
69	55	40	39	34	25	16	41	12	A–7–6(2)	SM
97	85	51	49	44	36	25	44	11	A–7–5(4)	ML
95	82	50	48	43	33	25	39	10	A–4(3)	SM or ML
97	83	38	36	31	20	15	NP	NP	A–4(1)	SM
88	82	55	50	38	24	17	32	8	A–4(4)	ML–CL
64	56	34	29	19	8	5	NP	NP	A–2–4(0)	SM

[2] SCS and BPR have agreed to consider that all soils having plasticity indexes within two points from the A-line are to be given a borderline classification. Examples of borderline classifications obtained by this use are ML-CL and GM-SM.

[3] NP=Nonplastic.

[4] 100 percent of the material of this horizon passed a 4-inch sieve.

TABLE 5.—*Estimated*

Soil series and map symbols	Depth to bedrock	Depth to seasonally high water table	Depth from surface	Classification		
				USDA texture	Unified	AASHO
	Feet	*Feet*	*Inches*			
Abbottstown (ArA, ArB2) (For properties of Readington soils in these mapping units, refer to the Readington series.)	4–6	[2] ½–1½	0–23	Silt loam or silty clay loam.	ML or CL	A–4 or A–6
			23–41	Silt loam (fragipan)	ML or CL	A–4 or A–6
			41–48	Shaly silt loam (fragipan).	ML or SM	A–4
			48	Shale.		
Baile (BaA, BaB)	5–8+	0–1	0–20	Silt loam	ML	A–4
			20–52	Clay loam or silt loam.	CL or MH	A–6 or A–7
			52–60	Loam	MH	A–5 or A–7
Bermudian (Be)	6–20+	3	0–34	Silt loam	ML	A–4
			34–50	Silt loam or silty clay loam.	ML	A–4 or A–6
Birdsboro (BrA, BrB2)	6–20+	5–10+	0–9	Silt loam	ML	A–4
			9–39	Silty clay loam or gravelly silty clay loam.	CL	A–6
			39–45	Gravel, silt, and sand.	GM or SM	A–2 or A–1
Bowmansville (Bs)	6–20+	0–1	0–12	Silt loam	ML	A–4
			12–60	Silty clay loam or clay loam.	CL	A–6
Bucks (BuA, BuB2)	4–5	20+	0–16	Silt loam	ML	A–4
			16–38	Silty clay loam	ML or CL	A–4 or A–6
			38–44	Fragmented shale	GP, GM	A–1 or A–3
			44	Shale.		
Cardiff (CaC2)	3½–5	20+	0–16	Channery silt loam	ML	A–4
			16–30	Channery loam	GM or SM	A–2 or A–4
			30–45	Mostly fragments of slate.	GP or GM	A–1 or A–2
			45	Quartzitic slate.		
Chester (CeA, CeB2, CeC2, CeC3)	5–10	20+	0–8	Silt loam	ML or CL	A–4
			8–42	Silty clay loam or clay loam.	ML, CL, MH	A–6 or A–7, A–4
			42–60	Saprolite of loam texture.	SM, ML, MH	A–4, A–5, A–7
Codorus (Ch)	6–20+	1–2	0–26	Silt loam	ML	A–4
			26–52	Silty clay loam	CL or ML	A–6 or A–4
			52–60	Sand	SW or SM	A–1 or A–2
Comus (Cm, CnA, CnB)	6–20+	3+	0–41	Silt loam	ML	A–4
			41–60	Silt loam or fine sandy loam.	MH or SM	A–5 or A–7
Conestoga (CoA, CoB2, CoC2, CoC3, CoD3)	5–8+	20+	0–14	Silt loam	ML or MH	A–7 or A–4
			14–60	Silty clay loam or silt loam.	ML, CL, or MH.	A–6 or A–7
Delanco (DeA, DeB2)	6–20+	1½–3	0–23	Silt loam	ML	A–4
			23–35	Silty clay loam	CL	A–6
			35–50	Loam	ML or MH	A–5 or A–4
Elioak:						
(ElB2, ElC2)	6–10	20+	0–8	Silt loam	ML or CL	A–4
			8–41	Clay loam or silty clay loam.	MH or CH	A–7
			41–60	Loam or silt loam	ML or MH	A–5 or A–7
(EmD3)	5–10+	20+	0–33	Clay loam or silty clay loam.	MH or CH	A–7
			33–52	Loam or silt loam	ML or MH	A–5 or A–7

See footnotes at end of table.

properties of the soils

Percentage passing sieve—			Range in permeability	Available water capacity	Range in reaction [1]	Corrosion potential		Shrink-swell potential	Moisture-density data	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)				Untreated steel pipes	Concrete pipes		Optimum moisture	Maximum dry density
			Inches per hour	*Inches per inch of depth*	*pH*				*Percent*	*Lbs. per cubic foot*
100	100	60–85	0. 20–0. 63	0. 21	4. 5–5. 0	High	Moderate	Low	16	101–110
100	100	60–85	<0. 20	. 21	4. 5–5. 0	High	High	Low	16	101–110
70–80	60–70	45–60	0. 20–0. 63	. 14	4. 5–5. 0	High	High	Low	12	111–120
95–100	90–100	60–75	0. 20–0. 63	. 22	4. 5–5. 5	Moderate	Moderate	Low	16	101–110
95–100	90–100	65–85	<0. 20	. 21	4. 5–5. 5	Moderate	Moderate	Moderate	21	101–110
85–95	80–90	60–75	<0. 20	. 21	4. 5–5. 5	Moderate	High	Moderate	18	101–110
95–100	90–100	70–90	0. 63–2. 0	. 21	4. 5–5. 5	Moderate	Moderate	Low	17	101–110
80–95	70–85	50–70	0. 20–0. 63	. 16	4. 5–5. 5	Moderate	Moderate	Low	17	101–110
85–95	80–95	70–85	0. 63–2. 0	. 21	4. 5–5. 0	Moderate	Moderate	Low		
75–85	70–80	60–75	0. 20–0. 63	. 17	4. 5–5. 0	Moderate	Moderate	Moderate	16	101–120
30–60	20–50	10–30	0. 63–6. 3	. 10	4. 0–5. 0	Low	High	Low	12	111–120+
95–100	90–100	70–90	0. 63–2. 0	. 21	4. 5–5. 5	High	High	Low		
80–95	70–85	55–70	0. 20–0. 63	. 18	4. 5–5. 0	High	High	Moderate	17	101–110
95–100	90–100	70–85	0. 63–2. 0	. 21	4. 5–6. 0	Low	Moderate	Low		
85–100	80–100	70–85	0. 63–2. 0	. 17	4. 5–5. 0	Moderate	Moderate	Moderate	16	101–120
10–20	5–15	5–10	0. 63–2. 0	. 05	4. 5–5. 0	Moderate	High	Moderate	15	111–120+
70–85	60–70	50–65	0. 63–2. 0	. 18	4. 5–5. 5	Low	Moderate	Low		
60–70	40–60	30–40	0. 63–2. 0	. 12	4. 5–5. 0	Low	Moderate	Low	12	120+
10–20	5–15	5–10	0. 63–6. 3	. 05	4. 5–5. 0	Low	Moderate	Low	10	120+
83–100	80–95	55–80	0. 63–2. 0	. 21	5. 1–5. 5	Moderate	Moderate	Low		
85–100	80–100	65–85	0. 63–2. 0	. 18	4. 5–5. 5	Low	Moderate	Low	18	101–110
70–100	65–100	40–65	2. 0–6. 3	. 10	4. 5–5. 0	Low	Moderate	Low	18	101–110
95–100	90–100	75–90	0. 20–0. 63	. 21	5. 1–5. 5	Moderate	Low	Low	17	101–110
95–100	90–100	80–95	0. 20–0. 63	. 18	4. 0–5. 0	Moderate	Low	Moderate	18	101–110
60–70	50–60	5–10	2. 0–6. 3+	. 06	4. 0–5. 0	Moderate	Moderate	Low	12	120+
100	90–100	70–90	0. 63–2. 0	. 21	5. 1–5. 5	Moderate	Moderate	Low	15	101–110
100	90–100	40–60	2. 0–6. 3	. 15	4. 5–5. 0	Moderate	High	Low	20	101–110
85–95	80–95	60–80	0. 63–2. 0	. 21	6. 1–6. 5	Moderate	Low	Moderate		
75–95	80–95	55–85	0. 20–0. 63	. 21	5. 6–7. 4	Moderate	Low	Moderate	20	101–110
90–100	85–95	65–85	0. 63–2. 0	. 21	4. 5–5. 0	Low	High	Low	15	101–110
90–100	85–100	70–95	0. 20–0. 63	. 18	4. 5–5. 0	Moderate	High	Moderate	16	101–110
75–95	65–85	55–70	0. 63–2. 0	. 18	4. 5–5. 0	Moderate	High	Moderate	18	101–110
85–95	80–95	65–85	0. 63–2. 0	. 21	4. 5–5. 0	Moderate	Moderate	Low		
85–100	80–100	70–95	0. 20–0. 63	. 18	4. 5–5. 0	Moderate	Moderate	Moderate	20	91–110
70–100	65–100	55–70	0. 63–2. 0	. 18	4. 0–4. 5	Moderate	Moderate	Low	20	101–110
85–100	80–100	70–95	0. 20–0. 63	. 18	4. 5–5. 0	Moderate	Moderate	Moderate	20	91–110
70–100	65–100	55–70	0. 63–2. 0	. 18	4. 0–5. 0	Moderate	Moderate	Low	20	101–110

TABLE 5.—*Estimated properties*

Soil series and map symbols	Depth to bedrock	Depth to seasonally high water table	Depth from surface	Classification		
				USDA texture	Unified	AASHO
	Feet	*Feet*	*Inches*			
Elsinboro (EnB2, EnC2, EsA, EsB2, EsC2)	6–20+	6+	0–11	Silt loam	ML	A–4
			11–46	Silty clay loam or silt loam.	ML or MH	A–6 or A–7
			46–60	Loam or clay loam	MH	A–5 or A–7
Glenelg:						
(GcB2, GcC2, GcC3, GcD2, GcD3)	4–8	20+	0–12	Channery loam	GM, ML, or SM	A–4
			12–28	Silty clay loam	GC, GM, or ML	A–6 or A–4
			28–50	Loam	GM or ML	A–6
			50	Mica schist.		
(GlA, GlB2, GlB3, GlC2, GlC3)	4–10	20+	0–12	Loam	ML or CL	A–4 or A–6
			12–28	Silty clay loam	ML or CL	A–4 or A–7
			28–50	Loam	ML or MH	A–4 or A–5
Glenville (GvA, GvB)	5–10	[2] 1½–3	0–10	Silt loam	ML or CL	A–4 or A–6
			10–24	Clay loam or silty clay loam.	ML or CL	A–4 or A–6
			24–48	Clay loam (fragipan).	SM, ML, or CL	A–4 or A–6
			48–60	Loam	SM or MH	A–4 or A–5
Hagerstown (HaA, HaB2, HaC2)	5–7+	15+	0–11	Silt loam	ML or CL	A–4 or A–6
			11–60	Silty clay loam, silty clay, or clay loam.	CH	A–7
Hatboro (Ht)	6–20+	0–1	0–42	Silt loam	ML or MH	A–4 or A–7
			42–60	Gravelly silty clay loam.	ML or CL	A–6 or A–7
Klinesville:						
(KlB2)	1–1½	20+	0–15	Gravelly loam	GM or GP	A–2 or A–1
			15–19	Loam or silt loam	GP or GM	A–1 or A–2
			19	Fractured sandstone.		
(KsD4, KsF3)	0–1	20+	0–9	Gravelly loam	GM or GP	A–2 or A–1
Lewisberry (LbB2, LbC2, LbD)	3½–5	20+	0–30	Gravelly loam or gravelly fine sandy loam.	SM or SP	A–2 or A–1
			30–42	Gravelly sandy loam	GM or GP	A–2
			42	Fractured sandstone.		
Lindside (Le)	6–20+	1½–3	0–20	Silt loam	ML or CL	A–4 or A–6
			20–40	Silty clay loam	CL or ML	A–6 or A–4
			40–60	Gravelly sand	SP or SM	A–3, A–2, or A–1
Linganore (LnB2, LnC2, LnC3, LnD2, LnE)	2–3	20+	0–20	Channery silt loam or channery silty clay loam.	ML or GM	A–7
			20–32	Channery silt and clay	SM or GM	A–1, A–2, or A–4
			32	Fractured slaty schist.		
Made land (Md) (Properties variable. Onsite investigation necessary.)						
Manor (MgB2, MgC2, MgC3, MgD2, MgD3, MlB2, MlB3, MlC2, MlC3, MlD2, MlD3. MlE, MnC, MnD, MnE, MnF).	6–20+	20+	0–23	Loam	ML	A–4 or A–7
			23–90	Loam	SM or ML	A–2 or A–4
Melvin (Mo)	6–20+	0–1	0–18	Silt loam	ML	A–4
			18–36	Silty clay loam	CL	A–6
			36–50	Clay	CH or CL	A–7

See footnotes at end of table.

