SOIL SURVEY OF

Armstrong County, Pennsylvania

United States Department of Agriculture
Soil Conservation Service
in cooperation with
The Pennsylvania State University
College of Agriculture and the Pennsylvania
Department of Environmental Resources
State Conservation Commission

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in the period 1965–70. Soil names and descriptions were approved in 1970. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1971. This survey was made cooperatively by the Soil Conservation Service and the Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Conservation Commission. It is part of the technical assistance furnished to the Armstrong County Conservation District. The Armstrong County Board of Commissioners helped to finance the survey.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

HOW TO USE THIS SOIL SURVEY

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

Locating Soils

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

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

an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

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

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

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

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

Engineers and builders can find under

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SOIL SURVEY OF ARMSTRONG COUNTY, PENNSYLVANIA

BY GEORGE D. MARTIN, SOIL CONSERVATION SERVICE

SOILS SURVEYED BY GEORGE D. MARTIN AND JOHN T. HAAGEN, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE IN COOPERATION WITH THE PENNSYLVANIA STATE UNIVERSITY, COLLEGE OF AGRICULTURE, AND THE PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES, STATE CONSERVATION COMMISSION

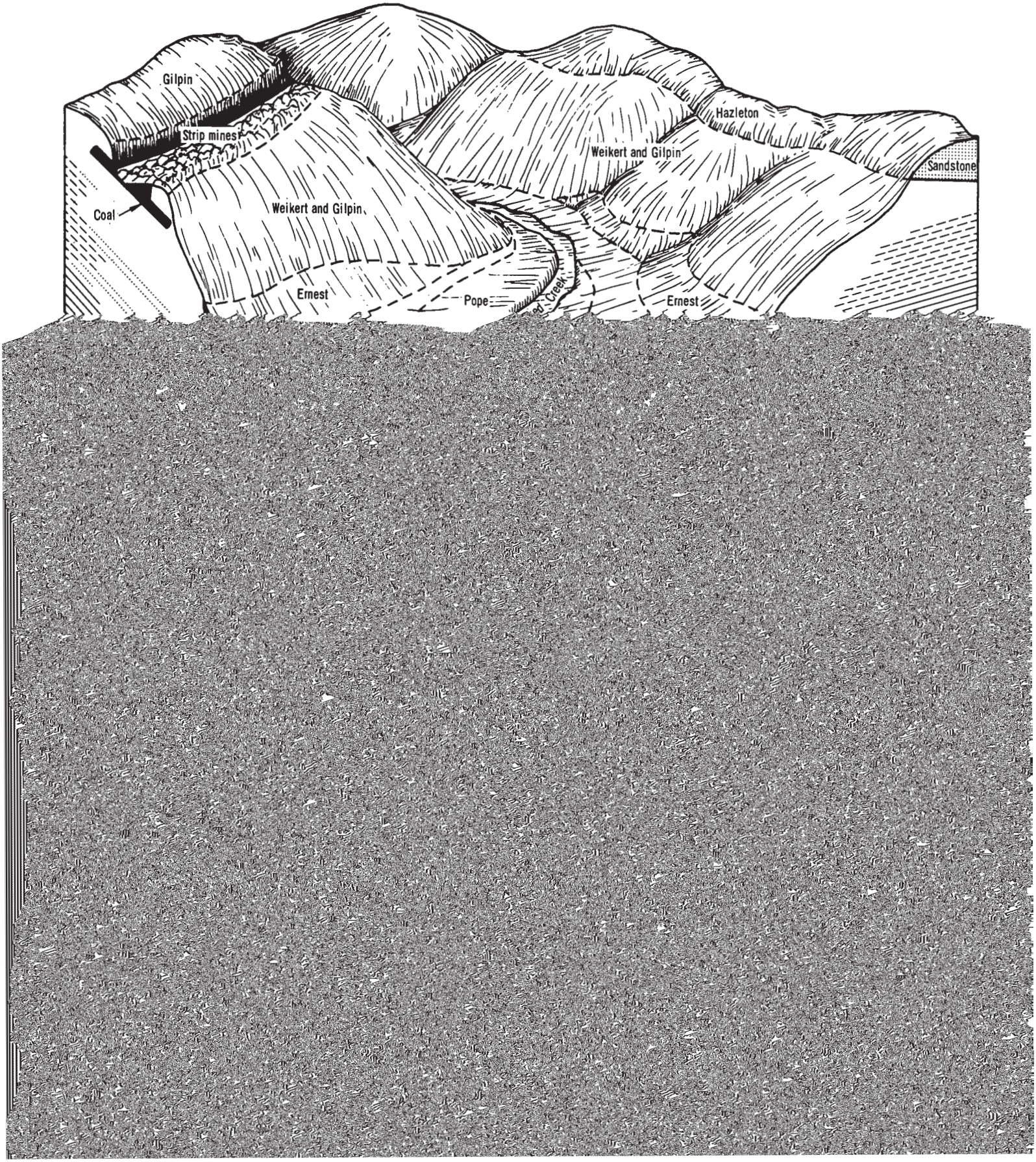
ARMSTRONG COUNTY lies in west central Pennsylvania, approximately 50 miles north of Pittsburgh Parker, and Worthington. Indiana University of Pennsylvania has a center in Kittanning.

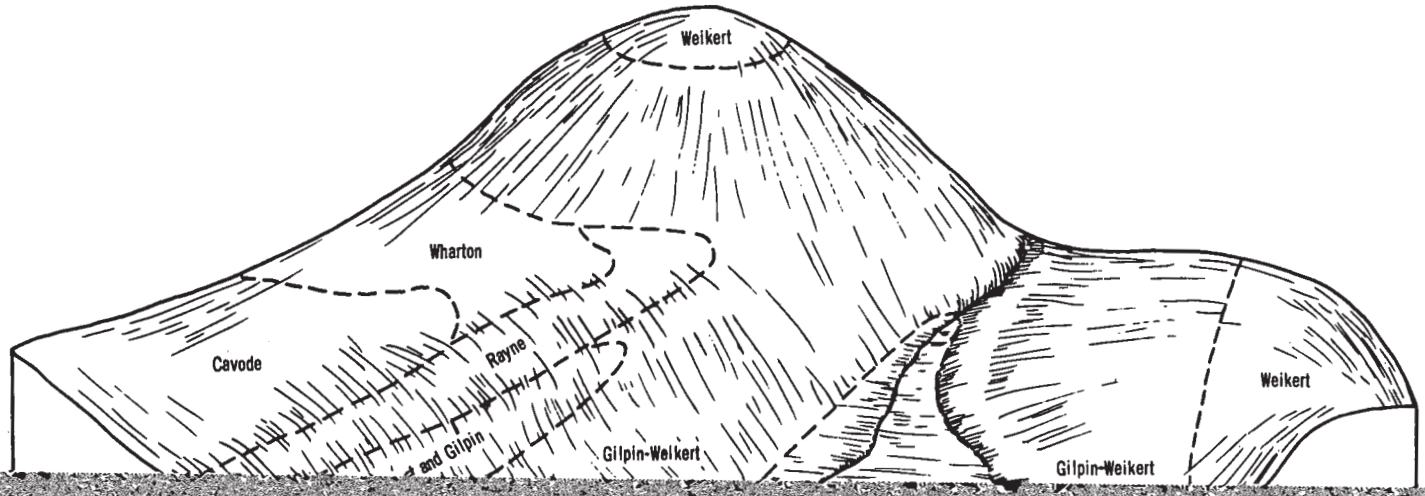
Rayne, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic

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

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants and


Gilpin
Strip mines
Coal
Weikert and Gilpin
Ernest
Pope
Hazleton
Weikert and Gilpin
Sandstone
Ernest


Weikert
Wharton
Cavode
Rayne
and Gilpin
Gilpin-Weikert
Gilpin-Weikert
Weikert

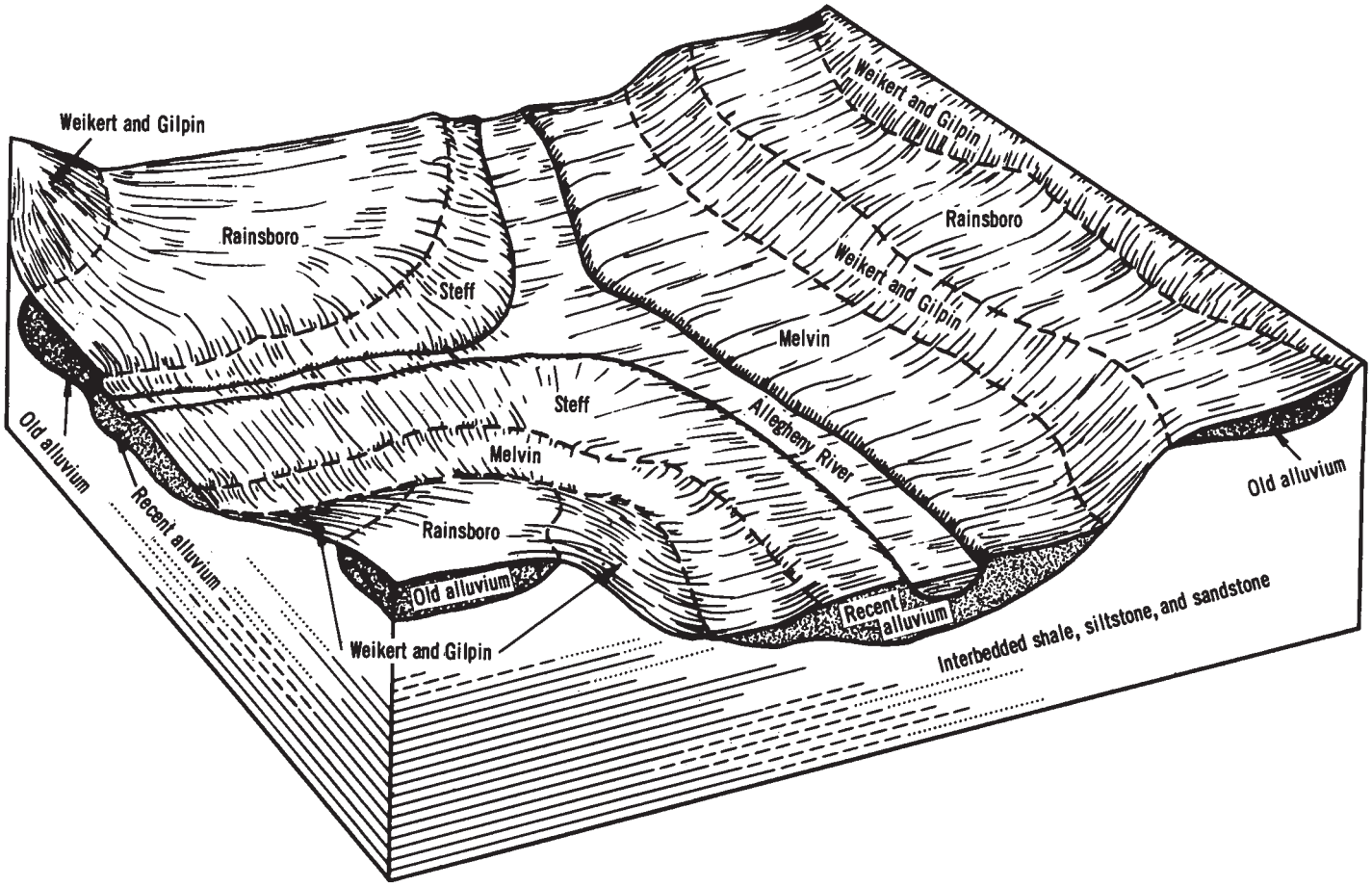


***Figure 4.*—Soils and underlying material in the Rainsboro-Melvin-Steff association.**

terraces should be investigated carefully because many areas have a high water table. Many of the terraces have been quarried for sand and gravel.

4. *Rayne-Ernest-Hazleton association*

Well drained and moderately well drained, deep, gently sloping to moderately steep soils in low-lying areas on

The Hazleton soils are deep, well drained, and stony or channery. They formed in material weathered from sandstone.

Minor soils are Cavode, Gilpin, Melvin, Weikert, and Wharton soils.