of the soils—Continued

Percentage passing sieve—			Range in permeability	Available water capacity	Range in reaction [1]	Corrosion potential		Shrink-swell potential	Moisture-density data	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)				Untreated steel pipes	Concrete pipes		Optimum moisture	Maximum dry density
			Inches per hour	*Inches per inch of depth*	*pH*				*Percent*	*Lbs. per cubic foot*
80–100	80–100	75–85	0. 63–2. 0	0. 20	4. 5–5. 5	Moderate	Moderate	Low		
80–100	80–100	75–90	0. 63–2. 0	. 18	4. 5–5. 5	Low	Moderate	Low	18	101–110
75–95	70–95	65–80	0. 20–2. 0	. 18	4. 0–5. 0	Low	Moderate	Low	18	101–110
75–85	70–85	40–75	0. 63–2. 0	. 16	5. 1–5. 5	Moderate	Moderate	Low	16	111–120+
70–85	65–80	40–60	0. 63–2. 0	. 17	4. 5–5. 0	Low	Moderate	Low	16	111–120+
60–80	55–75	35–55	0. 63–2. 0	. 15	4. 5–5. 0	Low	Moderate	Low	16	120+
85–95	80–95	55–80	0. 63–2. 0	. 21	5. 1–5. 5	Moderate	Moderate	Low		
85–100	75–100	55–85	0. 63–2. 0	. 18	4. 5–5. 0	Low	Moderate	Low	18	101–110
70–100	65–95	55–65	0. 63–2. 0	. 15	4. 5–5. 0	Low	Moderate	Low	20	101–110
85–100	80–100	60–80	0. 63–2. 0	. 21	4. 5–5. 0	High	Moderate	Low		
85–100	80–100	65–80	0. 20–0. 63	. 18	4. 5–5. 0	High	High	Low	18	101–110
75–100	70–95	40–75	<0. 20	. 18	4. 5–5. 0	High	High	Low	18	101–110
60–80	60–75	40–65	0. 63–2. 0	. 15	4. 5–5. 0	High	High	Low	20	101–110
95–100	90–100	75–95	2. 0–6. 3	. 23	5. 6–6. 0	Low	Low	Low		
90–100	90–100	85–95	0. 63–2. 0	. 20	5. 6–6. 5	Low	Moderate	Moderate	22	91–100
95–100	90–100	75–95	0. 20–0. 63	. 21	4. 5–5. 5	High	High	Low	20	101–110
70–95	60–95	60–80	<0. 20	. 17	4. 5–5. 0	High	High	Moderate	15	101–120
40–50	30–40	10–20	2. 0–6. 3	. 12	4. 5–5. 5	Low	Moderate	Low	15	120+
10–20	5–15	0–10	2. 0–6. 3		4. 5–5. 0	Low	Moderate	Low	10	120+
20–40	10–30	5–20	2. 0–6. 3+	. 12	4. 5–5. 5	Low	Moderate	Low	15	120+
70–85	60–75	10–30	2. 0–6. 3	. 12	4. 5–5. 5	Low	Moderate	Low	12	120+
30–40	20–30	5–10	2. 0–6. 3	. 08	4. 5–5. 0	Low	Moderate	Low	12	120+
95–100	90–100	75–90	0. 63–2. 0	. 21	6. 5–7. 4	Moderate	Low	Low	18	101–110
95–100	90–100	80–95	0. 63–2. 0	. 18	6. 1–7. 4	Moderate	Low	Moderate	15	101–110
60–70	50–60	5–10	2. 0–6. 3+	. 06	6. 5–7. 8	High	Low	Low	12	101–110
60–85	55–80	45–65	0. 20–0. 63	. 15	5. 1–6. 0	Low	Moderate	Low	12	120+
30–80	20–65	15–40	0. 63–2. 0	. 08	4. 5–5. 0	Low	Moderate	Low	10	120+
80–100	80–100	50–65	2. 0–6. 3	. 15	4. 5–5. 5	Low	Low	Moderate	18	101–110
80–100	60–100	30–60	2. 0–6. 3	. 15	4. 5–5. 0	Low	Moderate	Low	18	101–110
95–100	95–100	75–85	0. 63–2. 0	. 21	6. 1–7. 4	High	Moderate	Low	18	101–110
85–100	85–100	75–90	0. 20–0. 63	. 18	6. 1–7. 4	High	Moderate	Low	15	101–110
95–100	95–100	80–100	<0. 20	. 15	6. 1–7. 4	High	Low	High	22	91–100

TABLE 5.—*Estimated properties*

Soil series and map symbols	Depth to bedrock	Depth to seasonally high water table	Depth from surface	Classification		
				USDA texture	Unified	AASHO
	Feet	*Feet*	*Inches*			
Mt. Airy (MtA, MtB2, MtC2, MtC3, MtD2, MtE).	1½–3½	20+	0–36	Channery loam or channery silt loam.	GM	A–2 or A–1
			36	Hard mica schist.		
Penn:						
(PeB2, PnA2, PnB2, PnC2, PnC3, PoD, PsB2, PsC3).	2–3½	20+	0–22	Silt loam	ML or CL	A–4 or A–6
			22–32	Shale fragments, silt, and clay.	GM or GP	A–2 or A–1
(For interpretations of the Steinsburg soils in mapping units PsB2 and PsC3, see the Steinsburg series.)			32	Fractured, hard shale.		
(PhB2, PhC2, PhC3)	1½–3½	20+	0–10	Silt loam	ML or CL	A–4 or A–6
			10–22	Silt loam	GM or GP	A–2 or A–1
			22–32	Shale fragments, silt, and clay.	GM or GP	A–2 or A–1
			32	Fractured, hard shale.		
Raritan (RaA, RaB)	6–20+	[2] 1–2	0–9	Silt loam	ML	A–4
			9–35	Silty clay loam	ML or CL	A–6
			35–50	Mostly gravelly sand	SP or SM	A–1 or A–2
Readington	3½–6+	[2] 1½–3	0–10	Silt loam	ML or CL	A–4 or A–6
(Mapped only in undifferentiated units with Abbottstown soils.)			10–30	Clay loam or silty clay loam.	CL or ML	A–6
			30–48	Mostly shale fragments.	GM or GP	A–2 or A–1
			48	Hard, fractured shale.		
Rowland (Ro)	6–20+	½–1½	0–30	Silt loam or silty clay loam.	ML	A–4
			30–64	Clay loam	CL	A–6
Steinsburg (StB2, StD3)	1½–3	20+	0–30	Channery loam	GM or ML	A–2 or A–4
			30	Hard, fractured sandstone.		
Urbana (UrA, UrB2)	3½–7	[2] 1½–3	0–9	Silt loam	ML	A–4
			9–29	Silt loam or silty clay loam.	ML or CL	A–4 or A–6
			29–54	Mainly schist fragments.	GM or GP	A–2
			54	Fractured, hard schist.		
Wiltshire (Ws)	5–8	[2] 1½–3	0–16	Silt loam	ML	A–4
			16–26	Silty clay loam	CL or ML	A–6 or A–4
			26–37	Silty clay loam	ML or CL	A–4 or A–6
			37–50	Silt loam or silty clay loam.	ML	A–5

[1] Reaction is for unlimed soils; where soils have been limed, the pH is higher.

of the soils—Continued

Percentage passing sieve—			Range in permeability	Available water capacity	Range in reaction [1]	Corrosion potential		Shrink-swell potential	Moisture-density data	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)				Untreated steel pipes	Concrete pipes		Optimum moisture	Maximum dry density
			Inches per hour	*Inches per inch of depth*	*pH*				*Percent*	*Lbs. per cubic foot*
40–60	30–50	20–30	0. 63–2. 0	0. 12	4. 0–5. 5	Low	Moderate	Low	15	111–120
90–100	80–90	60–80	0. 63–2. 0	. 18	4. 5–5. 5	Low	High	Low	15	101–120
20–30	10–20	5–10	2. 0–6. 3	. 10	4. 5–5. 5	Low	High	Low	15	120+
70–85	75–90	50–75	2. 0–6. 3	. 14	4. 5–5. 5	Low	Moderate	Low	15	111–120+
20–30	10–20	5–10	2. 0–6. 3	. 10	4. 5–5. 5	Low	Moderate	Low	15	120+
20–30	10–20	5–10	2. 0–6. 3	. 10	4. 5–5. 5	Low	High	Low	15	120+
90–100	85–100	65–85	0. 63–2. 0	. 21	4. 5–5. 5	High	Moderate	Low		
90–100	85–100	70–95	<0. 20	. 21	4. 5–5. 5	High	Moderate	Moderate	16	101–110
60–70	50–60	5–10	2. 0–6. 3	. 06	4. 5–5. 0	High	Moderate	Low	12	101–110
100	100	70–85	0. 63–2. 0	. 21	4. 5–5. 5	Low	Moderate	Moderate		
95–100	90–100	60–85	0. 20–0. 63	. 21	4. 5–5. 5	High	High	Moderate	16	101–110
20–30	10–20	5–10	2. 0–6. 3	. 10	4. 5–5. 5	High	High	Low	12	120+
95–100	90–100	75–90	0. 20–0. 63	. 21	4. 5–5. 5	Moderate	High	Low	17	101–110
95–100	90–100	80–95	<0. 20	. 18	4. 5–5. 5	Moderate	High	Moderate	18	101–110
40–80	30–70	30–60	2. 0–6. 3	. 15	4. 0–5. 0	Low	Moderate	Low	15	111–120+
85–100	80–100	60–85	0. 20–0. 63	. 21	5. 1–5. 5	High	High	Moderate		
85–100	80–100	60–85	<0. 20	. 18	4. 5–5. 5	High	High	Moderate	16	101–110
30–40	20–30	10–20	<0. 20	. 12	4. 5–5. 5	High	High	Low	12	120+
85–100	80–100	60–85	0. 63–2. 0	. 21	5. 6–6. 0	Moderate	Low	Low		
85–100	80–100	65–90	0. 20–0. 63	. 18	5. 1–6. 0	High	Low	Moderate	18	101–110
85–95	80–95	65–85	<0. 20	. 18	5. 1–5. 5	High	Moderate	Moderate	16	101–110
60–95	70–95	50–75	0. 20–0. 63	. 15	5. 6–6. 5	High	Low	Moderate	18	101–110

[2] Water table perched.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability for earthwork	Susceptibility to frost action	Kind of available rock	Suitability as source of—		Soil features that affect—
				Topsoil [1]	Road fill	Pipelines (construction and maintenance) [2]
Abbottstown (ArA, ArB2) (For properties of Readington soils in these mapping units, refer to the Readington series.)	Poor	Severe	Shale or sandstone.	Fair	Fair	Perched water table; 4 to 6 feet to bedrock.
Baile (BaA, BaB)	Poor	Severe	Mica schist. [4]	Fair	Poor	High water table; 5 to 8 feet or more to bedrock.
Bermudian (Be)	Fair	Moderate	Variable	Good	Fair	3 feet to water table; 6 to 20 feet or more to bedrock.
Birdsboro (BrA, BrB2)	Poor	Moderate	Variable	Good	Good below depth of 3 feet.	5 feet or more to water table; 6 to 20 feet or more to bedrock.
Bowmansville (Bs)	Very poor	Severe	Variable	Fair	Poor; wet	High water table; 6 to 20 feet or more to bedrock; flood hazard.
Bucks (BuA, BuB2)	Poor	Moderate	Shale	Fair	Fair	4 to 5 feet to bedrock.
Cardiff (CaC2)	Fair	Moderate	Quartzitic slate.	Fair; large amount of slate fragments.	Good	3½ to 5 feet to bedrock.
Chester (CeA, CeB2, CeC2, CeC3)	Poor	Moderate	Mica schist. [4]	Good	Fair; elastic.	5 to 10 feet or more to bedrock.
Codorus (Ch)	Very poor	Severe	Variable	Good	Fair	1 to 2 feet to water table.

See footnotes at end of table.

interpretations

Soil features that affect—Continued						
Road and highway location [3]	Sites for ponds and reservoirs	Dikes, levees, and embankments	Drainage systems	Irrigation [3]	Terraces and diversions	Waterways
Perched water table; severe frost action.	Slow seepage; 4 to 6 feet to pervious bedrock.	Highly erodible.	Slowly permeable; highly erodible.	Slow permeability; moderate available moisture capacity.	Highly erodible; fair stability.	Moderate available moisture capacity; moderate fertility; highly erodible.
Seasonally high water table; poor stability; severe frost action.	Slow seepage; 5 to 8 feet or more to bedrock.	Poor stability; highly erodible; borrow material wet.	Slowly permeable; highly erodible; high water table.	Slow permeability; high water table.	Highly erodible; poor stability; high water table.	High water table; may be stony; difficult to vegetate.
Water table; flood hazard; poor stability; moderate frost action.	Moderate seepage; 6 to 20 feet or more to bedrock; constant water source.	Poor stability; highly erodible; flood hazard.	Not needed; well drained.	Moderately slow permeability; highly erodible.	Highly erodible; poor stability.	Highly erodible.
Good stability; moderate frost action.	Slow to moderate seepage; 6 to 20 feet or more to bedrock; pervious substratum.	Good stability; moderately erodible; semipervious.	Not needed; well drained.	Moderately slow permeability; moderately erodible.	Moderately erodible; good stability.	Moderately erodible.
High water table; flood hazard; poor stability; severe frost action.	Moderate to slow seepage; 6 to 20 feet or more to bedrock; constant water source; flood hazard.	Poor stability; moderately erodible; borrow material wet.	Moderately slowly permeable; moderately erodible; poor outlets; flood hazard.	Moderately slow permeability; high water table; flood hazard.	Flood hazard; moderately erodible; poor stability.	Flood hazard; high water table.
Soil features favorable.	Slow to moderate seepage; 4 to 5 feet to pervious bedrock.	Fair to good stability; moderately erodible.	Not needed; well drained.	Soil features favorable.	High water table; erodible.	Moderately erodible.
3½ to 5 feet to bedrock.	Moderate to rapid seepage; 3½ to 5 feet to pervious bedrock.	Fair stability; moderately erodible; pervious.	Not needed; well drained.	Moderate permeability.	Moderately erodible; fair stability; rock outcrops.	Moderate fertility; rock outcrops.
Good stability; moderate frost action; micaceous material.	Slow to moderate seepage; 5 to 10 feet or more to pervious bedrock.	Moderately erodible; difficult to compact; subject to piping.	Not needed; well drained.	Moderate permeability.	Moderately erodible; good stability.	Moderately erodible.
Seasonally high water table; flood hazard; very poor stability; severe frost action.	Slow to very rapid seepage; constant water source; pervious substratum.	Poor stability; highly erodible; flood hazard.	Seasonally high water table; slowly permeable; highly erodible; flood hazard; poor outlets.	Slow permeability; high water table; flood hazard.	Highly erodible; very poor stability; seasonal high water table.	Highly erodible; flood hazard.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability for earthwork	Susceptibility to frost action	Kind of available rock	Suitability as source of—		Soil features that affect—
				Topsoil [1]	Road fill	Pipelines (construction and maintenance) [2]
Comus (Cm, CnA, CnB)	Poor	Moderate	Variable	Good	Fair	3 feet to water table.
Conestoga (CoA, CoB2, CoC2, CoC3, CoD3).	Poor	Moderate	Calciferous schist.	Good	Poor	5 to 8 feet or more to bedrock.
Delanco (DeA, DeB2)	Poor	Severe	Variable	Fair	Fair	1½ to 3 feet to water table; 6 to 20 feet or more to bedrock.
Elioak (ElB2, ElC2, EmD3)	Poor	Moderate	Mica schist.[4]	Good	Poor	5 to 10 feet or more to bedrock.
Elsinboro (EnB2, EnC2, EsA, EsB2, EsC2).	Poor	Moderate	Variable	Good	Poor	6 feet to water table.
Glenelg (GcB2, GcC2, GcC3, GcD2, GcD3, GlA, GlB2, GlB3, GlC2, GlC3).	Poor	Moderate	Mica schist.[4]	Fair	Generally fair, but good in stony areas.	4 to 8 feet to bedrock.
Glenville (GvA, GvB)	Poor	Moderate	Mica schist.[4]	Generally fair, but poor in stony areas.	Fair	Perched water table; 5 to 10 feet to bedrock.
Hagerstown (HaA, HaB2, HaC2)	Poor	Moderate	Limestone	Good	Fair	5 to 7 feet or more to bedrock.
Hatboro (Ht)	Poor	Severe	Variable	Fair	Poor	High water table; 6 to 20 feet or more to bedrock; flood hazard.

See footnotes at end of table.

interpretations—Continued

Soil features that affect—Continued						
Road and highway location [3]	Sites for ponds and reservoirs	Dikes, levees, and embankments	Drainage systems	Irrigation [3]	Terraces and diversions	Waterways
Seasonally high water table; flood hazard; poor stability; moderate frost action; seepage.	Slow to rapid seepage; 6 to 20 feet or more to bedrock; constant water source; pervious substratum.	Poor stability; highly erodible; flood hazard.	Not needed; well drained.	Flood hazard	Highly erodible; poor stability.	Highly erodible; flood hazard.
Fair stability; moderate frost action.	Slow to moderate seepage; 5 to 8 feet or more to pervious bedrock.	Difficult to compact; highly erodible.	Not needed; well drained.	Moderately slow permeability.	Highly erodible; fair stability.	High fertility; highly erodible.
Seasonally high water table; fair stability; severe frost action; seepage.	Slow to moderate seepage; 6 to 20 feet or more to bedrock; pervious substratum.	Fair stability; moderately erodible.	Moderately slowly permeable; moderately erodible; seepage.	Moderately slow permeability; seasonally high water table.	Moderately erodible; fair stability; seepage.	Moderately erodible; seepage.
Fair to good stability; moderate frost action; micaceous material.	Slow to moderate seepage; 5 to 10 feet or more to pervious bedrock.	Difficult to compact; subject to piping; moderately erodible.	Not needed; well drained.	Soil features favorable.	Moderately erodible; fair to good stability.	Moderately erodible.
Fair to good stability; moderate frost action.	Slow to moderate seepage; 6 to 20 feet or more to bedrock; pervious substratum.	Fair to good stability; moderately erodible; semipervious.	Not needed; well drained.	Moderately erodible.	Moderately erodible; fair to good stability.	Moderately erodible.
Fair to good stability; moderate frost action; micaceous material.	Moderate seepage; 4 to 8 feet to pervious bedrock.	Difficult to compact; subject to piping; moderately erodible.	Not needed; well drained.	Soil features favorable.	Moderately erodible; fair to good stability.	Moderately erodible.
Perched water table; micaceous material.	Slow to moderate seepage; 5 to 10 feet to pervious bedrock.	Difficult to compact; moderately erodible.	Slowly permeable; moderately erodible; perched water table.	Slow permeability; high water table.	Moderately erodible; fair stability.	Moderately erodible.
Rock outcrops in places; irregular surface; sinkholes.	Slow seepage; sinks and solution channels in bedrock at depth of 5 to 7 feet or more.	Good stability; moderately erodible.	Not needed; well drained.	Moderate permeability.	Moderately erodible; good stability.	High fertility; moderately erodible.
High water table; flood hazard; very poor stability; severe frost action.	Slow to moderate seepage; 6 to 20 feet or more to bedrock; constant water source; flood hazard.	Very poor stability; moderately erodible; borrow material wet.	Slowly permeable; moderately erodible; poor outlets; flood hazard.	Slow permeability; high water table; flood hazard.	Moderately erodible; very poor stability; high water table; flood hazard.	Moderately erodible; high water table; flood hazard.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability for earthwork	Susceptibility to frost action	Kind of available rock	Suitability as source of—		Soil features that affect—
				Topsoil [1]	Road fill	Pipelines (construction and maintenance) [2]
Klinesville (KlB2, KsD4, KsF3)	Fair	Slight	Sandstone and shale.	Poor; stony	Good, but quantity generally insufficient.	Shallow to bedrock.
Lewisberry (LbB2, LbC2, LbD)	Good	Slight	Sandstone	Poor	Good	3½ to 5 feet to bedrock.
Lindside (Le)	Poor	Moderate	Variable	Good	Fair	1½ to 3 feet to water table; 6 to 20 feet or more to bedrock; flood hazard.
Linganore (LnB2, LnC2, LnC3, LnD2, LnE).	Fair	Moderate	Hard slaty schist.	Generally fair, but poor in stony areas.	Good below depth of 2 feet.	2 to 3 feet to bedrock.
Made land (Md) (Properties variable. Onsite investigation necessary.)						
Manor (MgB2, MgC2, MgC3, MgD2, MgD3, MlB2, MlB3, MlC2, MlC3, MlD2, MlD3, MlE, MnC, MnD, MnE, MnF).	Poor	Moderate	Mica schist. [4]	Fair to good	Poor; elastic	6 to 20 feet or more to bedrock.
Melvin (Mo)	Poor	Severe	Variable	Good	Poor	Water table at surface; 6 to 20 feet or more to bedrock; flood hazard.
Mt. Airy (MtA, MtB2, MtC2, MtC3, MtD2, MtE).	Fair	Slight to moderate.	Mica schist. [4]	Poor; stony	Good	1½ to 3½ feet to bedrock.
Penn: (PeB2, PnA2, PnB2, PnC2, PnC3, PoD, PsB2, PsC3). (For properties of Steinsburg soils in mapping units PsB2 and PsC3, refer to the Steinsburg series.)	Poor	Moderate	Shale or sandstone.	Good	Fair to depth of 2 feet, good below.	1½ to 3½ feet to bedrock.
(PhB2, PhC2, PhC3)	Fair	Moderate	Shale	Fair	Good	1½ to 3½ feet to bedrock.

See footnotes at end of table.

interpretations—Continued

Soil features that affect—Continued						
Road and highway location [3]	Sites for ponds and reservoirs	Dikes, levees, and embankments	Drainage systems	Irrigation [3]	Terraces and diversions	Waterways
Slight frost action; shallow to bedrock.	Shallow to pervious bedrock.	Pervious; stony; slightly erodible.	Not needed; well drained.	Low available moisture capacity; rapid permeability.	Poor stability; shallow to bedrock.	Shallow to bedrock; low available moisture capacity; low fertility.
Fair stability; slight frost action; 3½ to 5 feet to bedrock.	Rapid seepage; 3½ to 5 feet to bedrock.	Pervious; stony; slightly erodible.	Not needed; well drained.	Moderately rapid permeability.	Fair stability; 3½ to 5 feet to bedrock.	Low available moisture capacity; low fertility; 3½ to 5 feet to bedrock.
Seasonally high water table; flood hazard; poor stability.	Flood hazard; constant water source; pervious substratum.	Poor stability; highly erodible; flood hazard; seasonally high water table.	Highly erodible; flood hazard; seasonally high water table.	High water table; flood hazard.	Highly erodible; poor stability; seasonally high water table.	High fertility; highly erodible; flood hazard.
2 to 3 feet to bedrock.	Moderate seepage; 2 to 3 feet to pervious bedrock.	Good stability; moderately erodible.	Not needed; well drained.	Low available moisture capacity; moderate permeability.	Moderately erodible; good stability; rock outcrops.	Low to moderate available moisture capacity; rock outcrops.
Poor to fair stability; moderate frost action; micaceous material.	Moderate to rapid seepage; 6 to 20 feet or more to pervious bedrock.	Poor to fair stability; highly erodible.	Not needed; well drained.	Moderately rapid permeability.	Highly erodible; poor to fair stability.	Highly erodible.
High water table; flood hazard; poor stability; severe frost action.	Very slow seepage; 6 to 20 feet or more to bedrock; constant water source; flood hazard.	Very poor stability; highly erodible; borrow material wet.	Slowly permeable; highly erodible; poor outlets; flood hazard.	Slow permeability; high water table; flood hazard.	Highly erodible; poor stability.	High fertility; flood hazard; high water table.
1½ to 3½ feet to bedrock.	Moderate to rapid seepage; 1½ to 3½ feet to pervious bedrock.	Fair stability; moderately erodible; pervious.	Not needed; well drained.	Moderate available moisture capacity; moderate permeability.	Moderately erodible; fair stability; rock outcrops.	Moderate available moisture capacity; rock outcrops.
Fair stability; moderate frost action; 1½ to 3½ feet to bedrock.	Moderate to rapid seepage; 1½ to 3½ feet to bedrock.	Fair stability; moderately erodible; semipervious; may be stony.	Not needed; well drained.	Moderate available moisture capacity.	Moderately erodible; stoniness: 1½ to 3½ feet to bedrock.	Stoniness; 1½ to 3½ feet to bedrock.
Fair stability; moderate frost action; 1½ to 3½ feet to bedrock.	Moderate to rapid seepage; 1½ to 3½ feet to bedrock.	Fair stability; moderately erodible; semipervious; may be stony.	Not needed; well drained.	Moderate available moisture capacity.	Moderately erodible; stoniness; 1½ to 3½ feet to bedrock.	Stoniness; 1½ to 3½ feet to bedrock.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability for earthwork	Susceptibility to frost action	Kind of available rock	Suitability as source of—		Soil features that affect—
				Topsoil [1]	Road fill	Pipelines (construction and maintenance) [2]
Raritan (RaA, RaB)	Poor	Severe	Variable	Fair	Fair	Perched water table; 6 to 20 feet or more to bedrock.
Readington (Mapped only in undifferentiated units with Abbottstown soils.)	Poor	Severe	Shale or sandstone.	Fair	Fair to depth of 2 feet, good below.	Perched water table; 3½ to 6 feet or more to bedrock.
Rowland (Ro)	Poor	Severe	Variable	Fair	Fair	½ to 1½ feet to water table; 6 to 20 feet or more to bedrock.
Steinsburg (StB2, StD3)	Fair	Slight	Sandstone	Fair	Good	1½ to 3 feet to bedrock.
Urbana (UrA, UrB2)	Poor	Severe	Actinolite	Fair	Fair to depth of 2½ feet, good below.	Perched water table; 3½ to 7 feet to bedrock.
Wiltshire (Ws)	Very poor	Severe	Limestone or schist.	Good	Fair	Perched water table; 5 to 8 feet to bedrock.

[1] Rating for topsoil is given for the plow layer only, or to an average depth of 10 inches, whichever is less. Also, severely eroded soils are considered unsuitable as a source of topsoil.

[2] The soil features listed that affect suitability for pipelines do not include the corrosive properties of soils. See table 5 for ratings of corrosion potential.

The ratings are based on the degree of the greatest single limitation. For example, if flooding severely limits use of a soil in the disposal of sewage effluent from septic tanks, the limitation is rated severe, though the soil may be well suited to that use in all other respects.

A rating of severe for a particular use does not mean that a soil so rated cannot be put to that use. For example, a soil having a high water table may be severely limited in its use for cemeteries and still be used for them, if measures are taken to improve drainage or to lower the water table. Likewise, a soil that is shallow to hard rock can be used as a site for a home with basement if the rock can be excavated without too much expense.

Following are the chief properties that limit the soils of the county in their suitability for each use specified in table 7.

Filter fields for sewage disposal: Permeability of the soil, depth to a seasonally high water table, depth to bedrock or other impervious layer, slope, and hazard of flooding.

Sewage lagoons: Soil permeability, depth to bedrock or other impervious layer, slope, stoniness, hazard of flooding, and organic-matter content.

Homes with basements: Depth to water table, depth to bedrock (assuming a 5-foot excavation for basement), kind or hardness of bedrock, hazard of flooding, and stoniness or rockiness. (The suitability of a soil for foundations should be investigated on the site.)

interpretations—Continued

Soil features that affect—Continued						
Road and highway location [3]	Sites for ponds and reservoirs	Dikes, levees, and embankments	Drainage systems	Irrigation [3]	Terraces and diversions	Waterways
Perched water table; poor stability; severe frost action.	Seepage slow in subsoil but rapid in substratum; 6 to 20 feet or more to bedrock.	Poor stability; highly erodible.	Slowly permeable; highly erodible; seasonally high water table.	Slow permeability; high water table.	Highly erodible; poor stability.	Highly erodible.
Perched water table; fair stability; severe frost action.	Seepage slow in subsoil but rapid in substratum; 3½ to 6 feet or more to pervious bedrock.	Fair stability; highly erodible.	Moderately slowly permeable; highly erodible; perched water table.	Moderate available moisture capacity; perched water table.	Highly erodible; fair stability; perched water table.	Highly erodible.
Seasonally high water table; flood hazard; poor stability; severe frost action.	Very slow seepage; constant water source; pervious substratum.	Poor stability; highly erodible; flood hazard.	Slowly permeable; highly erodible; flood hazard; seasonally high water table.	Slow permeability; seasonally high water table; flood hazard.	Highly erodible; poor stability.	Moderately erodible; flood hazard.
Fair stability; slight frost action; 1½ to 3 feet to bedrock.	Rapid seepage; 1½ to 3 feet to bedrock.	Moderately erodible; pervious; stony.	Not needed; well drained.	Moderate available moisture capacity.	Seasonally high water table; moderately erodible; fair stability; 1½ to 3 feet to bedrock.	1½ to 3 feet to bedrock.
Perched water table; fair stability; severe frost action.	Very slow seepage; 3½ to 7 feet to pervious bedrock.	Highly erodible; difficult to compact.	Slowly permeable; highly erodible; perched water table.	Slow permeability; high water table.	Highly erodible; fair stability.	Highly erodible.
Perched water table; severe frost action.	Slow seepage; 5 to 8 feet to pervious bedrock.	Highly erodible; difficult to compact.	Slowly permeable; highly erodible; perched water table.	Slow permeability; high water table.	Highly erodible; fair stability.	Highly erodible.

[3] Other than slope and relief. The effects of these features increase with an increase in gradient and complexity.
[4] Mica schist varies in hardness and utility. It may be injected with quartzite.

Streets and parking lots: Wetness and depth to water table, slope, hazard of flooding, depth to bedrock, and kind of bedrock.

Sanitary land fill: Depth to water table, depth to hard bedrock, stoniness, permeability, slope, soil texture, and hazard of flooding.

Home gardens: Texture of the surface layer, permeability of the subsoil, slope, degree of erosion, moisture-holding capacity, depth to water table, and natural drainage.

Recreational Uses of Soils

In the eastern part of the United States, the major recreational activities that are influenced by soils are hunting, fishing, picnicking, camping, hiking, and organized sports. Soil features related to hunting and fishing are discussed in the subsection "Wildlife."

Facilities of outdoor recreation that depend a great deal on soil properties are campsites for tents and trailers, athletic fields and playgrounds, parks and picnic areas, areas of grass for lawns and golf fairways, paths and trails for hiking, and service buildings in recreational areas.

Table 8 rates the degree and kind of limitation of each soil in Carroll County for specified recreational uses. The limitations are rated *slight*, *moderate*, and *severe*. These ratings were made on the basis of depth to the water table, wetness, the hazard of flooding, soil permeability, texture content of gravel and stones, and slope.