Some productive farms are on this association, and many of the soils have only moderate limitations for

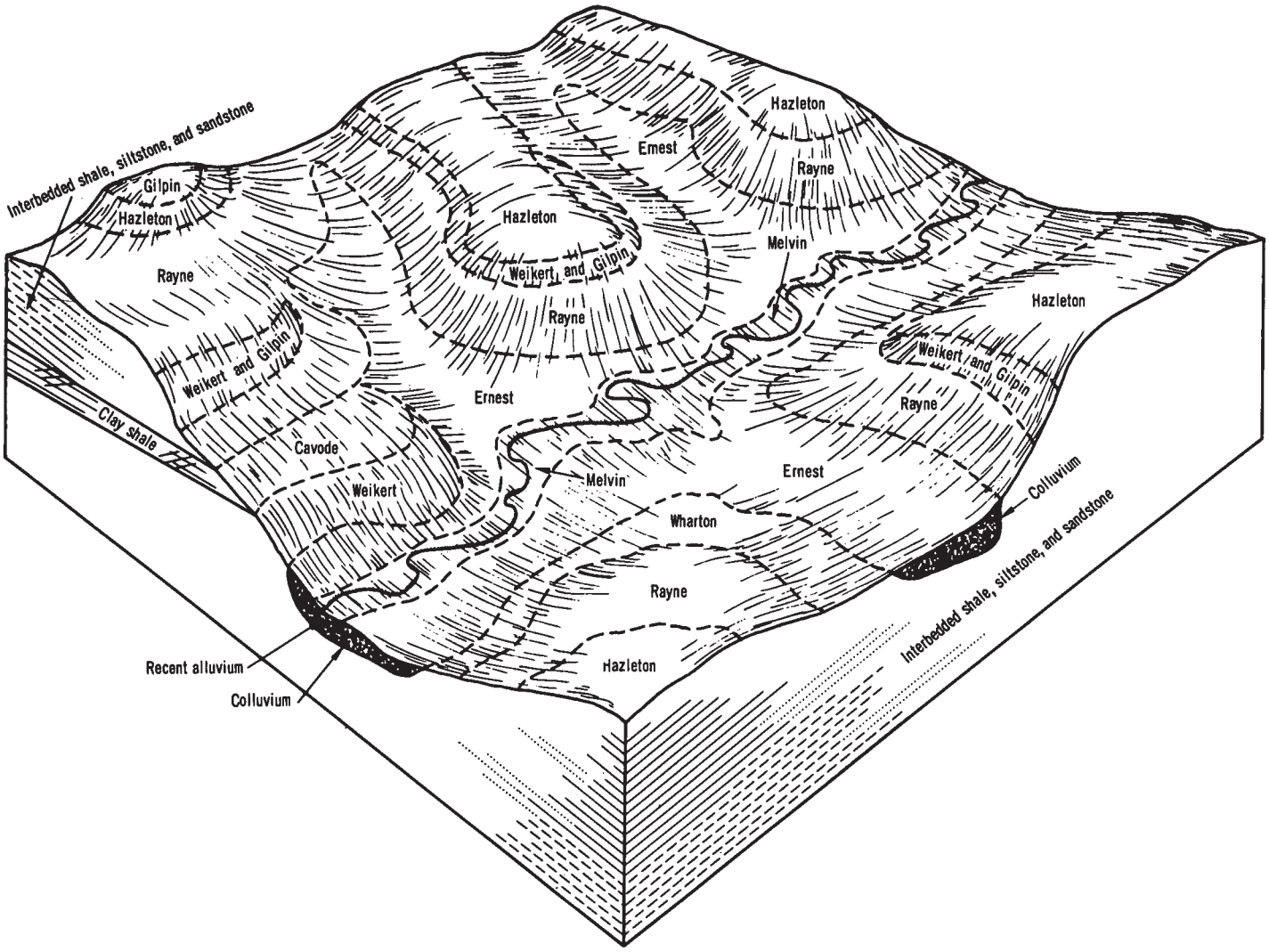


***Figure 5.*—Soils and underlying material in the Rayne-Ernest-Hazleton association.**

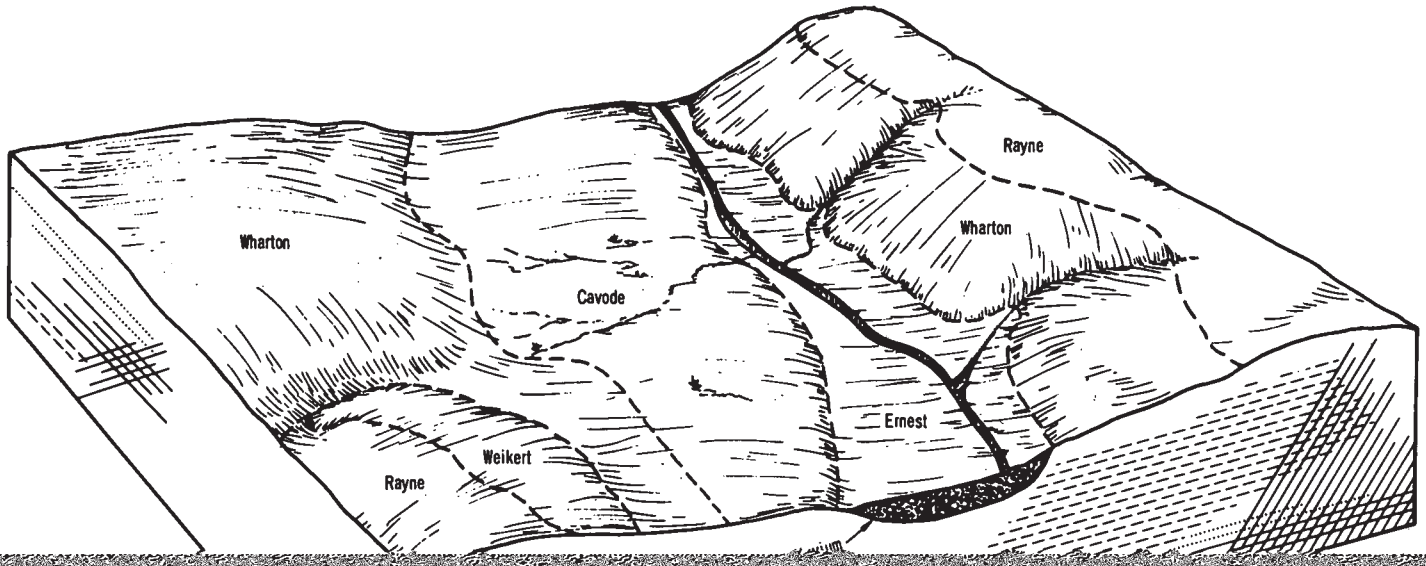
but wet spots are common and can be a nuisance during wet periods.

The Rayne soils are deep and well drained. They formed in material weathered from interbedded shale, siltstone, and sandstone.

The Cavode soils are deep and somewhat poorly drained. They formed in material weathered from clay shale. These soils have a seasonal high water table, and

Use and Management of the Soils

The first part of this section explains the system of capability classification used by the Soil Conservation Service and discusses management of the soils by capability units. The second part gives estimated yields of crops under two levels of management. Other parts of the section discuss the suitability of the soils for


Rayne
Wharton
Wharton
Cavode
Ernest
Weikert
Rayne

the soils in it are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, woodland, or wildlife habitat.

CAPABILITY UNITS are soil groups within each subclass. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–1 or IIIe–2. 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 paragraphs. The Arabic numeral specifically identifies the capability unit within each subclass.

Management by capability units [1]

Good soil management requires the selection of a suitable cropping system and the application of conservation practices that will maintain the productivity of the soil and control wetness and erosion. The conservation practices needed depend on the nature of the soil and the intensity of the cropping system.

On sloping soils, contour stripcropping, terraces, and sod waterways can conserve soil and water. On sloping, wet soils, graded strips, terraces, and grassed waterways can remove surface water and control erosion. Subsurface water generally can be removed by random tile drains or open ditches where suitable outlets are available.

Winter cover crops, stubble mulching, minimum tillage, and green manure crops help to maintain and improve the organic-matter content and soil structure and to reduce erosion. Such practices are needed most if the cropping system is intensive or if the soils are cultivated continuously.

Lime and fertilizer should be applied according to the need indicated by soil tests and according to the kind of crop.

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

The capability units in Armstrong County are discussed in the following pages. The numbers of the units are not consecutive because not all of the capability units in Pennsylvania are represented in Armstrong County. The names of soil series are mentioned in the description of each capability unit, but this does not mean that all the soils of a given series are in the unit. The capability unit of each soil in the county is listed in the "Guide to Mapping Units" at the back of this survey.

CAPABILITY UNIT I–1

This unit consists of deep, well-drained, nearly level soils of the Pope series. These soils formed in alluvium derived from shale, siltstone, and sandstone. Permeability is moderately rapid, and the available moisture capacity is high. Surface runoff is slow, and the hazard of erosion is slight.

The soils of this unit are suited to most crops commonly grown in the county and to many specialty crops, such as vegetables. The soils are suitable for intensive cultivation. Seeding a cover crop with the intertilled crops in fall helps to maintain an adequate content of organic matter and to protect the soil in winter when the hazard of flooding is greatest.

CAPABILITY UNIT IIe–1

This unit consists of deep, well-drained, gently sloping soils of the Allegheny, Hazleton, and Rayne series. The Hazleton and Rayne soils formed in material weathered from sandstone, shale, and siltstone. The Allegheny soils formed in loamy alluvial sediment. Permeability is moderate to moderately rapid, and the available moisture capacity is low to high. Surface runoff is medium, and the hazard of erosion is moderate.

These soils are suited to most crops commonly grown in the county, including row crops, hay, and pasture (fig. 7). Under intensive cropping, an adequate content of organic matter must be maintained. Stripcropping, cover crops, and diversions help to control erosion if the soils are farmed.

CAPABILITY UNIT IIe–2

Only Gilpin-Weikert complex, 3 to 8 percent slopes, is in this unit. This complex consists of shallow to moderately deep, well-drained, gently sloping soils. The Gilpin soil is shaly only in the substratum, but the Weikert soil is shaly throughout. Both soils formed in material weathered from interbedded acid shale, siltstone, and fine-grained sandstone. The available moisture capacity is low to moderate, and permeability is moderate to moderately rapid. Runoff is medium, and the hazard of erosion is moderate.

These soils are suited to most crops commonly grown in the county, but short periods of drought damage most crops. Maintaining an adequate content of organic matter helps to increase the supply of moisture available for plants. The use of a proper cropping system stripcropping, cover crops, and diversions help to control erosion if these soils are cultivated.

CAPABILITY UNIT IIe–3

This unit consists of moderately deep, moderately well drained and somewhat poorly drained, gently sloping soils of the Ernest, Gilpin, Rainsboro, Vandergrift, and Wharton series. Except for the Gilpin soils, these soils have a seasonal high water table. The Ernest and Rainsboro soils have a subsoil that is firm and brittle in the lower part; this causes springs and seep areas. The available moisture capacity is moderate to high, and permeability is moderate to slow. Runoff is medium, and the hazard of erosion is moderate.

These soils are best suited to crops that tolerate some seasonal wetness. Draining wetter areas with random tile drains increases their suitability for farming. A proper cropping system, stripcropping, cover crops, grassed waterways, and diversions help to control erosion.

CAPABILITY UNIT IIw–1

This unit consists of deep, moderately well drained,

[1] ROBERT L. BOND, State resource conservationist, Soil Conservation Service, helped prepare this section.

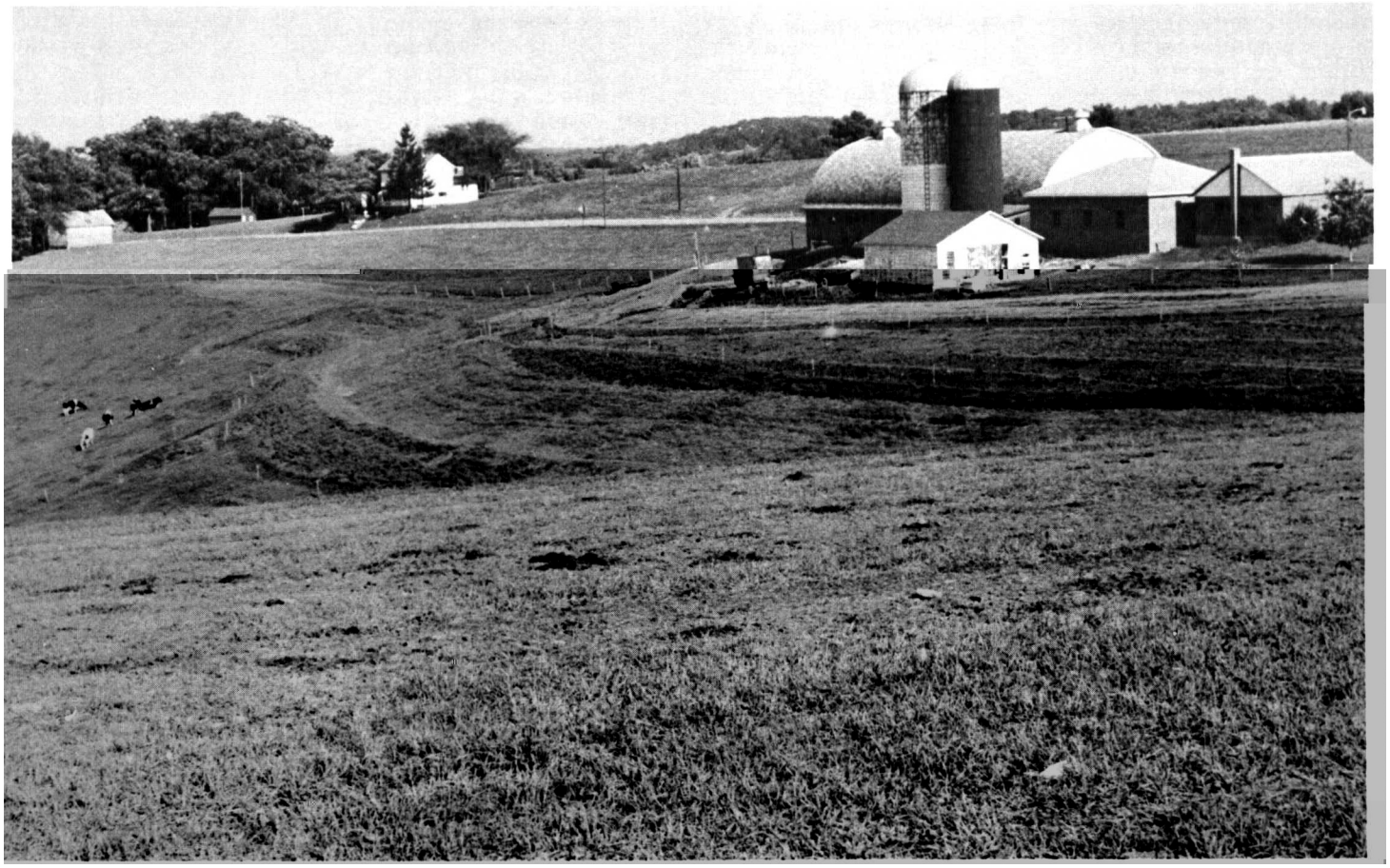


Figure 7.—**Hay on Hazleton channery loam, 3 to 8 percent slopes. This soil is in capability unit IIe–1. Permanent pasture is on steeper Hazleton soils on the left in the background. The steeper soils are in capability unit IVe–1.**

nearly level soils of the Steff series. These soils formed in alluvium derived from shale, siltstone, and sandstone. Steff loam is subject to more frequent flooding than Steff loam, high bottom. The soils have a seasonal high water table. The available moisture capacity is high, and permeability is moderate. Runoff is slow, and the hazard of erosion is slight.

The soils of this unit are suited to crops that tolerate some wetness. They can be intensively cultivated, and random tile or other artificial drainage increases their suitability for crops. Growing cover crops helps to maintain an adequate content of organic matter.

CAPABILITY UNIT IIw–2

This unit consists of deep, moderately well drained, nearly level soils of the Ernest and Rainsboro series. These soils have a seasonal high water table. The available moisture capacity is moderate, and permeability is moderately slow and slow. Runoff is slow, and the hazard of erosion is slight.

CAPABILITY UNIT IIIe–1

This unit consists of deep, well-drained, sloping soils of the Allegheny, Hazleton, and Rayne series. The Allegheny soils are on stream terraces, and the Hazleton and Rayne soils are on uplands. The available moisture capacity is moderate to high, and permeability is moderate to moderately rapid. Runoff is medium, and the hazard of erosion is moderate.

The soils of this unit are suited to all crops commonly grown in the county. A cropping system that includes several years of hay and stripcropping, cover crops, and diversions help to slow runoff and control erosion.

CAPABILITY UNIT IIIe–2

This unit consists of shallow to moderately deep, well-drained, gently sloping to sloping soils of the Gilpin and Weikert series. These soils formed in material weathered from interbedded acid shale, siltstone, and fine-grained sandstone. The Weikert soils are more [illegible]

quire a large amount of water. A cropping system that includes several years of hay, stripcropping, cover crops, and diversions on the longer slopes helps to slow runoff and control erosion. Frequent, light applications of lime and fertilizer are generally more beneficial than heavier, less frequent applications.

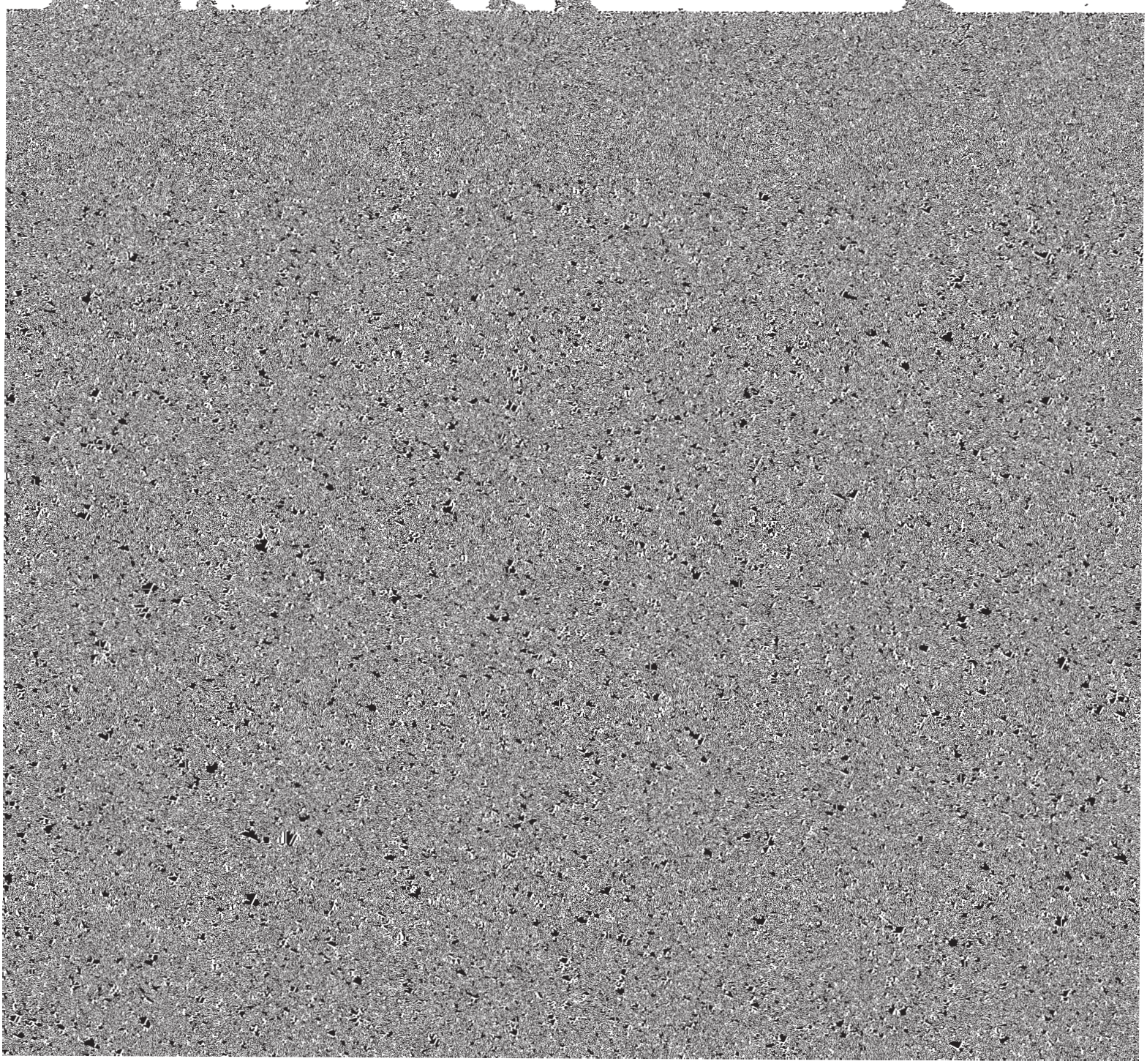
CAPABILITY UNIT IIIe-3

This unit consists of moderately deep and deep, well-drained, gently sloping soils of the Gilpin and Upshur series. These soils are on uplands. The Upshur soils are more difficult to manage than Gilpin soils because of

the only soil in this unit. It is a deep, well-drained, moderately steep soil on uplands. The available moisture capacity is low, and permeability is moderately rapid. Runoff is rapid, and the hazard of erosion is severe.

This soil is best suited to crops that require a minimum amount of tillage. A cropping system that includes several years of hay or pasture and limited cultivation of intertilled crops helps to maintain good soil tilth. Stripcropping, grassed waterways, and diversions on long slopes help to control erosion.

CAPABILITY UNIT IVe-2



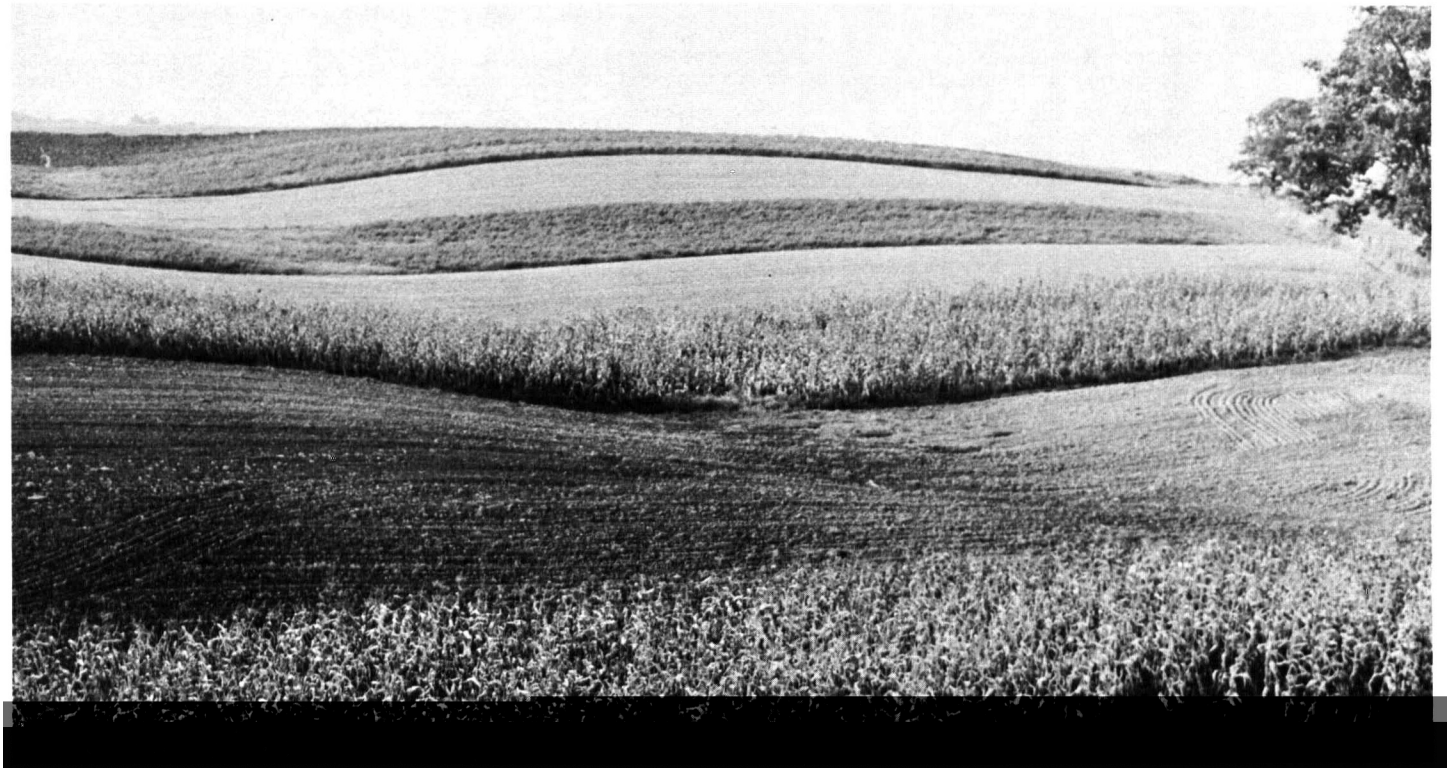


Figure 8.—**Stripcropping on Gilpin-Weikert complex, 15 to 25 percent slopes.**

These soils are best suited to continuous hay or pasture or to woodland, wildlife habitat, or recreation. A continuous plant cover maintains soil tilth and helps to control erosion.

CAPABILITY UNIT VIs-1

This unit consists of moderately deep and deep, well-drained and moderately well drained, nearly level to moderately steep soils of the Ernest, Gilpin, Hazleton, and Rayne series. These soils are on uplands. Most areas are wooded and have stones on the surface. The available moisture capacity is moderate to high, and permeability is moderately slow to moderately rapid. Runoff is moderate to rapid, and the hazard of erosion is moderate to high.

The soils of this unit are best suited to woodland, wildlife habitat, and recreation. Thinning forests and selective harvesting help to maintain the desired trees.