TABLE 7.—*Soil limitations for*

Soil series and map symbols	Sewage disposal	
	Filter fields	Lagoons
Abbottstown (ArA, ArB2) (For limitations of Readington soils in these mapping units, see the Readington series.)	Severe: perched water table; slow permeability.	Slight on ArA. Moderate on ArB2: slope.
Baile (BaA, BaB)	Severe: high water table; slow permeability.	Slight on BaA. Moderate on BaB: slope.
Bermudian (Be)	Severe: flood hazard; moderately slow permeability.	Severe: flood hazard
Birdsboro (BrA, BrB2)	Severe: moderately slow permeability	Slight on BrA. Moderate on BrB2: slope.
Bowmansville (Bs)	Severe: flood hazard; moderately slow permeability.	Severe: flood hazard
Bucks (BuA, BuB2)	Slight	Slight on BuA. Moderate on BuB2: slope.
Cardiff (CaC2)	Moderate: 3½ to 5 feet to bedrock	Moderate: 3½ to 5 feet to bedrock
Chester:		
(CeA, CeB2)	Slight	Moderate: moderate permeability; slope
(CeC2,CeC3)	Moderate: slope	Severe: slope; moderate permeability
Codorus (Ch)	Severe: flood hazard; slow permeability	Severe: flood hazard
Comus:		
(Cm)	Severe: flood hazard	Severe: flood hazard
(CnA, CnB)	Slight	Severe: moderate permeability
Conestoga:		
(CoA, CoB2)	Severe: moderately slow permeability	Slight on CoA. Moderate on CoB2: slope.
(CoC2, CoC3)	Severe: moderately slow permeability	Severe: slope
(CoD3)	Severe: slope; moderately slow permeability.	Severe: slope
Delanco (DeA, DeB2)	Severe: moderately slow permeability	Moderate on DeA: slow permeability Moderate on DeB2: slow permeability; slope.
Elioak:		
(ElB2)	Severe: moderately slow permeability	Moderate: slope; moderately slow permeability.
(ElC2)	Severe: moderately slow permeability	Severe: slope
(EmD3)	Severe: slope	Severe: slope

See footnotes at end of table.

selected nonfarm uses

Homes with basements [1]	Streets and parking lots	Sanitary land fill [2] (trench method)	Home gardens
Severe: perched water table	Moderate: perched water table.	Severe: perched water table slow permeability.	Severe: wetness.
Severe: high water table	Severe: high water table	Severe: high water table; slow permeability.	Very severe: high water table; wetness.
Severe: flood hazard	Severe: flood hazard	Severe: flood hazard	Severe: flood hazard.
Slight	Slight on BrA. Moderate on BrB2: slope.	Moderate: moderately slow permeability.	Slight on BrA. Moderate on BrB2: slope.
Severe: flood hazard; high water table.	Severe: flood hazard; high water table.	Severe: flood hazard; high water table.	Severe: flood hazard; wetness.
Slight	Moderate: 4 to 5 feet to bedrock.	Slight	Slight on BuA. Moderate on BuB2: slope.
Moderate: 3½ to 5 feet to bedrock.	Severe: slope	Moderate: 3½ to 5 feet to bedrock.	Severe: slope; droughty.
Slight	Slight on CeA. Moderate on CeB2: slope.	Slight	Slight on CeA. Moderate on CeB2: slope.
Moderate: slope	Severe: slope	Moderate: slope	Severe on CeC2: slope. Very severe on CeC3: slope and erosion.
Severe: flood hazard; seasonally high water table.	Severe: flood hazard	Severe: flood hazard; seasonally high water table; slow permeability.	Severe: wetness; flood hazard.
Severe: flood hazard	Severe: flood hazard	Severe: flood hazard	Severe: flood hazard.
Slight	Slight on CnA. Moderate on CnB: slope.	Slight	Slight on CnA. Moderate on CnB: slope.
Slight	Slight on CoA. Moderate on CoB2: slope.	Moderate: moderately slow permeability.	Slight on CoA. Moderate on CoB2: slope.
Moderate: slope	Severe: slope	Moderate: slope; moderately slow permeability.	Severe on CoC2: slope. Very severe on CoC3: slope and erosion.
Moderate: slope	Severe: slope	Severe: slope	Very severe: slope and erosion.
Moderate: seasonally high water table.	Moderate on DeA: seasonally high water table. Moderate on DeB2: seasonally high water table; slope.	Moderate: seasonally high water table; slow permeability.	Moderate on DeA: seasonal wetness. Moderate on DeB2: seasonal wetness; slope.
Slight	Moderate: slope	Slight	Moderate: slope.
Moderate: slope	Severe: slope	Moderate: slope	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Very severe: slope and erosion.

TABLE 7.—*Soil limitations for*

Soil series and map symbols	Sewage disposal	
	Filter fields	Lagoons
Elsinboro: (EsA, EnB2, EsB2)	Slight	Slight on EsA. Moderate on EnB2 and EsB2: slope.
(EnC2, EsC2)	Moderate: slope	Severe: slope
Glenelg: (GlA, GcB2, GlB2, GlB3)	Slight	Moderate: moderate permeability; slope.
(GcC2, GlC2, GcC3, GlC3)	Moderate: slope	Severe: slope; moderate permeability
(GcD2, GcD3)	Severe: slope	Severe: slope
Glenville (GvA, GvB)	Severe: slow permeability	Slight on GvA. Moderate on GvB: slope.
Hagerstown: (HaA, HaB2)	Slight	Moderate: moderate permeability
(HaC2)	Moderate: slope	Severe: slope
Hatboro (Ht)	Severe: flood hazard; high water table; slow permeability.	Severe: flood hazard
Klinesville (KlB2, KsD4, KsF3)	Severe: shallow to bedrock	Severe: shallow to bedrock
Lewisberry: (LbB2, LbC2)	Moderate: 3½ to 5 feet to bedrock; slope	Severe: moderately rapid permeability
(LbD)	Severe: slope	Severe: slope
Lindside (Le)	Severe: flood hazard	Severe: flood hazard
Linganore (LnB2, LnC2, LnC3, LnD2, LnE)	Severe: 2 to 3 feet to bedrock	Severe: 2 to 3 feet to bedrock
Made land (Md) (Limitations variable. Onsite investigation necessary.)		

See footnotes at end of table.

selected nonfarm uses—Continued

Homes with basements [1]	Streets and parking lots	Sanitary land fill [2] (trench method)	Home gardens
Slight	Slight on EsA. Moderate on EnB2 and EsB2: slope.	Slight	Slight on EsA. Moderate on EnB2 and EsB2: slope.
Moderate: slope	Severe: slope	Moderate: slope	Severe: slope.
Slight	Slight on GlA. Moderate on GcB2, GlB2, and GlB3: slope.	Slight	Slight on GlA. Moderate on GcB2 and GlB2: slope. Severe on GlB3: slope and erosion.
Moderate: slope	Severe: slope	Moderate: slope	Severe on GcC2 and GlC2: slope. Very severe on GcC3 and GlC3: slope and erosion.
Severe: slope	Severe: slope	Moderate: slope	Very severe: slope and erosion.
Moderate: perched water table.	Moderate: perched water table.	Severe: slow permeability	Moderate on GvA: seasonal wetness. Moderate on GvB: seasonal wetness; slope.
Slight	Slight on HaA. Moderate on HaB2: slope.	Slight	Slight on HaA. Moderate on HaB2: slope.
Moderate: slope	Severe: slope	Moderate: slope	Severe: slope.
Severe: flood hazard; high water table.	Severe: flood hazard; high water table.	Severe: flood hazard; high water table; slow permeability.	Severe: flood hazard; wetness.
Severe on KlB2: shallow to bedrock. Severe on KsD4 and KsF3: slope; shallow to bedrock.	Severe: shallow to bedrock	Severe: shallow to bedrock	Very severe on KlB2: shallow to bedrock. Very severe on KsD4 and KsF3: slope; erosion; shallow to bedrock.
Moderate: 3½ to 5 feet to bedrock.	Moderate on LbB2: slope; 3½ to 5 feet to bedrock. Severe on LbC2: slope.	Moderate: 3½ to 5 feet to bedrock.	Moderate on LbB2: slope; droughty. Severe on LbC2: slope; droughty.
Severe: slope	Severe: slope	Severe: 3½ to 5 feet to bedrock; slope.	Very severe: slope; droughty.
Severe: flood hazard	Severe: flood hazard	Severe: flood hazard	Severe: wetness; flood hazard.
Severe: 2 to 3 feet to bedrock.	Severe: 2 to 3 feet to bedrock.	Severe: 2 to 3 feet to bedrock.	Severe: on LnB2: shallow; droughty. Very severe on LnC2, LnC3, LnD2, and LnE: slope; 2 to 3 feet to bedrock.

TABLE 7.—*Soil limitations for*

Soil series and map symbols	Sewage disposal	
	Filter fields	Lagoons
Manor: (MgB2, MIB2, MIB3)	Slight	Severe: moderately rapid permeability
(MgC2, MIC2, MgC3, MIC3)	Moderate: slope	Severe: moderately rapid permeability
(MID2, MID3, MgD2, MgD3, MIE)	Severe: slope	Severe: moderately rapid permeability
(MnC, MnD, MnE, MnF)	Severe: slope; stoniness	Severe: slope; stoniness
Melvin (Mo)	Severe: flood hazard; high water table	Severe: flood hazard
Mt. Airy: (MtA, MtB2)	Moderate: 1½ to 3½ feet to bedrock	Severe: 1½ to 3½ feet to bedrock
(MtC2, MtC3)	Moderate: 1½ to 3½ feet to bedrock	Severe: 1½ to 3½ feet to bedrock
(MtD2, MtE)	Severe: slope	Severe: 1½ to 3½ feet to bedrock
Penn: (PeB2, PnA2, PnB2, PsB2)	Severe: 1½ to 3½ feet to bedrock	Severe: 1½ to 3½ feet to bedrock; slow permeability.
(PhB2, PhC2, PhC3)	Severe: 1½ to 3½ feet to bedrock	Severe: 1½ to 3½ feet to bedrock
(PnC2, PnC3, PsC3)	Severe: 1½ to 3½ feet to bedrock	Severe: 1½ to 3½ feet to bedrock; slow permeability.
(PoD) (For limitations of the Steinsburg soils in mapping units PsB2 and PsC3, see the Steinsburg series.)	Severe: 1½ to 3½ feet to bedrock	Severe: slope
Raritan (RaA, RaB)	Severe: perched water table; slow permeability.	Slight on RaA. Moderate on RaB: slope.
Readington (Mapped only in undifferentiated units with Abbottstown soils.)	Severe: moderately slow permeability; slope.	Moderate: 3½ to 6 feet to bedrock; slope
Rowland (Ro)	Severe: flood hazard; seasonally high water table; slow permeability.	Severe: flood hazard
Steinsburg: (StB2)	Severe: 1½ to 3 feet to bedrock	Severe: 1½ to 3 feet to bedrock
(StD3)	Severe: 1½ to 3 feet to bedrock; slope	Severe: 1½ to 3 feet to bedrock
Urbana (UrA, UrB2)	Severe: slow permeability	Moderate on UrA: 3½ to 7 feet to bedrock. Moderate on UrB2: slope; 3½ to 7 feet to bedrock.
Wiltshire (Ws)	Severe: slow permeability	Slight

[1] Limitations shown are for homes in subdivisions. These are areas crisscrossed at short intervals by paved streets; street grades are kept to a minimum and individual lots generally are much less than 1 acre in size.

selected nonfarm uses—Continued

Homes with basements [1]	Streets and parking lots	Sanitary land fill [2] (trench method)	Home gardens
Slight	Moderate: slope	Slight	Moderate on MgB2 and MIB2: slope. Severe on MIB3: slope and erosion.
Moderate: slope	Severe: slope	Moderate: slope	Severe on MgC2 and MIC2: slope. Very severe on MgC3 and MIC3: slope and erosion.
Severe: slope	Severe: slope	Severe: slope	Very severe: erosion; slope.
Severe: slope; stoniness	Severe: slope; stoniness	Severe: slope; stoniness	Very severe: stoniness.
Severe: flood hazard; high water table.	Severe: flood hazard; high water table.	Severe: flood hazard; high water table; moderately slow permeability.	Severe: flood hazard; wetness.
Severe: 1½ to 3½ feet to bedrock.	Severe: 1½ to 3½ feet to bedrock.	Severe: 1½ to 3½ feet to bedrock.	Severe on MtA: 1½ to 3½ feet to bedrock; droughty. Severe on MtB2: 1½ to 3½ feet to bedrock; slope.
Severe: 1½ to 3½ feet to bedrock.	Severe: slope; 1½ to 3½ feet to bedrock.	Severe: 1½ to 3½ feet to bedrock; slope.	Very severe: slope and erosion.
Severe: slope	Severe: slope; 1½ to 3½ feet to bedrock.	Severe: slope; 1½ to 3½ feet to bedrock.	Very severe: slope.
Severe: 1½ to 3½ feet to bedrock.	Severe: 1½ to 3½ feet to bedrock.	Severe: 1½ to 3½ feet to bedrock.	Moderate: 1½ to 3½ feet to bedrock; slope.
Severe: 1½ to 3½ feet to bedrock.	Severe: 1½ to 3½ feet to bedrock; slope.	Severe: 1½ to 3½ feet to bedrock.	Severe: 1½ to 3½ feet to bedrock; droughty; erosion hazard.
Severe: 1½ to 3½ feet to bedrock; slope.	Severe: 1½ to 3½ feet to bedrock; slope.	Severe: 1½ to 3½ feet to bedrock.	Severe: 1½ to 3½ feet to bedrock; slope; erosion hazard.
Severe: 1½ to 3½ feet to bedrock; slope.	Severe: 1½ to 3½ feet to bedrock; slope.	Severe: 1½ to 3½ feet to bedrock; slope.	Very severe: slope.
Severe: perched water table	Moderate: seasonal wetness	Severe: perched water table; slow permeability.	Severe: wetness.
Moderate: perched water table; 3½ to 6 feet to bedrock.	Moderate: 3½ to 6 feet to bedrock; perched water table.	Severe: 3½ to 6 feet to bedrock; perched water table.	Moderate: seasonal wetness; slope.
Severe: flood hazard	Severe: flood hazard	Severe: flood hazard; seasonally high water table.	Severe: flood hazard; seasonally high water table.
Severe: 1½ to 3 feet to bedrock.	Severe: 1½ to 3 feet to bedrock.	Severe: 1½ to 3 feet to bedrock.	Moderate: 1½ to 3 feet to bedrock; slope.
Severe: 1½ to 3 feet to bedrock; slope.	Severe: 1½ to 3 feet to bedrock.	Severe: 1½ to 3 feet to bedrock; slope.	Very severe: slope and erosion.
Moderate: perched water table.	Moderate: perched water table.	Severe: slow permeability; 3½ to 7 feet to bedrock.	Moderate on UrA: seasonal wetness. Moderate on UrB2: seasonal wetness; slope.
Moderate: perched water table.	Moderate: seasonal wetness	Severe: slow permeability	Moderate: seasonal wetness.

[2] Limitations for cemeteries generally are similar to those for sanitary land fill, but the use for cemeteries is limited to a greater degree if the soils are severely eroded or very stony.