CAPABILITY UNIT VIIe-1

This unit consists of shallow to deep, well-drained, steep and very steep soils of the Gilpin, Upshur, and Weikert series. The available moisture capacity is low to high, and permeability is slow to moderately rapid. Runoff is rapid, and the hazard of erosion is high.

These soils are best suited to trees, wildlife habitat, and watershed protection. Conifers that tolerate drought grow well on areas that need good cover. A continuous plant cover helps to control erosion.

Estimated crop yields

Table 1 shows the estimated yields for representative field and forage crops grown in the county. These estimates are averages for a period of 10 years or more.

The estimated yields are given under two levels of management. In columns A are the yields to be expected under management commonly used by farmers in the county. In columns B are yields that can be obtained in an average growing season under improved management.

Under improved management farmers use most of the adapted crop varieties, fertilization rates, and insect and disease control measures currently recommended. Management practices are applied at the proper time and in such a way as to be most effective. Soil and water conservation practices such as minimum tillage, contour tillage, stripcropping, crop residue management, diversions, drainage, and waterways are followed. Irrigation is not considered in these yields.

The yields in columns B are not intended to be maximum yields obtainable; they vary for the different soils, but usually represent an increase over present yields for the county. It is expected that yields, especially under improved management, will increase 10 to 25 percent by 1985 as a result of the development of new crop varieties and improved technology. Yields increased about 2 percent per year in Pennsylvania during the 1960's.

Mine dumps, Strip mines, Upshur-Gilpin silt loams, 25 to 35 percent slopes, Urban land, and Weikert and Gilpin soils, 25 to 70 percent slopes, were not included in the table because they are not suited to the crops specified.

TABLE 1.—*Estimated average yields per acre of*

[In columns A are estimated yields under management commonly used in the county, and in columns B are estimated yields under
Mine dumps, Strip mines, Upshur-Gilpin silt loams, 25 to 35 percent slopes, Urban land, and Weikert and Gilpin

Soil	Corn				Oats		Wheat	
	Grain		Silage					
	A	B	A	B	A	B	A	B
	Bu	*Bu*	*Tons*	*Tons*	*Bu*	*Bu*	*Bu*	*Bu*
Allegheny silt loam, 3 to 8 percent slopes	75	120	15	24	65	75	35	45
Allegheny silt loam, 8 to 15 percent slopes	70	110	14	22	60	70	30	40
Cavode silt loam, 3 to 8 percent slopes	50	85	10	17	50	65	--------	35
Cavode silt loam, 8 to 15 percent slopes	45	80	9	16	45	60	--------	30
Cavode silt loam, 15 to 25 percent slopes	40	75	8	15	40	55	--------	25
Ernest silt loam, 0 to 3 percent slopes	55	100	11	20	55	65	30	40
Ernest silt loam, 3 to 8 percent slopes	55	100	11	20	55	65	30	40
Ernest silt loam, 8 to 15 percent slopes	50	90	10	18	50	60	25	35

field and forage crops under two levels of management

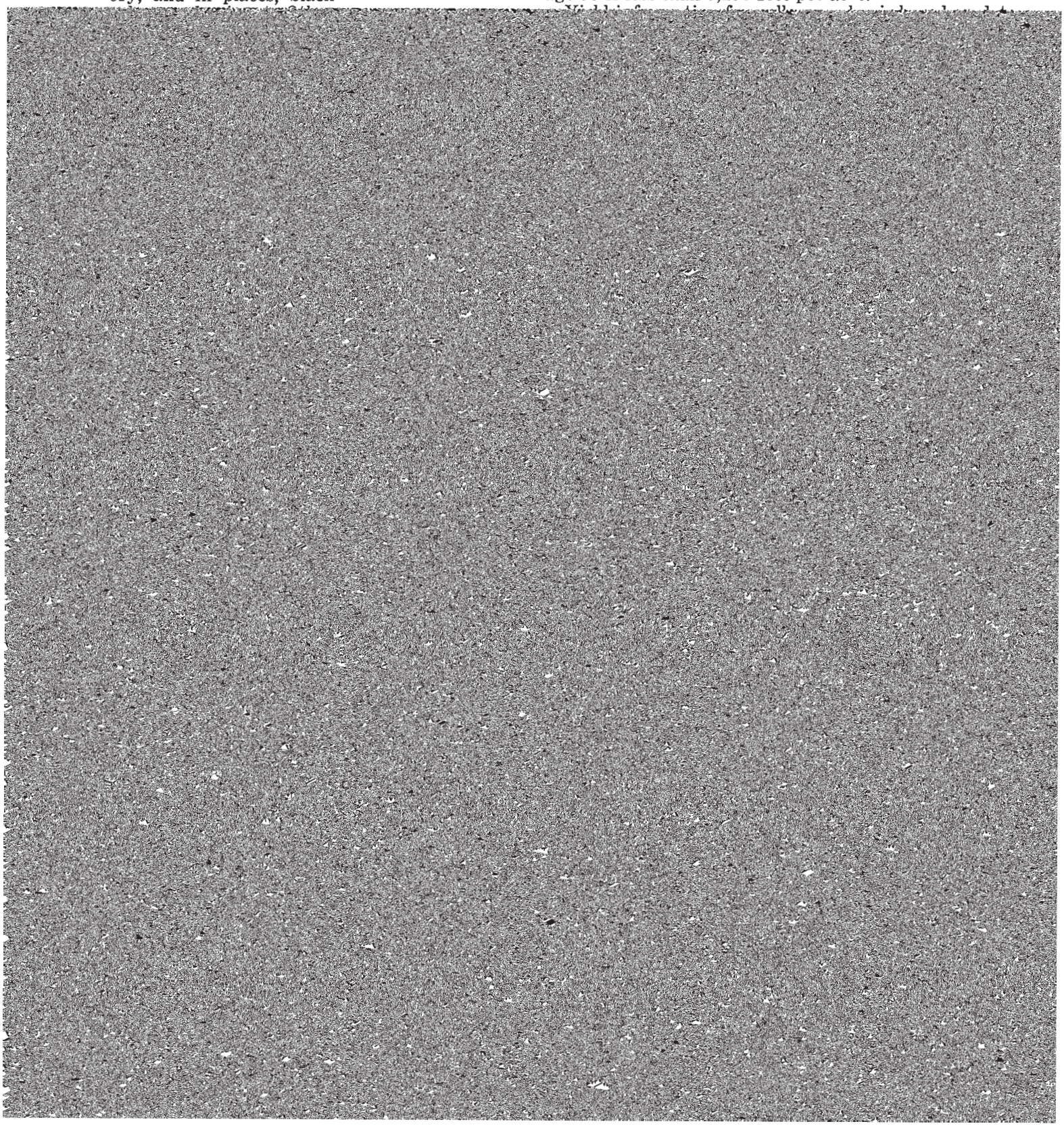
improved management. Dashes in columns indicate that the soil is not suited to the specified crop at the given level of management. soils, 25 to 70 percent slopes, were not included in the table because they are not suited to the specified crops]

Hay				Pasture			
Alfalfa-grass mixture		Trefoil-grass or clover-grass mixture		Bluegrass		Tall grass-legume mixture	
A	B	A	B	A	B	A	B
Tons	*Tons*	*Tons*	*Tons*	*Cow-acre-days* [1]	*Cow-acre-days* [1]	*Cow-acre-days* [1]	*Cow-acre-days* [1]
2.6	4.5	2.0	3.5	80	160	130	255
2.5	4.0	1.9	3.0	75	135	125	230
----------	----------	1.5	3.0	60	135	75	170
----------	----------	1.5	3.0	60	135	75	170
----------	----------	1.3	2.5	50	115	65	145
2.0	3.5	1.6	3.0	65	135	100	200
2.1	3.5	1.7	3.0	70	135	105	200
2.0	3.5	1.7	3.0	70	135	100	200
1.9	3.0	1.6	2.5	65	115	95	170
----------	----------	----------	----------	55	110	----------	----------
----------	----------	----------	----------	50	100	----------	----------
1.5	2.5	1.2	2.0	50	90	75	145
1.4	2.5	1.1	2.0	45	90	70	145
----------	----------	----------	----------	35	60	----------	----------
2.6	4.0	2.0	3.5	80	160	130	230
2.5	3.5	1.9	3.0	75	135	125	200
2.4	3.5	1.7	3.0	70	135	120	200
----------	----------	----------	----------	55	105	----------	----------

yellow birch, white pine, and sugar maple.

Oak-hickory ---------- 30 percent
White oak, red oak, hickory, and in places, black

yield at age 50 is 9,750 board feet per acre. A site index of 55 to 64 is rated fair, and the expected yield at age 50 is about 6,300 board feet per acre. A site index of less than 54 is rated poor, and the expected yield at age 50 is less than 3,250 feet per acre.



some replanting is ordinarily needed. Natural regeneration cannot always be relied upon for adequate and early restocking. A rating of *severe* indicates that more than 50 percent of planted seedlings are likely to die, and special preparation of the seedbed, superior planting techniques, and considerable replanting are needed for adequate and immediate restocking. Restocking cannot be expected to result from natural regeneration.

Plant competition.—Plant competition refers to the rate at which brush, grass, and undesirable trees are likely to invade the stand on different kinds of soil. Plant competition is *slight* if unwanted plants do not prevent adequate natural regeneration and early growth or interfere with adequate development of planted seedlings. It is *moderate* if competing plants delay natural

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

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

Ponds can be stocked with fish, and they can be used

TABLE 2.—*Soil*

[Mine dumps (Ms) and Strip mines (Sm) are not listed in the table. For information about revegetating these

Soil series and map symbols	Site quality	Management problems		
		Erosion hazard	Equipment limitations	Seedling mortality
Allegheny: AlB, AlC	Very good	Slight	Slight	Slight
Cavode: CaB, CaC, CaD	Very good	Slight for CaB, moderate for CaC, and severe for CaD.	Moderate	Moderate
Ernest: EnA, EnB, EnC, EnD, ErB, ErD.	Very good	Slight for EnA, EnB, and ErB, moderate for EnC and ErD, and severe for EnD.	Slight for EnA, EnB, EnC and ErB, and moderate for EnD and ErD.	Slight
Gilpin: GwB, GwC, GwD	Good	Slight	Slight for GwB and GwC, and moderate for GwD.	Moderate
Hazleton: HaB, HaC, HaD, HlD.	Good	Slight	Slight for HaB and HaC, and moderate for HaD and HlD.	Slight
Melvin: Me	Fair	Slight	Severe	Severe
Pope: Pm, Po	Excellent	Slight	Slight	Slight
Rainsboro: RaA, RaB, RaC.	Good	Slight for RaA and RaB, and moderate for RaC.	Slight	Slight
Rayne: RnB, RnC, RpD	Very good	Slight for RnB and RnC, and moderate for RpD.	Slight for RnB and RnC and moderate for RpD.	Slight for RnB and RnC, and moderate for RpD.
Steff: Se, Sf	Excellent	Slight	Slight	Slight
Upshur: UgB, UgC, UgD, UgE.	Good	Slight for UgB, moderate for UgC, and severe for UgD and UgE.	Moderate for UgB and UgC, and severe for UgD and UgE.	Slight
Urban land: Ur. Not suited to commercial trees.				
Weikert: WeB, WeC, WkF.	Fair for WeB and WeC, and good for WkF.	Slight for WeB and WeC, and moderate for WkF.	Slight for WeB and WeC, and severe for WkF.	Moderate for WkF, and severe for WeB and WeC.
Wharton: WrB, WrC, WtB, WtC, WtD, WvB, WvC, WvD.	Very good	Slight for WrB, WtB, and WvB, moderate for WrC, WtC, and WvC, and severe for WtD and WvD.	Slight for WrB, WrC, WtB, WtC, WvB, and WvC, and moderate for WtD and WvD.	Slight

interpretations for woodland

land types, see "A Guide for Revegetation of Bituminous Strip Mine Spoils in Pennsylvania" (*16*)]

Management problems—Continued			Suitable trees—	
Plant competition		Windthrow hazard	To favor in existing stands	For planting or seeding
Conifers	Hardwoods			
Severe	Moderate	Slight	Yellow-poplar, red oak, sugar maple, black walnut, ash.	Yellow-poplar, larch, Virginia pine, black walnut, Norway spruce, white pine.
Severe	Severe	Moderate	Yellow-poplar, ash, white pine, red oak, sugar maple.	Yellow-poplar, Norway spruce, white pine, larch, white spruce.
Severe	Moderate	Slight	Yellow-poplar, red oak, ash, sugar maple.	Yellow-poplar, larch, Norway spruce, white spruce, white pine.
Moderate	Slight	Slight	Red oak, ash, sugar maple, yellow-poplar, Virginia pine.	Yellow-poplar, red pine, Norway spruce, larch, Virginia pine, white pine.
Moderate	Slight	Slight	Red oak, ash, yellow-poplar, black oak, sugar maple, white pine.	Yellow-poplar, red pine, Norway spruce, larch, Virginia pine, white pine.
Severe	Severe	Moderate	Red maple, sycamore	White pine, white spruce.
Severe	Moderate	Slight	Yellow-poplar, red oak, sugar maple, black walnut, ash, white pine.	Yellow-poplar, larch, Norway spruce, black walnut, red pine, white pine.
Moderate	Slight	Slight	Red oak, sugar maple, yellow-poplar, ash.	Yellow-poplar, Norway spruce, white pine, larch, Virginia pine, red pine.
Severe	Moderate	Slight	Red oak, ash, Virginia pine, black oak, sugar maple, yellow-poplar.	Yellow-poplar, red pine, Norway spruce, larch, Virginia pine, white pine.
Severe	Moderate	Slight	Red oak, ash, white pine, yellow-poplar, sugar maple, black walnut.	Yellow-poplar, larch, white pine, black walnut, Norway spruce.
Moderate	Slight	Slight	Red oak, ash, sugar maple, Virginia pine, white pine, yellow-poplar.	Yellow-poplar, Norway spruce, red pine, white pine, larch, Virginia pine.
Slight for WeB and WeC, and moderate for WkF.	Slight	Moderate for WeB and WeC, and slight for WkF.	Red oak, chestnut oak, Virginia pine, black oak (WeB, WeC); red oak, ash, Virginia pine, yellow-poplar, sugar maple (WkF).	Red pine, Virginia pine, white pine (WeB, WeC); larch, red pine, Norway spruce, yellow-poplar, Virginia pine, white pine (WkF).
Severe	Moderate	Slight	Yellow-poplar, red oak, ash, sugar maple, white pine.	Yellow-poplar, larch, red pine, Norway spruce, white pine.

as second class pheasant range. Local populations of pheasant are established, and there is some natural reproduction. Survival is low, however, and annual stocking is necessary. The largest pheasant population is within the Wharton-Rayne-Cavode soil association near Worthington and Cowansville, where small grain is the main crop.

Cottontail rabbits are abundant throughout Armstrong County. Farmland on the rolling hills and small timber operations provide ideal habitat for rabbits. The urban areas also support a large population of rabbits because the shrubbery and flower gardens provide good habitat.

Bobwhite quail inhabit parts of the Gilpin-Weikert-Ernest soil association where weeds and brush grow on idle land.

A large population of mourning doves lives within the Wharton-Rayne-Cavode soil association, which is mostly clean farmed. Smaller populations of doves are scattered elsewhere in the county.

Woodcock inhabit the bottom land where alders are dominant within the Rainsboro-Melvin-Steff soil association. Loamy, lighter textured soils produce the best

pensive and require intensive effort. Satisfactory results are questionable.

On *unsuitable* soils, it is impractical to create, improve, or maintain habitat because of very severe limitations. Unsatisfactory results are probable.

Not considered in the ratings are present land use, the location of a soil in relation to other soils, and the mobility of wildlife.

The elements of wildlife habitat and the kinds of wildlife in table 3 are defined in the following paragraphs.

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

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

Wild herbaceous upland plants are native or introduced perennial grasses or forbs that generally are established naturally and that provide food and cover

grown land. Examples are quail, ring-necked pheasant, mourning dove, woodcock, cottontail rabbit, meadow lark, killdeer, and field sparrow.

Woodland wildlife are birds and mammals that inhabit woodland. Examples are ruffed grouse, wild turkey, wood thrush, warbler, vireo, deer, squirrel, and raccoon.

Wetland wildlife are birds and mammals that inhabit swamps, marshes, and open water areas. Examples are ducks, geese, heron, snipe, rail, coot, muskrat, mink, and beaver.

Engineering Uses of the Soils [5]

This section is useful to planning commissions, town and city managers, land developers, engineers, contractors, farmers, and others who need information about soils used as structural material or as foundation on which structures are built.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, drainage, shrink-swell potential, grain size, plasticity, and reaction. Also important are depth to the water table, depth to bedrock, and slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreation areas

loads or that require excavations to depths greater than those shown in the tables, generally depths of more than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil can include small areas of other kinds of soil that have strongly contrasting properties and different suitability or limitations for soil engineering.

Some of the terms in this soil survey have special meaning to soil scientists. The Glossary defines many of the terms commonly used in soil science.

Engineering soil classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*3*) used by SCS engineers, the Department of Defense, and others, and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*2*).

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

The AASHTO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution

TABLE 3.—*Soil suitability*

Soil series and map symbols	Elements of wildlife habitat			
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood trees and plants
Allegheny: AlB, AlC	Suited	Well suited	Well suited	Well suited
Cavode:	[illegible]	[illegible]	[illegible]	[illegible]

for wildlife habitat

Elements of wildlife habitat—continued				Kinds of wildlife		
Coniferous plants	Wild herbaceous wetland plants	Shallow water developments	Shallow excavated ponds	Openland wildlife	Woodland wildlife	Wetland wildlife

TABLE 4.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The the first column. The symbol > means

Soil series and map symbols	Depth to—		Depth from surface	Classification		USDA texture	Coarse fraction greater than 3 inches	Percentage passing sieve—	
	Seasonal water table	Bedrock		Unified	AASHTO			No. 4 (4.7 mm)	No. 10 (2.0 mm)
	Feet	*Feet*	*Inches*				*Percent*		
Allegheny: AlB, AlC	>3	>6	0–9	ML, CL	A–4, A–6	Silt loam	0–15	90–100	90–100
			9–40	ML, CL, SM	A–4, A–6	Loam, sandy clay loam.	0–15	70–100	70–95
			40–52	SM, SC, GM, GC	A–2, A–4, A–6	Very gravelly loam, clay loam.	0–45	50–95	35–70
			52–84	GM, GC, SM, SC	A–2	Very shaly clay.	0–45	45–75	35–60
Cavode: CaB, CaC, CaD	½–1½	3½–6	0–5	ML, CL	A–4, A–6	Silt loam	0–5	90–100	90–100
			5–26	ML, CL	A–4, A–6, A–7	Silty clay loam.	0–5	80–95	75–95
			26–48	ML, CL, GM, GC, SM, SC	A–2, A–4, A–6	Shaly silty clay loam, shaly clay.	0–10	60–90	25–85
			48	----------	----------	Acid gray shale bedrock.			
Ernest: EnA, EnB, EnC, EnD, ErB, ErD.	1½–3	>6	0–8	ML, CL	A–4, A–6	Silt loam	0–15	75–100	70–100
			8–50	ML, CL	A–4, A–6, A–7	Silt loam, silty clay loam, shaly silt loam.	0–15	75–100	70–100
			50–74	ML, CL, GM, GC, SM	A–4, A–6	Shaly silt loam, shaly silty clay.	5–25	70–95	60–95
*Gilpin: GwB, GwC, GwD For the Weikert part, see the Weikert series.	>3	1½–3½	0–26	ML	A–4	Silt loam, silty clay loam.	0–20	85–100	60–90
			26–34	SM, SC, GM, GC	A–2, A–4	Shaly silt loam, channery loam.	0–35	40–70	20–65
			34	----------	----------	Grayish-brown, rippable shale bedrock.			
Hazleton: HaB, HaC, HaD, HlD.	>3	3½–5	0–17	GM, ML	A–2, A–4	Channery loam, channery sandy loam.	0–30	50–85	40–75
			17–36	GM, ML	A–2, A–4	Very channery loam.	10–40	50–85	40–80
			36–48	SM, GM	A–2, A–4	Very channery loamy sand, very channery loam.	10–50	45–85	35–75
			48	----------	----------	Grayish-brown, fractured sandstone.			

significant in engineering

soils in such mapping units may have different properties, and for this reason it is necessary to refer to other series as indicated in more than; the symbol < means less than]

Percentage passing sieve—Continued		Permeability	Available moisture capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential	Corrosivity to—	
No. 40 (0.42 mm)	No. 200 (0.074 mm)							Steel	Concrete
		Inches per hour	*Inches per inch of soil*	*pH*	*Percent*	*Pounds per cubic foot*			
85–100	70–90	0.6–2.0	0.18–0.20	4.5–6.5	----------	----------	Low	Low	Moderate.
65–95	45–95	0.6–2.0	0.12–0.16	4.5–5.5	10–15	110–125	Low	Low	Moderate.
25–50	15–40	0.6–6.0	0.06–0.12	4.5–5.5	5–10	125–130	Low	Low	Moderate

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Depth to— Seasonal water table	Depth to— Bedrock	Depth from surface	Classification Unified	Classification AASHTO	USDA texture	Coarse fraction greater than 3 inches	Percentage passing sieve— No. 4 (4.7 mm)	Percentage passing sieve— No. 10 (2.0 mm)
	Feet	*Feet*	*Inches*				*Percent*		
Melvin: Me	[1] 0–½	4–6+	0–9	ML, CL	A–4, A–6	Silty clay loam.	----------	90–100	90–100
			9–52	CL, ML	A–4, A–6, A–7	Silty clay loam, silt loam, loam.	----------	85–100	95–100
			52–60	ML, CL, GM, GC, SC	A–2, A–4, A–6	Very gravelly sandy clay loam.	0–10	45–75	25–60
Mine dumps: Ms. Properties are too variable to be estimated.									
Pope: Pm, Po	[1] >3	>5	0–42	ML, CL, SM, GM	A–2, A–4	Silt loam, loam, fine sandy loam.	0–5	75–100	70–100
			42–60	SM, SC	A–2	Gravelly loamy sand.	0–10	75–100	55–100
Rainsboro: RaA, RaB, RaC	1½–3	>6	0–8	ML	A–4	Silt loam	----------	90–100	85–100
			8–60	ML, CL, MH	A–4, A–6, A–7	Silty clay loam, silt loam.	0–10	90–100	85–100
			60–76	ML, CL	A–4, A–6	Clay loam, sandy clay loam.	0–15	75–100	70–100
*Rayne: RnB, RnC, RpD. For the Gilpin part of RpD, see the Gilpin series.	>3	3½–5	0–6	ML	A–4	Silt loam	0–20	85–100	80–90
			6–60	ML, CL, SC, SM, GM, GC	A–2, A–4, A–6	Shaly silty clay loam, very shaly silt loam.	0–30	40–75	30–60
			60	----------	----------	Grayish brown, rippable shale bedrock.			
Steff: Se, Sf	[1] 1½–3	>5	0–45	ML	A–4	Silty clay loam, silt loam, loam.	----------	95–100	90–100
			45–70	SM, ML, GM	A–2, A–4	Sandy loam, fine sandy loam, gravelly sandy loam.	----------	60–85	45–70
Strip mines: Sm. Properties are too variable to be estimated.									
*Upshur: UgB, UgC, UgD, UgE. For the Gilpin part, see the Gilpin series.	>3	3½–6	0–6	ML, CL	A–4, A–6	Silt loam	----------	95–100	90–100
			6–36	CH, CL, ML	A–6, A–7	Silty clay, clay.	----------	95–100	90–100
			36–58	GM, GC, SM, SC	A–2, A–4	Very shaly silty clay.	0–15	50–80	25–60
			58	----------	----------	Red shale bedrock.			

significant in engineering—Continued

Percentage passing sieve—Continued		Permeability	Available moisture capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential	Corrosivity to—	
No. 40 (0.42 mm)	No. 200 (0.074 mm)							Steel	Concrete
		Inches per hour	*Inches per inch of soil*	*pH*	*Percent*	*Pounds per cubic foot*			
85–100	70–95	0.6–2.0	0.18–0.20	6.1–7.3	----------	----------	Low	High	Low.
85–100	70–90	0.6–2.0	0.14–0.18	5.6–6.5	12–18	105–110	Low	High	Low.
25–55	15–55	0.6–2.0	0.06–0.10	6.1–7.3	8–14	108–122	Low	High	Low.
55–100	30–80	2.0–6.0	0.12–0.16	4.5–7.0	10–18	106–120	Low	Low	Low.
50–100	15–30	2.0–6.0	0.05–0.08	4.5–6.0	5–9	110–120	Low	Low	Moderate.
80–100	70–100	0.2–2.0	0.14–0.18	5.6–6.5	----------	----------	Low	Moderate	Low.
80–100	70–100	0.2–0.6	0.09–0.14	4.5–6.0	15–20	100–115	Moderate	High	Moderate.
65–100	55–95	0.2–0.6	0.10–0.14	5.1–6.0	12–20	105–120	Moderate	High	Moderate.
70–85	60–85	0.6–2.0	0.16–0.18	4.5–7.0	----------	----------	Low	Low	Low.
25–55	15–55	0.6–2.0	0.06–0.12	4.5–5.5	13–15	114–118	Low	Moderate	Moderate.
80–100	60–90	0.6–2.0	0.15–0.20	4.5–6.5	10–19	104–120	Low	Moderate	Moderate.
45–60	20–55	0.6–2.0	0.06–0.10	4.5–5.5	8–12	115–122	Low	Low	Moderate.
80–95	70–95	0.2–0.6	0.18–0.20	4.5–6.5			Moderate	Moderate	Moderate.