TABLE 8.—*Degree and kind of limitations*

Soil series and map symbols	Campsites for tents and trailers [1]	Athletic fields and other play areas
Abbottstown (ArA, ArB2) (For limitations of Readington soils in these mapping units, see the Readington series.)	Severe: slow permeability; seasonally perched water table.	Severe: slow permeability; seasonally perched water table.
Baile (BaA, BaB)	Severe: seasonally high water table; slow permeability.	Severe: seasonally high water table; slow permeability.
Bermudian (Be)	Moderate: moderately slow permeability	Moderate: moderately slow permeability
Birdsboro (BrA, BrB2)	Moderate on BrA: moderately slow permeability. Moderate on BrB2: slope; moderately slow permeability.	Moderate on BrA: moderately slow permeability. Moderate on BrB2: slope; moderately slow permeability.
Bowmansville (Bs)	Severe: high water table; flood hazard	Severe: high water table; flood hazard
Bucks (BuA, BuB2)	Slight on BuA. Moderate on BuB2: slope.	Slight on BuA. Moderate on BuB2: slope.
Cardiff (CaC2)	Severe: slope	Severe: slope
Chester: (CeA, CeB2)	Slight on CeA. Moderate on CeB2: slope.	Slight on CeA. Moderate on CeB2: slope.
(CeC2, CeC3)	Severe: slope	Severe: slope
Codorus (Ch)	Moderate: seasonally high water table; slow permeability.[2]	Severe: slow permeability [2]
Comus: (Cm)	Slight [2]	Slight [2]
(CnA, CnB)	Slight on CnA. Moderate on CnB: slope.	Slight on CnA. Moderate on CnB: slope.
Conestoga: (CoA, CoB2)	Moderate on CoA: moderately slow permeability. Moderate on CoB2: moderately slow permeability; slope.	Moderate on CoA: moderately slow permeability. Moderate on CoB2: moderately slow permeability; slope.
(CoC2, CoC3, CoD3)	Severe: slope	Severe: slope
Delanco (DeA, DeB2)	Moderate: seasonally high water table; moderately slow permeability.	Moderate: seasonally high water table; moderately slow permeability.
Elioak: (ElB2)	Moderate: moderately slow permeability; slope.	Moderate: moderately slow permeability; slope.
(ElC2, EmD3)	Severe: slope	Severe: slope
Elsinboro: (EnB2, EsA, EsB2)	Slight on EsA. Moderate on EnB2 and EsB2: slope.	Slight on EsA. Moderate on EnB2: slope; coarse fragments. Moderate on EsB2: slope.
(EnC2, EsC2)	Severe: slope	Severe: slope

See footnotes at end of table.

for specified recreational uses

Parks and picnic areas	Lawns and golf fairways	Paths and trails	Service buildings
Moderate: seasonally perched water table.	Moderate: seasonally perched water table.	Slight	Severe: seasonally perched water table.
Severe: seasonally high water table.	Severe: seasonally high water table.	Severe: seasonally high water table.	Severe: seasonally high water table.
Slight [2]	Slight [2]	Slight [2]	Severe: flood hazard.
Slight	Slight	Slight	Slight.
Severe: high water table; flood hazard.	Severe: high water table; flood hazard.	Severe: high water table; flood hazard.	Severe: high water table; flood hazard.
Slight	Slight	Slight	Slight.
Moderate: slope	Moderate: slope; slate fragments.	Slight	Moderate: slope; 3½ to 5 feet to bedrock.
Slight	Slight	Slight	Slight.
Moderate: slope	Moderate: slope	Slight	Moderate: slope.
Moderate: seasonally high water table.[2]	Moderate: seasonally high water table.[2]	Moderate: seasonally high water table.[2]	Severe: flood hazard; seasonally high water table.
Slight [2]	Slight [2]	Slight [2]	Severe: flood hazard.
Slight	Slight	Slight	Slight.
Slight	Slight	Slight	Slight.
Moderate on CoC2 and CoC3: slope. Severe on CoD2: slope	Moderate on CoC2 and CoC3: slope. Severe on CoD2: slope	Slight on CoC2 and CoC3 Moderate on CoD2: slope	Moderate on CoC2 and CoC3: slope. Severe on CoD2: slope.
Slight	Slight	Slight	Moderate: seasonally high water table.
Slight	Slight	Slight	Slight.
Moderate on EIC2: slope Severe on EmD3: slope	Moderate on EIC2: slope Severe on EmD3: slope; erosion.	Slight on EIC2 Moderate on EmD3: slope	Moderate on EIC2: slope. Severe on EmD3: slope.
Slight	Slight on EsA and EsB2. Moderate on EnB2: coarse fragments.	Slight	Slight.
Moderate: slope	Moderate on EnC2: slope; coarse fragments. Moderate on EsC2: slope.	Slight	Moderate: slope.

TABLE 8.—*Degree and kind of limitations*

Soil series and map symbols	Campsites for tents and trailers [1]	Athletic fields and other play areas
Glenelg: (GcB2, GlB2, GlB3)	Moderate: slope	Moderate on GcB2: slope; schist fragments Moderate on GlB2 and GlB3: slope.
(GcC2, GcC3, GlC2, GlC3)	Severe: slope	Severe: slope
(GcD2, GcD3)	Severe: slope	Severe: slope
(GlA)	Slight	Slight
Glenville (GvA, GvB)	Severe: slow permeability	Severe: slow permeability
Hagerstown: (HaA, HaB2)	Slight on HaA. Moderate on HaB2: slope.	Slight on HaA. Moderate on HaB2: slope.
(HaC2)	Severe: slope	Severe: slope
Hatboro (Ht)	Severe: high water table; slow permeability; flood hazard.	Severe: high water table; slow permeability; flood hazard.
Klinesville: (KlB2)	Moderate: rock fragments; shallow to bedrock.	Severe: shallow to bedrock; rock fragments.
(KsD4)	Severe: slope; rock fragments	Severe: shallow to bedrock; slope; rock fragments.
(KsF3)	Severe: slope	Severe: slope
Lewisberry: (LbB2)	Moderate: slope	Moderate: 3½ to 5 feet to bedrock; slope; coarse fragments.
(LbC2, LbD)	Severe: slope	Severe: slope
Lindside (Le)	Moderate: high water table [2]	Moderate: high water table [2]
Linganore: (LnB2)	Moderate: slope	Severe: 2 to 3 feet to bedrock.
(LnC2, LnC3)	Severe: slope	Severe: slope
(LnD2, LnE)	Severe: slope	Severe: slope
Manor: (MgB2, MlB2, MlB3)	Moderate: slope	Moderate on MgB2: slope; coarse fragments. Moderate on MlB2 and MlB3: slope.
(MgC2, MgC3, MlC2, MlC3)	Severe: slope	Severe: slope
(MgD2, MgD3, MlD2, MlD3, MlE)	Severe: slope	Severe: slope
(MnC, MnD, MnE, MnF)	Severe: slope; stones	Severe: slope; stones
Melvin (Mo)	Severe: high water table; slow permeability; flood hazard.	Severe: high water table; flood hazard

See footnotes at end of table.

for specified recreational uses—Continued

Parks and picnic areas	Lawns and golf fairways	Paths and trails	Service buildings
Slight	Slight on GlB2 and GlB3. Moderate on GcB2: schist fragments.	Slight	Slight.
Moderate: slope	Moderate on GcC2 and GcC3: slope; schist fragments. Moderate on GlC2 and GlC3: slope.	Slight	Slight.
Severe: slope	Severe: slope	Moderate: slope	Severe: slope.
Slight	Slight	Slight	Slight.
Slight	Slight	Slight	Moderate: perched water table.
Slight	Slight	Slight	Slight.
Moderate: slope	Moderate: slope	Slight	Moderate: slope.
Severe: high water table; flood hazard.	Severe: high water table; flood hazard.	Severe: high water table; flood hazard.	Severe: high water table; flood hazard.
Severe: shallow to bedrock	Moderate: shallow to bedrock	Slight	Severe: shallow to bedrock.
Severe: shallow to bedrock; slope.	Severe: shallow to bedrock; slope; rock fragments.	Moderate: slope	Severe: slope; shallow to bedrock.
Severe: slope	Severe: slope	Severe: slope	Severe: slope; shallow to bedrock.
Slight	Moderate: coarse fragments	Slight	Moderate: 3½ to 5 feet to bedrock.
Moderate on LbC2: slope	Moderate on LbC2: slope; coarse fragments.	Slight on LbC2.	Moderate on LbC2: 3½ to 5 feet to bedrock; slope.
Severe on LbD: slope.	Severe on LbD: slope.	Moderate on LbD: slope.	Severe on LbD: slope.
Slight [2]	Slight [2]	Slight [2]	Severe: flood hazard.
Slight	Moderate: 2 to 3 feet to bedrock; coarse fragments.	Slight	Severe: 2 to 3 feet to bedrock.
Moderate: 2 to 3 feet to bedrock; slope.	Moderate: slope; coarse fragments.	Slight	Severe: 2 to 3 feet to bedrock.
Severe: slope	Severe: slope	Moderate on LnD2: slope. Severe on LnE: slope.	Severe: 2 to 3 feet to bedrock; slope.
Slight	Slight on MlB2 and MlB3. Moderate on MgB2: coarse fragments.	Slight	Slight.
Moderate: slope	Moderate on MgC2 and MgC3: slope; coarse fragments. Moderate on MlC2 and MlC3: slope.	Slight	Moderate: slope.
Severe: slope	Severe: slope	Moderate on MgD2, MgD3, MlD2, and MlD3: slope. Severe on MlE: slope.	Severe: slope.
Severe: slope; stones	Severe: slope; stones	Severe: slope; stones	Severe: slope; stones.
Severe: high water table; flood hazard.	Severe: high water table; flood hazard.	Severe: high water table; flood hazard.	Severe: high water table; flood hazard.

TABLE 8.—*Degree and kind of limitations*

Soil series and map symbols	Campsites for tents and trailers [1]	Athletic fields and other play areas
Mt. Airy:		
(MtA, MtB2)	Slight on MtA. Moderate on MtB2: slope.	Severe: 1½ to 3½ feet to bedrock; coarse fragments.
(MtC2, MtC3)	Severe: slope	Severe: slope; 1½ to 3½ feet to bedrock
(MtD2, MtE)	Severe: slope	Severe: slope
Penn:		
(PeB2, PhB2, PnB2, PsB2)	Moderate: slope	Severe on PeB2, PnB2, and PsB2: 1½ to 3½ feet to bedrock. Severe on PhB2: 1½ to 3½ feet to bedrock; coarse fragments.
(PhC2, PhC3)	Severe: slope	Severe: slope
(PnA2)	Slight	Severe: 1½ to 3½ feet to bedrock
(PnC2, PnC3, PsC3, PoD) (For limitations of the Steinsburg soils in mapping units PsB2 and PsC3, see the Steinsburg series.)	Severe: slope	Severe: slope
Raritan (RaA, RaB)	Severe: slow permeability	Moderate: perched water table; slow permeability.
Readington (Mapped only in undifferentiated units with Abbottstown soils.)	Moderate: perched water table; moderately slow permeability.	Moderate: perched water table; moderately slow permeability.
Rowland (Ro)	Moderate: seasonally high water table; slow permeability.[2]	Severe: slow permeability [2]
Steinsburg:		
(StB2)	Moderate: slope	Severe: 1½ to 3 feet to bedrock; slope; coarse fragments.
(StD3)	Severe: slope	Severe: slope
Urbana (UrA, UrB2)	Severe: slow permeability	Severe: slow permeability
Wiltshire (Ws)	Severe: slow permeability	Moderate: slow permeability

[1] On soils having slopes of 3 to 15 percent, the degree of limitation for tent camping is generally somewhat less than that shown.

Formation and Classification of Soils

This section consists of three parts. In the first part the factors of soil formation are discussed as they relate to the formation of soils in Carroll County. The second part explains the morphology of soils. In the third part each soil series represented in the county is placed in its respective family, subgroup, and order of the current system for classifying soils and also in the appropriate great soil group and order of the classification system established in 1938.

Factors in Soil Formation

Soils are the products of soil-forming processes acting upon materials altered or deposited by geologic forces. The five major factors in the formation of soils are climate, living organisms, parent material, relief, and time. Climate and living organisms, particularly vegetation, are the active forces in soil formation. Their effect on parent material is modified by relief and by the length of time the parent material has been in place. The relative importance of each factor varies from place to place. In some places

for specified recreational uses—Continued

Parks and picnic areas	Lawns and golf fairways	Paths and trails	Service buildings
Moderate: 1½ to 3½ feet to bedrock.	Moderate: 1½ to 3½ feet to bedrock; coarse fragments.	Slight	Severe: 1½ to 3½ feet to bedrock.
Moderate: slope	Moderate: slope; coarse fragments; 1½ to 3½ feet to bedrock.	Slight	Severe: 1½ to 3½ feet to bedrock.
Severe: slope	Severe: slope	Moderate on MtD2: slope. Severe on MtE: slope.	Severe: 1½ to 3½ feet to bedrock; slope.
Moderate: 1½ to 3½ feet to bedrock.	Moderate on PeB2, PnB2, and PsB2: 1½ to 3½ feet to bedrock. Moderate on PhB2: 1½ to 3½ feet to bedrock; coarse fragments.	Slight	Severe: 1½ to 3½ feet to bedrock.
Moderate: slope	Moderate on PhC2: slope; coarse fragments. Severe on PhC3: 1½ to 3½ feet to bedrock; slope; coarse fragments.	Slight	Severe: 1½ to 3½ feet to bedrock.
Moderate: 1½ to 3½ feet to bedrock.	Moderate: 1½ to 3½ feet to bedrock.	Slight	Severe: 1½ to 3½ feet to bedrock.
Moderate on PnC2, PnC3, and PsC3: slope. Severe on PoD: slope	Moderate on PnC2: slope Severe on PnC3, PsC3, and PoD: 1½ to 3½ feet to bedrock; slope.	Slight on PnC2, PnC3, and PsC3. Moderate on PoD: slope	Severe: 1½ to 3½ feet to bedrock.
Slight	Slight	Slight	Severe: perched water table.
Slight	Slight	Slight	Moderate: perched water table; 3½ to 6 feet to bedrock.
Moderate: seasonally high water table.[2]	Moderate: seasonally high water table.[2]	Moderate: seasonally high water table.[2]	Severe: flood hazard.
Moderate: 1½ to 3 feet to bedrock.	Moderate: 1½ to 3 feet to bedrock; coarse fragments.	Slight	Severe: 1½ to 3 feet to bedrock.
Severe: slope	Severe: slope	Moderate: slope	Severe: 1½ to 3 feet to bedrock; slope.
Slight	Slight	Slight	Moderate: perched water table.
Slight	Slight	Slight	Moderate: perched water table.