TABLE 4.—*Estimated soil properties*

significant in engineering—Continued

Percentage passing sieve—Continued		Permeability	Available moisture capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential	Corrosivity to—	
No. 40 (0.42 mm)	No. 200 (0.075 mm)							Steel	Concrete
		Inches per hour	*Inches per inch of soil*	*pH*	*Percent*	*Pounds per cubic foot*			
85–100	85–95	0.6–2.0	0.15–0.17	5.1–6.5	----------	----------	Moderate	High	Moderate.
80–100	70–100	<0.2	0.10–0.16	5.1–6.0	15–22	102–115	High	High	Moderate.

TABLE 5.—*Interpretations of*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The

engineering properties of the soils

soils in such mapping units may have different properties and limitations, and for this reason, it is necessary to refer to other series the first column]

Soil features affecting—continued					
Ponds—continued					
Embankments	Drainage for crops and pasture	Sprinkler irrigation	Terraces, diversions, and waterways	Winter grading	Pipeline construction and maintenance
Medium to low shear strength; susceptible to piping; fair to poor compaction characteristics.	Well drained ------	High available moisture capacity.	Siltation in channels.	Features generally favorable.	Features generally favorable.
Medium to low shear strength; susceptible to piping; fair compaction characteristics.	Slow permeability; seasonal high water table.	Seasonal high water table; slow permeability.	Seasonal high water table; erodible.	Seasonal high water table; forms large clods when frozen.	Seasonal high water table; bedrock at a depth of 3½ to 6 feet; high corrosion potential.
Medium to low	Seasonal high	Seasonal high water	Erodible; seepage	Seasonal high water	Seasonal high water

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Roadfill	Roads and highways	Ponds: Reservoir area
*Rayne: RnB, RnC, RpD. For the Gilpin part of RpD, see the Gilpin series.	Good: poor on very stony phase.	Unsuited: too many fines.	Fair: shaly; too many fines.	Features generally favorable; stony in some areas; bedrock at a depth of 3½ to 5 feet.	Permeable material; bedrock at a depth of 3½ to 5 feet.
Steff: Se, Sf	Good	Unsuited: too many fines; good to fair in substratum in some areas.	Fair: too many fines.	Flooding; seasonal high water table; high frost heave potential.	Flooding
Strip mines: Sm. Too variable for interpretations to be made.					
*Upshur: UgB, UgC, UgD, UgE. For the Gilpin part, see the Gilpin series.	Fair: silty clay below a depth of 6 inches.	Unsuited: too many fines.	Poor: high shrink-swell potential.	Unstable material; slippage hazard; high shrink-swell potential; bedrock at a depth of 3½ to 6 feet.	Bedrock at a depth of 3½ to 6 feet.
Urban land: Ur. Too variable for interpretations to be made.					
Vandergrift. Mapped only with Wharton soils.	Fair: silty clay loam.	Unsuited: too many fines.	Poor: high shrink-swell potential.	Unstable material; slippage hazard; high shrink-swell potential; bedrock at a depth of 3½ to 6 feet.	Features generally favorable.
*Weikert: WeB, WeC, WkF. For the Gilpin part of WkF, see the Gilpin series.	Poor: shaly; limited quantity.	Unsuited: too many fines; bedrock at a depth of 1 to 1½ feet.	Poor: bedrock at a depth of 1 to 1½ feet.	Bedrock at a depth of 1 to 1½ feet.	Pervious bedrock at a depth of 1 to 1½ feet.
*Wharton: WrB, WrC, WtB, WtC, WtD, WvB, WvC, WvD. For the Gilpin part of WtB, WtC, and WtD, see the Gilpin series. For the Vandergrift part of WvB, WvC, and WvD, see the Vandergrift series.	Good	Unsuited: too many fines.	Fair: moderate shrink-swell potential.	Seasonal high water table; fair to poor stability; slips when saturated; moderate frost heave potential.	Bedrock at a depth of 4 to 6 feet.

of the materials, and neither do they indicate quality of the deposit.

Road fill is soil material used in embankments for

Roads and highways have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting

properties of the soils—Continued

Soil features affecting—continued					
Ponds—continued Embankments	Drainage for crops and pasture	Sprinkler irrigation	Terraces, diversions, and waterways	Winter grading	Pipeline construction and maintenance
Medium to low shear strength.	Well drained	Features generally favorable; stony in some areas.	Erodible; stony in some areas.	Features generally favorable.	Stony in some areas; bedrock at a depth of 3½ to 5 feet.
Medium to low shear strength.	Seasonal high water table; flooding.	Seasonal high water table.	Nearly level; flooding; seasonal high water table.	Seasonal high water table; flooding.	Flooding; seasonal high water table.
Low shear strength; medium to high compressibility; poor compaction characteristics.	Well drained	Slow permeability	Erodible; high content of clay.	Poor workability	High shrink-swell potential; slippage hazard; bedrock at a depth of 3½ to 6 feet; high corrosion for uncoated steel.
Low shear strength; medium to high compressibility; poor compaction characteristics.	Slow permeability; seasonal high water table.	Slow permeability; seasonal high water table.	Erodible; seasonal high water table; high content of clay.	Poor workability; seasonal high water table.	High shrink-swell potential; slippage hazard; bedrock at a depth of 3½ to 6 feet; high corrosion potential for uncoated steel.
Bedrock at a depth of 1 to 1½ feet.	Well drained	Very low available moisture capacity; bedrock at a depth of 1 to 1½ feet.	Bedrock at a depth of 1 to 1½ feet; very low available moisture capacity.	Bedrock at a depth of 1 to 1½ feet.	Bedrock at a depth of 1 to 1½ feet.
Low shear strength; medium to high compressibility; poor compaction characteristics.	Slow permeability; seasonal high water table.	Seasonal high water table; slow permeability.	Seasonal high water table; high content of clay.	Seasonal high water table.	Seasonal high water table; high content of clay; slippage hazard; high corrosion potential.

Soil properties that most affect design and construction of roads and highways are the load-supporting capacity and stability of the subgrade and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material and the shrink-swell potential indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect the ease of excavation and the amount of cut and fill needed to reach an even grade.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and the depth to fractured or permeable bedrock or other permeable material.

TABLE 6.—*Engineering*

[Tests performed by the Pennsylvania Department of Transportation, Soil Testing Laboratory, Harrisburg, according to

Soil series and location	Parent material	Engineering report number	Depth from surface	Moisture density [1]	
				Maximum dry density	Optimum moisture
			Inches	*Pounds per cubic foot*	*Percent*
Melvin:					
2 miles east of Kittanning along Cowanshannock Creek, in Rayburn Township. (Modal)	Alluvium from shale, siltstone, sandstone, and limestone.	68–20497	22–35	106	18
		68–20498	52–60	122	13
Pope:					
2 miles southeast of Elderton, in Plum Creek Township. (Modal)	Alluvium from shale, siltstone, and sandstone.	68–20503	20–29	106	18
		68–20504	48–61	117	13
Rainsboro:					
3½ miles southwest of West Mosgrove and 1½ miles north of Allegheny River, in East Franklin Township. (Modal)	Loess and loamy sediments.	68–20511	40–50	113	15
		68–20512	60–70	117	14
Steff:					
1½ miles southeast of Elderton and 100 yards south of U.S. Highway 422 along Crooked Creek, in Plum Creek Township. (Modal)	Alluvium from shale, siltstone, and sandstone.	68–20501	25–33	104	19
		68–20502	60–70	122	12
Vandergrift:					
3.5 miles south southwest of Dayton and ¼ mile	Shale and siltstone.	68–20507	21–34	102	22

test data

standard procedures of the American Association of State Highway and Transportation Officials (AASHTO) (*2*)]

Mechanical analysis [2]										Liquid limit	Plasticity index	Classification	
Percentage passing sieve—						Percentage smaller than—						AASHTO	Unified
3 in.	¾ in.	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No.200 (0.074 mm)	0.05 mm	0.02 mm	0.005 mm	0.002 mm				
										Percent			
-------	-------	100	99	98	84	75	60	42	32	36	14	A-6(10)	CL
100	85	68	59	44	30	27	18	12	10	30	9	A-2-4(0)	SC
-------	-------	-------	-------	100	79	68	55	32	20	33	8	A-4(8)	ML-CL
-------	-------	-------	100	99	30	22	13	6	4	[3]NP	[3]NP	A-2-4(0)	SM
-------	-------	100	99	99	93	85	46	22	17	27	6	A-4(8)	ML-CL
-------	100	99	99	95	81	75	56	28	18	21	3	A-4(8)	ML
-------	-------	-------	100	99	82	73	48	29	21	34	8	A-4(8)	ML
100	97	73	63	52	24	19	13	7	4	21	1	A-2-4(0)	SM
-------	-------	100	99	99	98	97	89	72	59	66	35	A-7-5(20)	CH
-------	100	98	93	85	72	67	51	28	17	34	11	A-6(8)	ML-CL

coarser than 2 millimeters in diameter. In the SCS 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 analysis data in this table are not suitable for naming textural classes for soils.

[3] NP means nonplastic.

based on data obtained by mechanical analysis and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods.

Tests to determine compaction (or moisture-density) characteristics have been explained for table 4.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from semisolid to plastic. If the moisture content is further increased, the material changes from plastic to liquid. The plastic limit is the moisture content at which the soil material changes from semisolid to plastic; and the liquid limit, from plastic to liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Use of the Soils for Community Development

This section provides information of special interest to persons or organizations who plan community development and recreation facilities. This information is a scientific basis for developing land-use plans for Armstrong County. Interpretive maps can be made from the soil maps and information in table 7 to help determine the degree and kind of limitation of the soils of any given area.

This information and the soil maps give general guidance, but the mapping and written information are restricted in detail by the map scale and should be used only in planning more detailed field investigation to determine the in-place condition of the soil at any specific site.

Only soil features are evaluated in this section, since the ease or difficulty of making improvements is largely controlled by the characteristics of the soils. Economic factors and location, however, often determine the ultimate use of an area, regardless of the soil limitations involved.

Table 7 lists all the soils in the county and shows the kind and estimated degree of their limitations for selected uses. Ratings of limitations used in the table are slight, moderate, and severe. A rating of *slight* means that soil properties are generally favorable, and limitations are so minor that they can easily be overcome. A rating of *moderate* means that limitations can be overcome or modified by planning, special design, or special maintenance. A rating of *severe* means that limitations require costly soil reclamation, special design, intense maintenance, or a combination of these.

Figure 9.—**The high shrink-swell potential of Vandergrift soils make them susceptible to landslides.**

Following are explanations of the columns in table 7.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material to a depth of 6 feet is evaluated. The soil properties considered are those that affect both the absorption of effluent and the construction and operation of the system. Properties that affect absorption are permeability, depth to water table, depth to rock, and susceptibility to flooding. Slope is a soil property that affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor and has sides, or embankments, of compacted soil material. It is assumed that the embankment is compacted to medium density and the pond is

are the engineering properties of the embankment material as interpreted from the Unified soil classification and the amount of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Buildings with basements, as rated in table 7, are not more than three stories high with an excavation for a basement that is less than 6 feet deep. The features that affect the rating for buildings with basements are those that relate to capacity to support load and to resist settlement under load and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

For lawns and landscaping suitable soil material is needed in an amount sufficient for desirable trees and other plants to survive and grow. The need for lime

slope, depth to and kind of bedrock, stoniness, and hazard of flooding. For rural roads, slope limitations

then, briefly, each mapping unit in that series. Unless stated otherwise, information given for the soil series

TABLE 7.—*Limitations of the soils*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Buildings with basements	Lawns and landscaping	Streets and parking lots	Sanitary landfill (Trench)
Allegheny:						
AlB	Slight	Severe: moderately rapid permeability in substratum.	Slight	Slight	Moderate: slope.	Slight
AlC	Moderate: slope.	Severe: slope; moderately rapid permeability in substratum.	Moderate: slope.	Moderate: slope.	Severe: slope	Moderate: slope.
Cavode:						
CaB	Severe: seasonal high water table; slow permeability.	Moderate: slope.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table; slope.	Severe: seasonal high water table.
CaC	Severe: seasonal high water table; slow permeability.	Severe: slope	Severe: seasonal high water table.	Moderate: seasonal high water table; slope.	Severe: slope	Severe: seasonal high water table.
CaD	Severe: seasonal high water table; slow permeability; slope.	Severe: slope	Severe: seasonal high water table.	Severe: slope	Severe: slope	Severe: seasonal high water table; slope.
Ernest:						
EnA	Severe: seasonal high water table; moderately slow permeability.	Slight	Moderate: seasonal high water table.	Slight	Moderate: seasonal high water table.	Moderate: seasonal high water table.
EnB	Severe: seasonal high water table; moderately slow permeability.	Moderate: slope.	Moderate: seasonal high water table.	Slight	Moderate: seasonal high water table; slope.	Moderate: seasonal high water table.
EnC	Severe: seasonal high water table; moderately slow permeability.	Severe: slope	Moderate: seasonal high water table; slope.	Moderate: slope.	Severe: slope	Moderate: seasonal high water table; slope.
EnD	Severe: seasonal high water ta-	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope

for community development

Camp areas		Buildings without basements	Paths and trails	Picnic areas	Playgrounds	Golf fairways
Tents and camp trailers	Travel trailers					
Slight	Moderate: slope.	Slight	Slight	Slight	Moderate: slope.	Slight.
Moderate: slope.	Severe: slope	Moderate: slope.	Slight	Moderate: slope.	Severe: slope	Moderate: slope.
Moderate: seasonal high water table; slow permeability.	Moderate: seasonal high water table; slow permeability; slope.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table.
Moderate: seasonal high water table; slope; slow permeability.	Severe: slope	Moderate: seasonal high water table; slope.	Moderate: seasonal high water table.	Moderate: seasonal high water table; slope.	Severe: seasonal high water table; slope.	Moderate: seasonal high water table; slope.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope; seasonal high water table.	Severe: slope	Severe: slope; seasonal high water table.	Severe: slope.
Moderate: moderately slow permeability.	Moderate: moderately slow permeability.	Slight	Slight	Slight	Moderate: moderately slow permeability; seasonal high water table.	Slight.
Moderate: moderately slow permeability.	Moderate: moderately slow permeability; slope.	Slight	Slight	Slight	Moderate: moderately slow permeability; slope; seasonal high water table.	Slight.
Moderate: moderately slow permeability; slope.	Severe: slope	Moderate: slope.	Slight	Moderate: slope.	Severe: slope	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope.	Severe: slope	Severe: slope	Severe: slope.
Moderate: moderately slow permeability; stony.	Moderate: moderately slow permeability; stony; slope.	Slight	Moderate: stony.	Slight	Moderate: moderately slow permeability; slope; stony; seasonal high water table.	Moderate: stony.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope; stony.	Severe: slope	Severe: slope	Severe: slope.
Moderate: shaly.	Moderate: shaly; slope.	Moderate: bedrock at a depth of 1 to 1½ feet.	Moderate: shaly.	Moderate: shaly.	Severe: bedrock at a depth of 1 to 1½ feet.	Severe: bedrock at a depth of 1 to 1½ feet.

TABLE 7.—*Limitations of the soils*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Buildings with basements	Lawns and landscaping	Streets and parking lots	Sanitary landfill (Trench)
GwC	Severe: bedrock at a depth of 1 to 1½ feet.	Severe: slope; bedrock at a depth of 1 to 1½ feet; moderately rapid permeability.	Moderate: slope; bedrock at a depth of 1 to 1½ feet.	Moderate: slope; bedrock at a depth of 1 to 1½ feet.	Severe: slope	Severe: bedrock at a depth of 1 to 1½ feet.
GwD	Severe: slope; bedrock at a depth of 1 to 1½ feet.	Severe: slope; bedrock at a depth of 1 to 1½ feet; moderately rapid permeability.	Severe: slope	Severe: slope	Severe: slope	Severe: slope; bedrock at a depth of 1 to 1½ feet.
Hazleton:						
HaB	Moderate: bedrock at a depth of 3½ to 5 feet.	Severe: moderately rapid permeability.	Moderate: bedrock at a depth of 3½ to 5 feet.	Slight	Moderate: hard bedrock at a depth of 3½ to 5 feet; slope.	Severe: bedrock at a depth of 3½ to 5 feet; moderately rapid permeability.
HaC	Moderate: bedrock at a depth of 3½ to 5 feet; slope.	Severe: moderately rapid permeability; slope.	Moderate: slope; bedrock at a depth of 3½ to 5 feet.	Moderate: slope.	Severe: slope	Severe: bedrock at a depth of 3½ to 5 feet; moderately rapid permeability.
HaD	Severe: slope	Severe: moderately rapid permeability; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: slope; bedrock at a depth of 3½ to 5 feet; moderately rapid permeability.
HlD	Severe: slope	Severe: moder-	Severe: slope	Severe: slope	Severe: slope	Severe: slope;

for community development—Continued

Camp areas		Buildings without basements	Paths and trails	Picnic areas	Playgrounds	Golf fairways
Tents and camp trailers	Travel trailers					
Moderate: shaly; slope.	Severe: slope	Moderate: bedrock at a depth of 1 to 1½ feet; slope.	Moderate: shaly.	Moderate: slope; shaly.	Severe: bedrock at a depth of 1 to 1½ feet; shaly; slope.	Severe: bedrock at a depth of 1 to 1½ feet.

TABLE 7.—*Limitations of the soils*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Buildings with basements	Lawns and landscaping	Streets and parking lots	Sanitary landfill (Trench)
Rainsboro:						
RaA	Severe: seasonal high water table; moderately slow permeability.	Slight	Moderate: seasonal high water table.	Slight	Moderate: seasonal high water table.	Moderate: seasonal high water table.
RaB	Severe: seasonal high water table; moderately slow permeability.	Moderate: slope.	Moderate: seasonal high water table.	Slight	Moderate: seasonal high water table; slope.	Moderate: seasonal high water table.
RaC	Severe: seasonal high water table; moderately slow permeability.	Severe: slope	Moderate: seasonal high water table; slope.	Moderate: slope.	Severe: slope	Moderate: seasonal high water table; slope.
Rayne:						
RnB	Moderate: bedrock at a depth of 3½ to 5 feet.	Moderate: slope; bedrock at a depth of 3½ to 5 feet; moderate permeability.	Moderate: bedrock at a depth of 3½ to 5 feet.	Slight	Moderate: slope.	Moderate: rippable bedrock at a depth of 3½ to 5 feet.
RnC	Moderate: bedrock at a depth of 3½ to 5 feet; slope.	Severe: slope	Moderate: slope; bedrock at a depth of 3½ to 5 feet.	Moderate: slope.	Severe: slope	Moderate: slope; bedrock at a depth of 3½ to 5 feet.
RpD	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope; bedrock at a depth of 1½ to 3½ feet.
Steff:						
Se	Severe: flooding; seasonal high water table.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Severe: flooding.
Sf	Moderate: seasonal high water table; flooding.	Severe: flooding.	Severe: flooding.	Slight	Moderate: seasonal high water table; flooding.	Severe: flooding.
Strip mines: Sm. Onsite investigation required.	Variable	Variable	Variable	Variable	Variable	Variable
Upshur:						
UgB	Severe: bedrock at a depth of 1½ to 3½ feet; slow permeability.	Severe: bedrock at a depth of 1½ to 3½ feet.	Moderate: bedrock at a depth of 1½ to 3½ feet; hazard of landslides in cuts.	Moderate: bedrock at a depth of 1½ to 3½ feet.	Moderate: slope; bedrock at a depth of 1½ to 3½ feet; hazard of landslides in cuts.	Severe: bedrock at a depth of 1½ to 3½ feet.
UgC	Severe: bed-	Severe: bedrock	Moderate: bed-	Moderate:	Severe: slope;	Severe: slope;

for community development—Continued

Camp areas		Buildings without basements	Paths and trails	Picnic areas	Playgrounds	Golf fairways
Tents and camp trailers	Travel trailers					
Moderate: moderately slow permeability.	Moderate: moderately slow permeability.	Slight	Slight	Slight	Moderate: seasonal high water table; moderately slow permeability.	Slight.
Moderate: moderately slow permeability.	Moderate: moderately slow permeability; slope.	Slight	Slight	Slight	Moderate: moderately slow permeability; slope; seasonal high water table.	Slight.
Moderate: moderately slow permeability; slope.	Severe: slope	Moderate: slope.	Slight	Moderate: slope.	Severe: slope	Moderate: slope.
Slight	Moderate: slope.	Slight	Slight	Slight	Moderate: slope.	Slight.
Moderate: slope.	Severe: slope	Moderate: slope.	Slight	Moderate: slope.	Severe: slope	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope; stony.	Severe: slope	Severe: slope	Severe: slope.
Moderate: flooding.	Moderate: flooding.	Severe: flooding.	Slight	Moderate: flooding.	Moderate: seasonal high water table; flooding.	Moderate: flooding.
Slight	Slight	Moderate: flooding.	Slight	Slight	Moderate: seasonal high water table.	Slight.
Variable: slope; coarse texture.	Variable: slope; coarse texture.	Variable: slope	Variable: slope; coarse texture.	Variable: slope; coarse texture.	Variable; slope; coarse texture.	Variable; slope; coarse texture.
Moderate: slow permeability.	Moderate: slow permeability; slope.	Slight	Slight	Slight	Moderate: slope; slow permeability.	Moderate: bedrock at a depth of 1½ to 3½ feet.
Moderate: slow permeability; slope.	Severe: slope	Moderate: slope.	Slight	Moderate: slope.	Severe: slope	Moderate: slope; bedrock at a depth of 1½ to 3½ feet.

TABLE 7.—*Limitations of the soils*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Buildings with basements	Lawns and landscaping	Streets and parking lots	Sanitary landfill (Trench)
UgD	Severe: slope; bedrock at a depth of 1½ to 3½ feet; slow permeability.	Severe: slope; bedrock at a depth of 1½ to 3½ feet.	Severe: slope; hazard of landslides in cuts.	Severe: slope	Severe: slope; hazard of landslides in cuts.	Severe: slope; bedrock at a depth of 1½ to 3½ feet.
UgE	Severe: slope; bedrock at a depth of 1½ to 3½ feet; slow permeability.	Severe: slope; bedrock at a depth of 1½ to 3½ feet.	Severe: slope; hazard of landslides in cuts.	Severe: slope	Severe: slope; hazard of landslides in cuts.	Severe: slope; bedrock at a depth of 1½ to 3½ feet.
Urban land:						
Ur Properties are variable. On-site investigation required.						
Weikert:						
WeB	Severe: bedrock at a depth of 1 to 1½ feet.	Severe: bedrock at a depth of 1 to 1½ feet; moderately rapid permeability.	Moderate: bedrock at a depth of 1 to 1½ feet.	Severe: bedrock at a depth of 1 to 1½ feet.	Moderate: slope; rippable bedrock at a depth of 1 to 1½ feet.	Severe: bedrock at a depth of 1 to 1½ feet.
[illegible]	Severe: bed-	Severe: slope;	Moderate:	Severe: bedrock	Severe: slope	Severe: bed-

for community development—Continued

Camp areas		Buildings without basements	Paths and trails	Picnic areas	Playgrounds	Golf fairways
Tents and camp trailers	Travel trailers					
Severe: slope	Severe: slope	Severe: slope	Moderate: slope.	Severe: slope	Severe: slope	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Moderate: shaly.	Moderate: shaly; slope.	Moderate: bedrock at a depth of 1 to 1½ feet.	Moderate: shaly.	Moderate: shaly.	Severe: bedrock at a depth of 1 to 1½ feet; shaly.	Severe: bedrock at a depth of 1 to 1½ feet.
Moderate: shaly; slope.	Severe: slope	Moderate: bedrock at a depth of 1 to 1½ feet; slope.	Moderate: shaly.	Moderate: shaly; slope.	Severe: bedrock at a depth of 1 to 1½ feet; slope; shaly.	Severe: bedrock at a depth of 1 to 1½ feet.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope; shaly; bedrock at a depth of 1 to 1½ feet.	Severe: slope; bedrock at a depth of 1 to 1½ feet.
Moderate: slow permeability.	Moderate: slow permeability; slope.	Slight	Slight	Slight	Moderate: seasonal high water table; slow permeability.	Slight.
Moderate: slow permeability; slope.	Severe: slope	Moderate: slope.	Slight	Moderate: slope.	Severe: slope	Moderate: slope.
Moderate: slow permeability.	Moderate: slow permeability; slope.	Slight	Slight	Slight	Moderate: slope; seasonal high water table; slow permeability; bedrock at a depth of 1½ to 3½ feet.	Moderate: bedrock at a depth of 1½ to 3½ feet.