[2] Seldom if ever flooded during period of use.

one factor is dominant and fixes most of the properties of the soil. Normally, however, the interaction of all five factors determines the kind of soil that develops in any given place.

Climate

Climate is important in the formation of soils because it influences the weathering of minerals. Weathering is more rapid under a warm, humid climate than it is under a cold or a dry climate. The type and abundance of vegetation are influenced by the amount of precipitation and the length of the growing season. Precipitation also affects the translocation and leaching of some products of weathering. Hard rains and frequent showers may cause excessive erosion.

Carroll County has a humid, continental climate. Climatic data for the county are given in the section "Climate."

The climate is fairly uniform throughout the county, and there are no significant differences among the soils caused by climate alone. All the soils are strongly weath-

ered, and most of them are leached, acid, and comparatively low in natural content of plant nutrients. The only soils that contain a larger natural supply of nutrients are those that developed in parent material exceptionally high in basic elements, such as calcium.

Living organisms

Native plants have been a major influence on the development of soils. In Carroll County the native vegetation consisted mostly of forest. This was made up almost entirely of hardwoods, and there were few if any coniferous trees.

Most hardwoods use a large amount of calcium and other bases if these elements are available. Hardwood trees and other plants take up minerals from the soil and store them in their roots, stems, and leaves. When deciduous trees shed their leaves or when the plants die and decay, the plant nutrients are returned to the soil and are used by other plants. This cycle, if undisturbed, is never ending.

Soil development also is affected by plant roots, for these penetrate soil material to various depths, generally increase its porosity, and may break coarse fragments, such as stones and pebbles. Organic acids produced by plants and their decay react on basic minerals contained in the parent material. Minerals taken into solution or suspension may be absorbed by plants or may be leached from the soil or translocated within it.

Rodents, worms, insects, and various other animals have contributed to the formation of soils. Except for man, however, there is little evidence that any animal has caused important differences among the soils in Carroll County. As agriculture developed in this county, the activity of man influenced soil formation. Forests were cleared, and new and different kinds of plants were introduced. Cultivation and, in places, artificial drainage changed the characteristics of many soils in the county.

Man's use of the land has caused an accelerated loss of soil through erosion. Because of this loss, the soil in many areas has been thinned and otherwise has been changed. Some of the material washed from uplands has been deposited in depressions and on flood plains. Formed in this material are young or immature soils.

Parent material

The soils of Carroll County have formed in two general kinds of parent material. By far the more extensive of these kinds is residuum derived from the weathering of rocks in place. The other consists of fine material and rock fragments transported by water, wind, or gravity, or by a combination of these forces.

The material weathered in place was derived from several kinds of sedimentary and metamorphic rocks. The soils that developed in residuum from sedimentary rocks are the Lewisberry and Steinsburg soils from sandstone; the Klinesville, Penn, Bucks, Readington, and Abbottstown soils primarily from shale; the Hagerstown soils from limestone; and the Wiltshire soils in part from limestone. The other soils on uplands of the county developed in residuum from such metamorphic rocks as schist, phyllite, and slate. These soils are in the Baile, Cardiff, Chester, Conestoga, Elioak, Glenelg, Glenville, Linganore, Manor, Mt. Airy, and Urbana series. The Wiltshire soils also formed partly from metamorphic rocks.

The transported material in which some of the soils formed consisted mainly of alluvium deposited on flood plains and stream terraces. The Bermudian, Bowmansville, Codorus, Comus, Hatboro, Lindside, Melvin, and Rowland soils lie on flood plains, where they formed in the most recently deposited alluvium. The Birdsboro, Delanco, Elsinboro, and Raritan soils are on stream terraces and formed in much older alluvial deposits. A thin mantle of silty material, which may have been laid down by wind, has influenced the upper horizons in the Abbottstown, Bucks, and Readington soils. Local alluvial material has influenced the surface horizon in the Baile, Glenville, and Wiltshire soils.

Relief

The soils in Carroll County range from nearly level to very steep. Differences in slope have a significant influence on the kind of soil that develops from a given parent material. This influence can be illustrated by comparing different soils that developed mainly on red Triassic shale in the northwestern part of the county. The Bucks and Penn soils are moderately deep or deep and well drained; they developed in areas where slopes are fairly smooth and undulating and are neither so strong as to encourage erosion nor so nearly level as to keep water standing.

The Klinesville soils are shallow and somewhat excessively drained, and they contain an abundance of shale fragments. They developed where the slope was steep enough so that the soil was removed through natural processes almost as rapidly as it formed.

The somewhat poorly drained Abbottstown soils and the moderately well drained Readington soils have a fragipan. These soils developed in areas that were so nearly level that there was little runoff, and consequently, a large part of the rain and snow water percolated downward through the soil. The percolating water carried silt and clay particles down and deposited them in the lower part of the soil. Here, the particles filled up most of the spaces between the soil granules and formed a fragipan.

Time

The parent material of the soils in this county ranges from very young to very old. The youngest is the alluvium deposited on flood plains during our present, or Holocene, geologic epoch. These deposits may receive new material from floodwater annually. Somewhat older is the material on terraces along some of the major streams. This material was laid down during the Pleistocene epoch. The thin mantles of silty deposits that occur locally probably date from the late Pleistocene epoch. Much older are the rocks that weathered into parent material for the soils that occupy the largest acreage in the county. The shale and sandstone are of Triassic age, the limestone is probably of Oligocene age, and the metamorphic rocks are generally thought to be of Precambrian age.

Soils that formed in the same kind of parent material but in areas of different relief do not necessarily mature in the same length of time. In steep areas, for example, no definite horizons have had time to develop, because the soil has been removed by erosion almost as rapidly as it has formed. In less sloping areas, there is time for some soil development.

Some of the alluvial material in the county has not been in place long enough for well-defined horizons to form. Most soils on flood plains are weakly developed for this reason.

Morphology of Soils

Most soils of the county have strongly differentiated horizons. Little horizonation is shown, however, in young soils on flood plains.

The formation of horizons in soils is the result of one or more of the following processes: (1) Accumulation of organic matter, (2) leaching of carbonates and other soluble salts, (3) chemical weathering, chiefly by hydrolysis, of the primary minerals of parent material into silicate clay minerals, (4) translocation of silicate clay minerals, and probably some silt-sized particles, from one horizon to another, and (5) chemical changes (oxidation, reduction, and hydration) and transfer of iron.

In almost all soils of the county, several of these processes have been active in the development of horizons. For example, the interaction of the first, second, third, and fourth processes is reflected in the strongly expressed horizons of the Birdsboro soils, and all five processes have been active in the development of the moderately well drained Delanco and Wiltshire soils. Only the first process has had any marked effect on the Bermudian and Comus soils. In some soils the second process, the leaching of carbonates and other salts, may have taken place in the soil materials before they were deposited, and some of the other processes may have been active before deposition.

Some organic matter has accumulated in all the soils to form an A1 horizon. In many places, however, the A1 horizon has lost its identity as a result of tillage and is now an Ap horizon or part of an Ap horizon. The amount of organic matter varies in the different soils. The Manor and Mt. Airy soils have a weak A1 horizon that contains little organic matter, whereas the Baile, Hatboro, and Melvin soils have a prominent A1 horizon in which the content of organic matter is much higher.

There have been few detailed studies of the clay mineralogy of the soils in Maryland. The soil material in this area, however, consists mostly of residuum from various kinds of rocks and of alluvium that washed from areas of the same or similar kinds of rocks. Generally, this material contains a mixture of clay minerals. It is likely that the clay fraction in the Glenelg, Manor, and Mt. Airy soils is dominantly mica. In the Elioak soils, probably one of the chief clay minerals is kaolinite.

The downward movement of clay minerals has contributed strongly to the development of horizons in many of the soils. These minerals have been partly removed from the A1 and A2 horizons and partly immobilized in a Bt horizon. This is characteristic of the Abbottstown, Baile, Birdsboro, Bucks, Chester, Conestoga, Delanco, Elioak, Elsinboro, Glenelg, Glenville, Hagerstown, Lewisberry, Linganore, Penn, Raritan, Readington, Urbana, and Wiltshire soils. If clay has been moved downward in other soils of the county, the quantity is insufficient to be clearly observable.

The reduction and transfer of iron has occurred to some degree in all the soils that have impeded drainage. But only in the wettest soils of Carroll County has this process, known as gleying, been of much significance. The Baile, Bowmansville, Hatboro, and Melvin soils have been most strongly affected by gleying.

Iron that has been reduced in areas where the soil is poorly aerated generally becomes mobile and may be partly or completely removed from the soil. In the soils of this county, however, most of the iron has moved either within the horizon where it originated or to another nearby horizon. Part of this iron may become reoxidized and segregated to form the yellowish-brown, strong-brown, or yellowish-red mottles that indicate impeded drainage and are common in a gleyed horizon.

When silicate clay forms from primary minerals, some iron generally is freed as hydrated oxide. Depending on the degree of hydration, these oxides are more or less red. Only a small amount of the oxide is required to color the subsoil reddish. In Carroll County the soils having a subsoil most strongly colored by iron oxide are the Elioak soils. The red colors in the Abbottstown, Bermudian, Birdsboro, Bowmansville, Bucks, Klinesville, Lewisberry, Penn, Raritan, Readington, and Rowland soils are mostly inherited from reddish geologic material, but in some of these soils the red colors may have been augmented by iron oxide.

A profile that is representative of each soil series in the county is described in detail in the section "Descriptions of the Soils."

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationships to one another and to the whole environment, and to develop principles that help us in understanding their behavior and their response to manipulation. First through classification and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

Thus in classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and used in managing farms, fields, and woodland; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*2*) and later revised (*4*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965. The current system is under continual study. Therefore, readers interested in developments of the current system should search the latest literature available (*3, 7*).

In table 9, the soil series of Carroll County are placed in some categories of the current system and in the great soil groups and orders of the older system. Placement of some soil series in the current system of classification may change as more precise information becomes available.

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar

TABLE 9.—*Soil series classified according to the present system of classification and the 1938 system with its later revisions*

Series	Present classification			1938 classification	
	Family	Subgroup	Order	Great soil group	Order
Abbottstown	Fine-loamy, mixed, mesic.	Aeric Fragiaqualfs	Alfisols	Gray-Brown Podzolic soils (somewhat poorly drained).	Zonal soils.
Baile	Fine-loamy, mixed, mesic.	Typic Ochraquults	Ultisols	Low-Humic Gley soils	Intrazonal soils.
Bermudian	Fine-loamy, mixed, mesic.	Fluventic Dystrochrepts	Inceptisols	Alluvial soils	Azonal soils.
Birdsboro	Fine-loamy, mixed, mesic.	Typic Hapludults	Ultisols	Gray-Brown Podzolic soils intergrading toward Red-Yellow Podzolic soils.	Zonal soils.
Bowmansville	Fine-loamy, mixed, acid, mesic.	Fluventic Haplaquepts	Inceptisols	Low-Humic Gley soils	Intrazonal soils.
Bucks	Fine-loamy, mixed, mesic.	Typic Hapludults	Ultisols	Gray-Brown Podzolic soils intergrading toward Red-Yellow Podzolic soils.	Zonal soils.
Cardiff	Loamy-skeletal, mixed, mesic.	Typic Dystrochrepts	Inceptisols	Sols Bruns Acides	Intrazonal soils.
Chester	Fine-loamy, mixed, mesic.	Typic Hapludults	Ultisols	Gray-Brown Podzolic soils intergrading toward Red-Yellow Podzolic soils.	Zonal soils.
Codorus	Fine-loamy, mixed, mesic.	Aquic Fluventic Dystrochrepts.	Inceptisols	Alluvial soils	Azonal soils.
Comus	Coarse-loamy, mixed, mesic.	Fluventic Dystrochrepts	Inceptisols	Alluvial soils	Azonal soils.
Conestoga	Fine-loamy, mixed, mesic.	Typic Hapludalfs	Alfisols	Gray-Brown Podzolic soils intergrading toward Red-Yellow Podzolic soils.	Zonal soils.
Delanco	Fine-loamy, mixed, mesic.	Aquic Hapludults	Ultisols	Red-Yellow Podzolic soils	Zonal soils.
Elioak	Clayey, kaolinitic, mesic.	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils	Zonal soils.
Elsinboro	Fine-loamy, mixed, mesic.	Typic Hapludults	Ultisols	Gray-Brown Podzolic soils intergrading toward Red-Yellow Podzolic soils.	Zonal soils.
Glenelg	Fine-loamy, mixed, mesic.	Typic Hapludults	Ultisols	Gray-Brown Podzolic soils intergrading toward Red-Yellow Podzolic soils.	Zonal soils.
Glenville	Fine-loamy, mixed, mesic.	Aquic Fragiudults	Ultisols	Gray-Brown Podzolic soils intergrading toward Red-Yellow Podzolic soils.	Zonal soils.
Hagerstown	Fine, mixed, mesic	Typic Paleudalfs	Ultisols	Gray-Brown Podzolic soils intergrading toward Red-Yellow Podzolic soils.	Zonal soils.
Hatboro	Fine-loamy, mixed, acid, mesic.	Fluventic Haplaquepts	Inceptisols	Alluvial soils	Azonal soils.
Klinesville	Loamy-skeletal, mixed, mesic.	Lithic Dystrochrepts	Inceptisols	Lithosols	Azonal soils.
Lewisberry	Coarse-loamy, mixed, mesic.	Ultic Hapludalfs	Ultisols	Gray-Brown Podzolic soils.[1]	Zonal soils.
Lindside	Fine-silty, mixed, mesic	Aquic Fluventic Eutrochrepts.	Inceptisols	Alluvial soils	Azonal soils.
Linganore	Loamy-skeletal, mixed, mesic.	Ultic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.	Zonal soils.
Manor	Coarse-loamy, micaceous, mesic.	Typic Dystrochrepts	Inceptisols	Sols Bruns Acides	Intrazonal soils.
Melvin	Fine-silty, mixed, nonacid, mesic.	Fluventic Haplaquepts	Inceptisols	Low-Humic Gley soils	Intrazonal soils.
Mt. Airy	Loamy-skeletal, micaceous, mesic.	Typic Dystrochrepts	Inceptisols	Sols Bruns Acides	Intrazonal soils.
Penn	Fine-loamy, mixed, mesic.	Ultic Hapludalfs	Alfisols	Gray-Brown Podzolic soils	Zonal soils.
Raritan	Fine-loamy, mixed, mesic.	Typic Fragiudults [2]	Ultisols	Gray-Brown Podzolic soils	Zonal soils.
Readington	Fine-loamy, mixed, mesic.	Typic Fragiudalfs	Alfisols	Gray-Brown Podzolic soils	Zonal soils.
Rowland	Fine-loamy, mixed, acid, mesic.	Aquic Fluventic Dystrochrepts.	Inceptisols	Alluvial soils	Azonal soils.

See footnotes at end of table.

TABLE 9.—*Soil series classified according to the present system of classification and the 1938 system with its later revisions* —Continued

Series	Present classification			1938 classification	
	Family	Subgroup	Order	Great soil group	Order
Steinsburg	Loamy-skeletal, mixed, mesic.	Typic Dystrochrepts	Inceptisols	Sols Bruns Acides	Intrazonal soils.
Urbana	Fine-loamy, mixed, mesic.	Aquic Fragiudalfs	Alfisols	Gray-Brown Podzolic soils	Zonal soils.
Wiltshire	Fine-loamy, mixed, mesic.	Typic Fragiudalfs	Alfisols	Gray-Brown Podzolic soils	Zonal soils.

[1] Soils of the Lewisberry series were classified as Sols Bruns Acides in literature previously published. On the basis of accumulated data, however, they are now classified as Gray-Brown Podzolic soils according to the 1938 classification system.

[2] Soils of the Raritan series are classified as Typic Fragiudults, but the soil described in the typical profile in this county is near the borderline between Typic Fragiudults and Aquic Fragiudults.

genesis, or mode of origin, are grouped together. The classes that make up the current system are briefly defined in the following paragraphs.

ORDER: Ten soil orders are recognized. Each order is named with a word of three or four syllables ending in *sol* (Ent-i-sol). The ten orders are 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.

Table 9 shows the three soil orders in Carroll County—Inceptisols, Alfisols, and Ultisols. Inceptisols are mineral soils in which horizons have started to develop. They generally occur on young but not recent land surfaces. Their name is derived from the Latin *inceptum*, for beginning. In Carroll County the Manor soils are examples of Inceptisols. They have a brightly colored B horizon but lack other horizons typical of soils of the higher orders.

Alfisols are soils that contain a clay-enriched B horizon having high base saturation, that is, base saturation of more than 35 percent. As a result, these soils have a greater natural supply of plant nutrients, especially calcium, than the soils of the other orders represented in this county. The name Alfisols is derived from *pedalfer*, an older term indicating a soil that contains clay characterized by oxides or hydrated oxides of aluminum and iron.

Ultisols are mineral soils that have a clay-enriched B horizon in which base saturation is low, generally less than 35 percent. Their name is derived from the Latin *ultimus*, or last.

SUBORDER: Each order is divided into suborders, primarily on the basis of those soil characteristics that seem to produce classes having the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders mainly reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation. Names of suborders have two syllables. The last syllable indicates the order. An example is Aquepts (*Aqu*, meaning water or wet, and *ept*, from Inceptisol). The suborder is not shown in table 9.

GREAT GROUP: Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated or those that have pans interfering with growth of roots or movement of water. The features used are the self-mulching properties of clays, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like.

The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is Fragiudalf (*Fragi*, for presence of a fragipan, *ud*, meaning of humid climates, and *alf*, from Alfisol). The great group is not shown separately in table 9, because the name of the great group is the last word in the name of the subgroup.

SUBGROUPS: Great groups are 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 of the range of any other great group, subgroup, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Fragiudalf (a typical Fragiudalf).

FAMILY: Families are separated within a subgroup primarily on the basis of properties important to the growth of plants or behavior of soils where used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, and thickness of horizons. A family name consists of a series of adjectives, and these are the class names for texture, mineralogy, and so on, that are used as family differentiae.

SERIES: The series consists of a group of soils that formed from a particular kind of parent material and have genetic horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the profile. Among these characteristics are color, structure, reaction, consistence, and mineralogical and chemical composition.

Climate [3]

Carroll County has a humid, continental climate. The general flow of atmospheric air is from west to east, but surges of cold, dry air from the north frequently alternate with masses of warm, moist air from the south. Much of the precipitation is brought in by storms that move northward or northeastward along the coast. The cold air from the north is moderated as it passes over the Appalachian Mountains. If the flow of air stagnates, solar radiation results in warm days in winter and very hot days in summer. The influence of the nearby Atlantic Ocean and Chesapeake Bay is felt when easterly winds occasionally help to moderate the temperature.

Although the county is mainly broad and undulating, it includes low rounded hills and rather narrow valleys. These differences in relief bring about small variations in climate from place to place. Because cold air is heavier than warm air, it flows into low places and commonly causes the minimum temperature to vary within short distances. Thus, the frost-free period is shorter in many low areas than it is in adjacent higher areas.

A summary of temperature and precipitation data from the Westminster station is given in table 10. These data are fairly representative of Carroll County.

[3] By W. J. MOYER, State climatologist, Weather Bureau, Environmental Science Services Administration, U.S. Department of Commerce.

The mean temperature at Westminster is about 54° F. The hottest period of the year is the last part of July and the first few days of August, when the maximum afternoon temperature averages about 88°. A temperature of 90° or more can be expected, on an average, about 27 days a year; a temperature of more than 100° occurs occasionally. The coldest period of the year is the latter part of January and the early part of February, when the minimum temperature averages near 22°. During an average winter, the temperature falls to zero or lower only once. The lowest temperature recorded at Westminster was −16° on February 10, 1899.

Table 11 shows the probability of freezing temperatures at Westminster on or after given dates in spring and on or before given dates in fall. The average growing season, or frost-free period, in the central part of the county is 177 days; it extends from the latter part of April to the middle of October. Variations in temperature differ somewhat in other parts of the county.

The annual precipitation at Westminster averages about 45 inches, but extremes range from 27.16 inches in 1930 to 58.61 inches in 1952. Generally, precipitation is fairly evenly distributed throughout the year. It ranges from 3 to 4 inches per month for most of the year but is slightly more in June, July, and August. The greatest monthly amount normally occurs in August.

The precipitation may be heavy in any one month, but it varies more in summer. During the hurricane Connie, on

TABLE 10.—*Temperature and*

[Elevation

Month	Temperature									Precipitation	
	Average			Extremes				Two years in 10, month will have at least 4 days with—		Average	Greatest daily
	Daily maximum	Daily minimum	Monthly	Highest on record	Year	Lowest on record	Year	Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		
	°F.	°F.	°F.	°F.		°F.		°F.	°F.	*Inches*	*Inches*
January	41.5	24.7	33.1	76	1950	−14	1935	60	10	3.36	2.32
February	43.1	24.7	33.9	79	1930	−16	1899	59	10	2.82	3.80
March	51.6	31.0	41.3	87	1945	2	1960	70	17	4.05	2.20
April	64.0	40.6	52.3	94	1896	9	1923	82	29	3.61	2.56
May	74.4	50.6	62.5	99	1895	27	1947	87	38	3.95	2.60
June	82.2	59.2	70.7	102	1934	35	1932	92	47	4.13	3.75
July	86.2	63.8	74.9	103	[2] 1936	42	1943	94	54	4.34	4.92
August	84.3	62.1	73.2	104	1930	41	1934	93	51	4.79	5.54
September	77.8	55.2	66.5	100	1953	30	[2] 1956	89	41	3.71	4.48
October	67.0	44.5	55.7	95	1941	20	1936	82	33	3.46	3.10
November	54.3	35.0	44.7	83	1950	7	[2] 1930	70	22	3.29	4.36
December	42.8	26.1	34.4	73	1929	−10	1942	60	12	3.31	2.18
Year	64.1	43.1	53.6	104	1930	−16	1899			44.82	5.54

[1] Averages for the period 1931–60. Extremes for the periods 1895–1901 (17 months missing), 1911–13, and 1920–63.
[2] Also on earlier dates, months or years.

August 13, 1955, a rainfall of 5.54 inches was recorded at Westminster. In summer, precipitation occurs mostly in showers and thunderstorms. These may bring heavy rainfall to one area and only a few drops of rain to another. As a result, the amount of moisture stored in the soil in summer commonly varies markedly within short distances. In winter, precipitation usually occurs in general storms that cover large areas and may last for several days.

Minor or local floods are a hazard every year along the small streams in the county. Although flooding can occur in any month, it is most frequent late in winter and in spring, when melting snow often contributes to the floodwater. In summer, intense storms cause flash flooding at times. On an average, rainfall of 2 to 2½ inches in one hour can be expected once in 10 years, and rainfall of 3 to 3½ inches in one hour can be expected once in 100 years.

Drought may occur at any time of year, but a serious drought is most likely in summer. Generally, the rainfall and the moisture stored in the soil are adequate for the favorable growth of crops. At times in summer, however, showers are unevenly distributed, dry periods occur at critical stages of plant growth, and the rate of evaporation is high.

The average annual snowfall at Westminster is 27.5 inches, but the annual total varies greatly from year to year. Only 2.0 inches of snow fell in the winter of 1949–50, whereas 78 inches was measured in 1963–64. The greatest single snowfall, which occurred on March 29 and 30, 1942, was 22 inches. The greatest depth of snow on the ground at one time was 32 inches, recorded on March 30, 1942.

Thunderstorms occur on an average of 32 days a year, and two-thirds of them occur in June, July, and August. Occasionally, local damage is caused by lightning, wind, hail, or flooding. Hail falls during these storms only once or twice a year.

Tornadoes are rare and have caused little damage. The effects of tropical storms or hurricanes are felt in the county about once a year, usually in August or September. Most of these storms cause only minor damage in Carroll County, and the rainfall that accompanies them is beneficial.

The prevailing wind is from the west-northwest or northwest, except from June through September, when the prevailing wind is southerly. The average wind velocity is 8 to 10 miles per hour, but winds of 50 to 60 miles per hour sometimes accompany hurricanes, severe thunderstorms in summer, or general storms in winter.

The relative humidity is lowest late in winter and early in spring, and it is highest in July, August, and September. Normally, the daily humidity is highest near sunrise and is lowest in midafternoon. Dense fog occurs on about 11 days of each year.

In an average year there are more than 220 sunny days in Carroll County. Normally, the county receives sunshine about 60 percent of the maximum time possible, but the range is from 50 or 55 percent in winter to 60 or 70 percent in summer.

precipitation at Westminster, Md.[1]

770 feet]

Year	Precipitation—Continued							Average number of days with—				
	One year in 10, month will have—		Snow, sleet					Precipitation of 0.10 inch or more	Temperature			
									Maximum		Minimum	
	Less than—	More than—	Average	Maximum monthly	Year	Greatest daily	Year		90° and above	32° and below	32° and below	0° and below
	Inches	*Inches*	*Inches*	*Inches*		*Inches*						
1948	1.7	6.0	6.4	26.0	1925	12.0	[2] 1961	8	0	6	24	1
1896	1.7	4.5	6.8	32.0	1964	15.0	1958	6	0	3	23	[3]
1942	2.0	6.2	7.8	42.0	1958	22.0	1942	9	0	1	19	0
1937	1.7	6.5	.3	10.0	1924	10.0	1924	8	[3]	0	5	0
1959	2.2	5.6	0	[4]	1923	[4]	1923	8	1	0	[3]	0
1946	1.7	7.0	0	0	--------	0	--------	7	6	0	0	0
1956	1.9	8.7	0	0	--------	0	--------	7	9	0	0	0
1955	1.9	11.1	0	0	--------	0	--------	7	8	0	0	0
1895	.9	6.4	0	0	--------	0	--------	6	2	0	[3]	0
[2] 1962	1.0	7.4	[4]	3.1	1925	3.1	1925	6	[3]	0	3	0
1897	1.1	5.8	1.0	10.0	1953	8.0	[2] 1953	6	0	[3]	14	0
1950	1.0	5.6	5.5	21.5	1962	11.0	1960	7	0	5	23	[3]
1955	35.3	57.2	27.8	42.0	1958	22.0	1942	85	27	15	111	1

[3] Less than one-half day.
[4] Trace, an amount too small to be measured.

TABLE 11.—*Probable dates of last specified freezing temperatures in spring and first in fall*

[Data from Westminister, Carroll County, Md.]

Probability	Dates for given probability and temperature		
	32° or lower	24° or lower	16° or lower
Spring:			
9 years in 10 later than	April 10	March 4	February 13
3 years in 4 later than	April 16	March 13	February 22
2 years in 3 later than	April 19	March 16	February 25
1 year in 2 later than	April 23	March 22	March 3
1 year in 3 later than	April 27	March 28	March 9
1 year in 4 later than	April 30	March 31	March 12
1 year in 10 later than	May 6	April 9	March 21
Fall:			
1 year in 10 earlier than	October 3	October 26	November 23
1 year in 4 earlier than	October 10	November 3	November 30
1 year in 3 earlier than	October 12	November 6	December 2
1 year in 2 earlier than	October 17	November 12	December 7
2 years in 3 earlier than	October 22	November 18	December 12
3 years in 4 earlier than	October 24	November 21	December 14
9 years in 10 earlier than	October 31	November 29	December 21

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Glossary

Acidity. See Reaction, soil.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere; but that in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster, such as a clod, crumb, block, or prism.

Alluvium. Soil material, such as sand, silt or clay, that has been deposited on land by streams.

Available moisture capacity. The difference between the amount of water in a soil at field capacity and the amount in the same soil at the permanent wilting point. Commonly expressed as inches of water per inch depth of soil, but sometimes expressed as inches of water per foot of soil.

Base (chemistry). Any of the positive, generally metallic elements or combinations of elements that make up the nonacid plant nutrients. The most important of these in plant nutrition are calcium (Ca), potassium (K), magnesium (Mg), and ammonium (NH_4).

Chroma. See Color, Munsell notation.

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.

Color, Munsell notation. A system for designating color by degrees of three simple variables—hue, value, and chroma. For example, the color notation 10YR 6/4 stands for a color with hue of 10YR, a value of 6, and a chroma of 4. Hue is the dominant spectral color; value relates to the relative lightness or darkness of color; and chroma is the relative purity or strength of color and increases as grayness decreases.

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 cosistence are—

Loose.—Noncoherent; will not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger, but resistence 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 materials, 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 protect the soil between periods of regular crop production; or a crop grown between trees and vines in orchards and vineyards.

Diversion. A structure, generally a terrace or a ditch, that is used to divert runoff from its natural course and, thus, to protect areas downslope from the effects of runoff.

Drainage. As a farm management operation, the removal of excess water from the soil. As a soil condition, the relative rapidity and extent of the removal of water from the soil, under natural conditions.

First bottom. The normal flood plain of a stream subject to occasional or frequent flooding.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The base of a slope, where there is a significant change in the grade or angle toward more nearly level land.

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, has a hard or very hard consistence, 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. It is generally mottled, is slowly or very slowly permeable to water, and has few to many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur 15 to 40 inches below the surface.

Glauconite. A granular, greenish mineral containing both iron and potassium. In Carroll County, it is a common component of sediments in deposits of which several distinctive soil series have developed. Locally called greensand.

Gleization, or gleying. The reduction, translocation, and segregation of soil compounds, notable of iron, usually in the subsoil or substratum, as a result of drainage and poor aeration; expressed in the soil by mottled colors dominated by gray. The soil-forming processes leading to the development of a gley soil.

Gravelly soil material. Material in which 15 to 50 percent, by volume, is rounded or angular fragments of rock that are not prominently flattened and are up to 3 inches in diameter. A single piece is a *pebble. Gravel* is a mass of pebbles.

Green-manure crop. A crop grown for the purpose of being turned under in an early stage of maturity or soon after maturity for soil improvement.

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 it is therefore 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 of a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused by (1) accumulation of clay, sesquioxides, humus, or some combination of these; (2) prismatic or blocky structure; (3) redder or stronger colors than the A horizon; or (4) some combination of these. The 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. This layer, commonly called the soil parent material, is presumed to be like that from which the overlying horizons were formed in most soils. If the underlying 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 the A or B horizon.

Hue. See Color, Munsell notation.

Internal soil drainage. The downward movement of water through the soil profile. The rate of movement is determined by the texture, structure, and other characteristics of the soil profile and underlying layers, and by the height of the water table, either permanent or perched. Relative terms for expressing internal soil drainage are *none, very slow, slow, medium, rapid,* and *very rapid.*

Leaching. The removal of soluble materials from soils or other material by percolating water.

Loam. Soil having equal amounts of sand, silt, and clay.

Morphology, soil. The physical constitution of the soil, including the texture, structure, consistence, color, porosity, and other physical, chemical, mineralogical, and biological properties of the various horizons that make up 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.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in making food and tissue. Nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil, and carbon, hydrogen, and oxygen obtained from the air and water, are plant nutrients.

Parent material. The weathered rock or partly weathered soil material from which a soil has formed; the C horizon.

Permeability, soil. The quality of a soil horizon that enables water or air to move through it. This quality depends primarily on the size and the distribution of pore spaces within the horizon. Ratings of permeability in inches per hour are *slow,* less than 0.20; *moderately slow,* 0.20 to 0.63; *moderate,* 0.63 to 2.00; *moderately rapid,* 2.00 to 6.3; *rapid,* 6.3.

pH value. A numerical means for designating acidity and alkalinity in soils and in other biological systems. See Reaction.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material. See Parent material and Horizon, soil.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values or in words as follows:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.3
Medium acid	5.6 to 6.0	Strongly alkaline	8.4 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. Elevations or inequalities of the land surface, considered collectively.

Sand. As a soil separate, individual rock or mineral fragments 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz, but they may be of any mineral composition. As a textural class, soil that is 85 percent or more sand and not more than 10 percent clay.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting upon parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

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 profile below plow depth.

Substratum. Any layer lying beneath the solum, or B horizon; the C or R horizon.

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 (agricultural). An embankment, or low ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff so that the water soaks into the soil or flows slowly to a prepared outlet without harm. Terraces are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Topography. See Relief.

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.

Value. See Color, Munsell notation.

V-type ditches. Ditches that are V-shaped and have smooth side slopes.

Water table. The highest part of the soil or underlying 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.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the soil series to which the mapping unit belongs. Other information is given in tables as follows:

Acreage and extent, table 1, p. 5.
Estimated yields, table 2, p. 43.
Wildlife habitat and kinds of wildlife, table 3, p. 51.
Engineering uses of the soils, tables 4, 5, and 6, pp. 54 through 71.
Nonfarm uses of soils, table 7, p. 72.
Recreational uses of soils, table 8, p. 78.

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability	
			Symbol	Page	Group	Page
ArA	Abbottstown and Readington silt loams, 0 to 3 percent slopes	7	IIIw-1	38	23	46
ArB2	Abbottstown and Readington silt loams, 3 to 8 percent slopes, moderately eroded	7	IIIw-1	38	23	46
BaA	Baile silt loam, 0 to 3 percent slopes	8	Vw-1	40	38	47
BaB	Baile silt loam, 3 to 8 percent slopes	8	VIw-2	41	38	47
Be	Bermudian silt loam	9	I-6	36	29	46
BrA	Birdsboro silt loam, 0 to 3 percent slopes	9	I-4	36	30	47
BrB2	Birdsboro silt loam, 3 to 8 percent slopes, moderately eroded	10	IIe-4	36	30	47
Bs	Bowmansville silt loam	10	IIIw-7	39	22	46
BuA	Bucks silt loam, 0 to 3 percent slopes	11	I-4	36	30	47
BuB2	Bucks silt loam, 0 to 8 percent slopes, moderately eroded	11	IIe-4	36	30	47
CaC2	Cardiff channery silt loam, 3 to 15 percent slopes, moderately eroded	12	IIIe-10	38	40	47
CeA	Chester silt loam, 0 to 3 percent slopes	12	I-4	36	30	47
CeB2	Chester silt loam, 3 to 8 percent slopes, moderately eroded	12	IIe-4	36	30	47
CeC2	Chester silt loam, 8 to 15 percent slopes, moderately eroded	13	IIIe-4	38	30	47
CeC3	Chester silt loam, 8 to 15 percent slopes, severely eroded	13	IVe-3	39	30	47
Ch	Codorus silt loam	13	IIw-7	37	29	46
Cm	Comus silt loam	14	I-6	36	29	46
CnA	Comus silt loam, local alluvium, 0 to 3 percent slopes	14	I-6	36	29	46
CnB	Comus silt loam, local alluvium, 3 to 8 percent slopes	14	IIe-6	36	29	46
CoA	Conestoga silt loam, 0 to 3 percent slopes	15	I-1	36	43	47
CoB2	Conestoga silt loam, 3 to 8 percent slopes, moderately eroded	15	IIe-24	37	43	47
CoC2	Conestoga silt loam, 8 to 15 percent slopes, moderately eroded	15	IIIe-24	38	43	47
CoC3	Conestoga silt loam, 8 to 15 percent slopes, severely eroded	15	IVe-1	39	43	47
CoD3	Conestoga silt loam, 15 to 25 percent slopes, severely eroded	15	VIe-1	40	44	47
DeA	Delanco silt loam, 0 to 3 percent slopes	16	IIw-1	37	46	48
DeB2	Delanco silt loam, 3 to 8 percent slopes, moderately eroded	16	IIe-16	37	46	48
ElB2	Elioak silt loam, 3 to 8 percent slopes, moderately eroded	17	IIe-4	36	30	47
ElC2	Elioak silt loam, 8 to 15 percent slopes, moderately eroded	17	IIIe-4	38	30	47
EmD3	Elioak silty clay loam, 15 to 25 percent slopes, severely eroded	17	VIe-2	41	30	47
EnB2	Elsinboro gravelly loam, 3 to 8 percent slopes, moderately eroded	18	IIe-4	36	30	47
EnC2	Elsinboro gravelly loam, 8 to 15 percent slopes, moderately eroded	18	IIIe-4	38	30	47
EsA	Elsinboro silt loam, 0 to 3 percent slopes	18	I-4	36	30	47
EsB2	Elsinboro silt loam, 3 to 8 percent slopes, moderately eroded	18	IIe-4	36	30	47
EsC2	Elsinboro silt loam, 8 to 15 percent slopes, moderately eroded	18	IIIe-4	38	30	47

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability	
			Symbol	Page	Group	Page
GcB2	Glenelg channery loam, 3 to 8 percent slopes, moderately eroded	18	IIe-4	36	30	47
GcC2	Glenelg channery loam, 8 to 15 percent slopes, moderately eroded	19	IIIe-4	38	30	47
GcC3	Glenelg channery loam, 8 to 15 percent slopes, severely eroded	19	IVe-3	39	30	47
GcD2	Glenelg channery loam, 15 to 25 percent slopes, moderately eroded	19	IVe-3	39	30	47
GcD3	Glenelg channery loam, 15 to 25 percent slopes, severely eroded	19	VIe-2	41	30	47
GlA	Glenelg loam, 0 to 3 percent slopes	19	I-4	36	30	47
GlB2	Glenelg loam, 3 to 8 percent slopes, moderately eroded	19	IIe-4	36	30	47
GlB3	Glenelg loam, 3 to 8 percent slopes, severely eroded	19	IIIe-4	38	30	47
GlC2	Glenelg loam, 8 to 15 percent slopes, moderately eroded	19	IIIe-4	38	30	47
GlC3	Glenelg loam, 8 to 15 percent slopes, severely eroded	19	IVe-3	39	30	47
GvA	Glenville silt loam, 0 to 3 percent slopes	20	IIw-2	37	46	48
GvB	Glenville silt loam, 3 to 8 percent slopes	20	IIe-13	37	46	48
HaA	Hagerstown silt loam, 0 to 3 percent slopes	21	I-1	36	25	46
HaB2	Hagerstown silt loam, 3 to 8 percent slopes, moderately eroded	21	IIe-1	36	25	46
HaC2	Hagerstown silt loam, 8 to 15 percent slopes, moderately eroded	21	IIIe-1	38	25	46
Ht	Hatboro silt loam	22	IIIw-7	39	22	46
KlB2	Klinesville gravelly loam, 3 to 8 percent slopes, moderately eroded	22	IVs-32	40	57	48
KsD4	Klinesville soils, 8 to 25 percent slopes, very severely eroded	22	VIIs-32	41	58	49
KsF3	Klinesville soils, 15 to 65 percent slopes, severely eroded	22	VIIs-32	41	58	49
LbB2	Lewisberry gravelly fine sandy loam, 3 to 8 percent slopes, moderately eroded	23	IIs-2	37	49	48
LbC2	Lewisberry gravelly fine sandy loam, 8 to 15 percent slopes, moderately eroded	23	IIIe-5	38	49	48
LbD	Lewisberry gravelly fine sandy loam, 15 to 25 percent slopes	23	IVe-5	39	49	48
Le	Lindside silt loam	24	IIw-7	37	29	46
LnB2	Linganore channery silt loam, 3 to 8 percent slopes, moderately eroded	25	IIIe-10	38	51	48
LnC2	Linganore channery silt loam, 8 to 15 percent slopes, moderately eroded	25	IVe-10	39	51	48
LnC3	Linganore channery silt loam, 8 to 15 percent slopes, severely eroded	25	VIe-3	41	51	48
LnD2	Linganore channery silt loam, 15 to 25 percent slopes, moderately eroded	25	VIe-3	41	52	48
LnE	Linganore channery silt loam, 25 to 45 percent slopes	25	VIIe-3	41	52,58	48,49
Md	Made land	25	-----	--	--	--
MgB2	Manor gravelly loam, 3 to 8 percent slopes, moderately eroded	25	IIe-25	37	43	47
MgC2	Manor gravelly loam, 8 to 15 percent slopes, moderately eroded	26	IIIe-25	38	43	47
MgC3	Manor gravelly loam, 8 to 15 percent slopes, severely eroded	26	IVe-25	39	43	47
MgD2	Manor gravelly loam, 15 to 25 percent slopes, moderately eroded	26	IVe-25	39	44	47

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability	
			Symbol	Page	Group	Page
MgD3	Manor gravelly loam, 15 to 25 percent slopes, severely eroded	26	VIe-3	41	44	47
MlB2	Manor loam, 0 to 8 percent slopes, moderately eroded	26	IIe-25	37	43	47
MlB3	Manor loam, 3 to 8 percent slopes, severely eroded	26	IIIe-25	38	43	47
MlC2	Manor loam, 8 to 15 percent slopes, moderately eroded	26	IIIe-25	38	43	47
MlC3	Manor loam, 8 to 15 percent slopes, severely eroded	26	IVe-25	39	43	47
MlD2	Manor loam, 15 to 25 percent slopes, moderately eroded	26	IVe-25	39	44	47
MlD3	Manor loam, 15 to 25 percent slopes, severely eroded	26	VIe-3	41	44	47
MlE	Manor loam, 25 to 45 percent slopes	26	VIIe-3	41	44	47
MnC	Manor very stony loam, 3 to 15 percent slopes	26	VIs-3	41	43	47
MnD	Manor very stony loam, 15 to 25 percent slopes	26	VIs-3	41	44	47
MnE	Manor very stony loam, 25 to 45 percent slopes	26	VIIs-3	41	44	47
MnF	Manor very stony loam, 45 to 75 percent slopes	26	VIIs-3	41	45	48
Mo	Melvin silt loam	27	IIIw-3	39	22	46
MtA	Mt. Airy channery loam, 0 to 3 percent slopes	28	IIIs-1	39	51	48
MtB2	Mt. Airy channery loam, 3 to 8 percent slopes, moderately eroded	28	IIIe-10	38	51	48
MtC2	Mt. Airy channery loam, 8 to 15 percent slopes, moderately eroded	28	IVe-10	39	51	48
MtC3	Mt. Airy channery loam, 8 to 15 percent slopes, severely eroded	28	VIe-3	41	51	48
MtD2	Mt. Airy channery loam, 15 to 25 percent slopes, moderately eroded	28	VIe-3	41	52	48
MtE	Mt. Airy channery loam, 25 to 45 percent slopes	28	VIIe-3	41	52,58	48,49
PeB2	Penn loam, 0 to 8 percent slopes, moderately eroded	29	IIe-10	36	40	47
PhB2	Penn shaly silt loam, 3 to 8 percent slopes, moderately eroded	29	IIIe-10	38	51	48
PhC2	Penn shaly silt loam, 8 to 15 percent slopes, moderately eroded	30	IVe-10	39	51	48
PhC3	Penn shaly silt loam, 8 to 15 percent slopes, severely eroded	30	VIe-3	41	51	48
PnA2	Penn silt loam, 0 to 3 percent slopes, moderately eroded	30	IIs-11	38	40	47
PnB2	Penn silt loam, 3 to 8 percent slopes, moderately eroded	30	IIe-10	36	40	47
PnC2	Penn silt loam, 8 to 15 percent slopes, moderately eroded	30	IIIe-10	38	40	47
PnC3	Penn silt loam, 8 to 15 percent slopes, severely eroded	30	IVe-10	39	40	47
PoD	Penn soils, 15 to 25 percent slopes	30	VIe-3	41	40	47
PsB2	Penn-Steinsburg loams, 3 to 8 percent slopes, moderately eroded	30	IIe-10	36	40	47
PsC3	Penn-Steinsburg loams, 8 to 15 percent slopes, severely eroded	30	IVe-10	39	40	47
RaA	Raritan silt loam, 0 to 3 percent slopes	31	IIIw-1	38	23	46
RaB	Raritan silt loam, 3 to 8 percent slopes	31	IIIw-1	38	23	46
Ro	Rowland silt loam	32	IIw-7	37	29	46
StB2	Steinsburg channery loam, 3 to 8 percent slopes, moderately eroded	33	IIe-10	36	40	47
StD3	Steinsburg channery loam, 8 to 25 percent slopes, severely eroded	33	VIe-3	41	40	47
UrA	Urbana silt loam, 0 to 3 percent slopes	34	IIw-2	37	46	48
UrB2	Urbana silt loam, 3 to 8 percent slopes, moderately eroded	34	IIe-13	37	46	48
Ws	Wiltshire silt loam	35	IIw-2	37	46	48

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