TABLE 7.—*Limitations of the soils*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Buildings with basements	Lawns and landscaping	Streets and parking lots	Sanitary landfill (Trench)
WtC	Severe: bedrock at a depth of 1½ to 3½ feet; seasonal high water table; slow permeability.	Severe: slope; bedrock at a depth of 1½ to 3½ feet.	Moderate: bedrock at a depth of 1½ to 3½ feet; seasonal high water table.	Moderate: slope; bedrock at a depth of 1½ to 3½ feet.	Severe: slope	Severe: bedrock at a depth of 1½ to 3½ feet; slope.
WtD	Severe: slope; bedrock at a depth of 1½ to 3½ feet; slow permeability; seasonal high water table.	Severe: slope; bedrock at a depth of 1½ to 3½ feet.	Severe: slope	Severe: slope	Severe: slope	Severe: slope; bedrock at a depth of 1½ to 3½ feet.
WvB	Severe: seasonal high water table; slow permeability.	Moderate: slope; bedrock at a depth of 3½ to 6 feet.	Severe: seasonal high water table; hazard of landslides in cuts.	Moderate: seasonal high water table.	Moderate: seasonal high water table; slope; hazard of landslides in cuts.	Severe: seasonal high water table.
WvC	Severe: seasonal high water table; slow permeability.	Severe: slope	Severe: seasonal high water table; hazard of landslides in cuts.	Moderate: slope; seasonal high water table.	Severe: slope; hazard of landslides in cuts; seasonal high water table.	Severe: seasonal high water table.
WvD	Severe: slope; slow permeability; seasonal high water table.	Severe: slope	Severe: slope; seasonal high water table; hazard of landslides in cuts.	Severe: slope	Severe: slope; seasonal high water table; hazard of landslides in cuts.	Severe: slope; seasonal high water table.

Crooked Creek Reservoir, 200 feet west of the main parking lot:

Ap—0 to 9 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; friable, nonsticky and slightly plastic; 10 percent coarse fragments; very strongly acid; clear, smooth boundary.

B2t—9 to 40 inches, brown (7.5YR 5/4) heavy loam; moderate, medium, subangular blocky structure; friable, slightly sticky and slightly plastic; thin, discontinuous clay films on peds; 5 percent coarse fragments; very strongly acid; clear, smooth boundary.

IIC1—40 to 52 inches, yellowish-brown (10YR 5/4) very gravelly loam; massive; friable, nonsticky and nonplastic; some black staining; 65 percent coarse fragments; very strongly acid; abrupt, smooth boundary.

IIIC2—52 to 84 inches, gray (10YR 5/1) very shaly clay; massive; firm, sticky and plastic; 75 percent coarse fragments; very strongly acid.

The solum is 30 to 40 inches thick. The depth to the IIIC horizon ranges from 40 to 72 inches or more. Coarse fragments make up as much as 10 percent of the A and B horizons and as much as 75 percent of the C horizons. The Ap horizon is brown or dark brown to dark grayish brown. The B horizon ranges from strong brown to dark yellowish brown and is heavy loam or sandy clay loam. The IIC horizon ranges from clay loam and sandy loam to very gravelly loam.

Allegheny soils are associated with the moderately well drained Rainsboro soils. Drainage of the Allegheny soils is similar to that of the Hazleton, Rayne, Gilpin, and Weikert soils, but all of those soils are on uplands.

A1B—Allegheny silt loam, 3 to 8 percent slopes. This soil has the profile described as representative of the series. Areas of this soil range from 10 to 35 acres. Surface runoff is medium, and the hazard of erosion is moderate if the soil is cultivated.

Included with this soil in mapping were a few areas of a sandy loam soil and of nearly level Allegheny soils.

This soil is suited to the crops grown in the county. Except for the erosion hazard, this soil has few limitations for most uses. Capability unit IIe–1.

A1C—Allegheny silt loam, 8 to 15 percent slopes. This soil is similar to the one described as representative of the series, but its surface layer is about 6 inches thick.

for community development—Continued

Camp areas		Buildings without basements	Paths and trails	Picnic areas	Playgrounds	Golf fairways
Tents and camp trailers	Travel trailers					
Moderate: slow permeability; slope.	Severe: slope	Moderate: slope.	Slight	Moderate: slope.	Severe: slope	Moderate: slope; bedrock at a depth of 1½ to 3½ feet.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope.	Severe: slope	Severe: slope	Severe: slope.
Moderate: slow permeability; seasonal high water table; moderately fine textured surface layer.	Moderate: slow permeability; slope; seasonal high water table; moderately fine textured surface layer.	Moderate: seasonal high water table.	Moderate: moderately fine textured surface layer; seasonal high water table.	Moderate: moderately fine textured surface layer; seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table.
Moderate: slow permeability; slope; seasonal high water table; moderately fine textured surface layer.	Severe: slope	Moderate: slope; seasonal high water table.	Moderate: moderately fine textured surface layer; seasonal high water table.	Moderate: moderately fine textured surface layer; slope; seasonal high water table.	Severe: slope; seasonal high water table.	Moderate: slope; seasonal high water table.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope; seasonal high water table; moderately fine textured surface layer.	Severe: slope	Severe: slope; seasonal high water table.	Severe: slope.

Areas of this soil range from 6 to 20 acres and are irregular in shape. Surface runoff is medium, and the hazard of erosion is moderate to high if the soil is cultivated.

Included with this soil in mapping were a few areas of Rainsboro soils and a few areas of a soil that has a sandy loam profile.

This soil is suited to the crops grown in the county and to hay, pasture, trees, and wildlife. Slope is a limitation for many uses. Capability unit IIIe–1.

Cavode Series

The Cavode series consists of deep, somewhat poorly drained, gently sloping to moderately steep soils. These soils are on uplands on ridgetops, benches, and some foot slopes. They formed in material that weathered from acid clay shale interbedded with some thin siltstone. The native vegetation is mixed hardwoods that include red oak, black oak, white oak, and red maple.

In a representative profile, in a wooded area, the surface layer is very dark brown silt loam about 5 inches thick. It is covered with a 2-inch mat of decaying leaves and twigs. The subsoil extends to a depth of 30 inches. The upper 7 inches of the subsoil is mottled, yellowish-brown, friable silty clay loam. The middle part is mottled, light brownish-gray, firm silty clay loam about 14 inches thick. The lower 4 inches is mottled, light brownish-gray, friable shaly silty clay loam. The substratum, at a depth of 30 to 48 inches, is gray, firm shaly silty clay loam. Acid, gray shale is at a depth of about 48 inches.

The available moisture capacity is moderate, and permeability is slow. A seasonal water table rises to within 6 to 18 inches of the surface in wet periods. Seep areas and wet-weather springs are common. If they are adequately drained, these soils are suited to most of the crops grown in the county. Many areas of these soils have been cleared and are used for crops. Other areas are wooded or are idle and reverting to

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

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Allegheny silt loam, 3 to 8 percent slopes	1,180	0.3	Rayne-Gilpin very stony silt loams, 8 to 25 percent slopes	1,290	.3
Allegheny silt loam, 8 to 15 percent slopes	2,920	.7	Steff loam	5,520	1.3
Cavode silt loam, 3 to 8 percent slopes	9,860	2.4	Steff loam, high bottom	850	.2
Cavode silt loam, 8 to 15 percent slopes	7,660	1.8			

soil that has many stones scattered on the surface. These areas are indicated on the detailed soil map by the symbol for very stony areas. Also included were small areas of Wharton soils.

This soil is suited to crops that tolerate wetness and to trees and wildlife. Artificial drainage can make it suitable for a wider range of crops. A seasonal water table and slow permeability are limitations for many uses. Capability unit IIIw–2.

CaC—Cavode silt loam, 8 to 15 percent slopes. This soil has a profile similar to the one described as representative of the series, but it is not so deep to bedrock. Areas of this soil range from 6 to 20 acres, are irregular in shape, and are on benches and side slopes. Surface runoff is medium, and the erosion hazard is moderate if the soil is cultivated.

Included with this soil in mapping were a few areas of soils that are medium acid to neutral in the substratum. Also included were some areas of a Cavode soil that has many stones scattered on the surface. These areas are shown on the soil map by the symbol for very stony areas. Also included were small areas of Wharton soils.

This soil is suited to crops that tolerate wetness and to trees and wildlife. Artificial drainage increases the range of suitable crops. A seasonal water table and slow permeability are limitations for many uses. Capability unit IIIe–4.

depths of 50 and 74 inches or more, is yellowish-brown, firm shaly silt loam.

The available moisture capacity is moderate, and permeability is moderately slow. A seasonal water table rises to within 18 to 36 inches of the surface in wet periods. If these soils are adequately drained, they are suited to most of the crops grown in the county. Most areas of these soils have been cleared and are used for crops. A few areas are wooded or are idle and reverting to woodland. The seasonal water table, moderately slow permeability, and slope are limitations for many uses.

Representative profile of Ernest silt loam, 8 to 15 percent slopes, in a pasture 2½ miles north of Spring Church at the intersection of Routes T460 and T349:

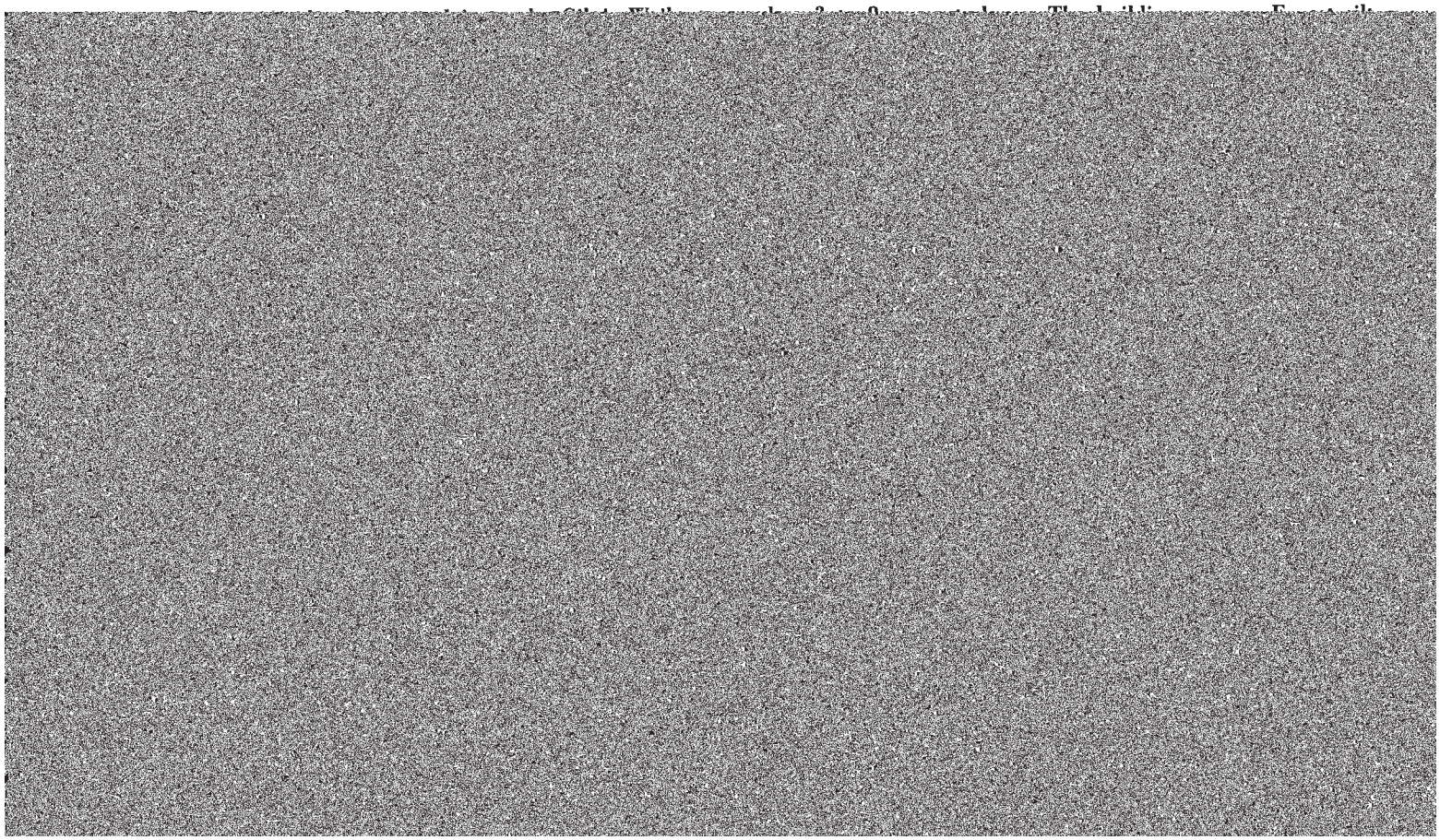
Ap—0 to 8 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; friable, slightly sticky and slightly plastic; 5 percent coarse fragments; very strongly acid; clear, smooth boundary.

B1t—8 to 15 inches, yellowish-brown (10YR 5/4) heavy silt loam; moderate, medium and fine, subangular blocky structure; friable, sticky and plastic; thin, discontinuous clay films on peds; 5 percent shale fragments; very strongly acid; clear, wavy boundary.

B2t—15 to 24 inches, strong-brown (7.5YR 5/6) light silty clay loam; few, medium, faint, yellowish-brown (10YR 5/6) and pinkish-gray (7.5YR 6/2) mottles; moderate, medium and coarse, subangular blocky structure; friable, sticky and plastic; thick, continuous clay films on peds; 10 percent shale

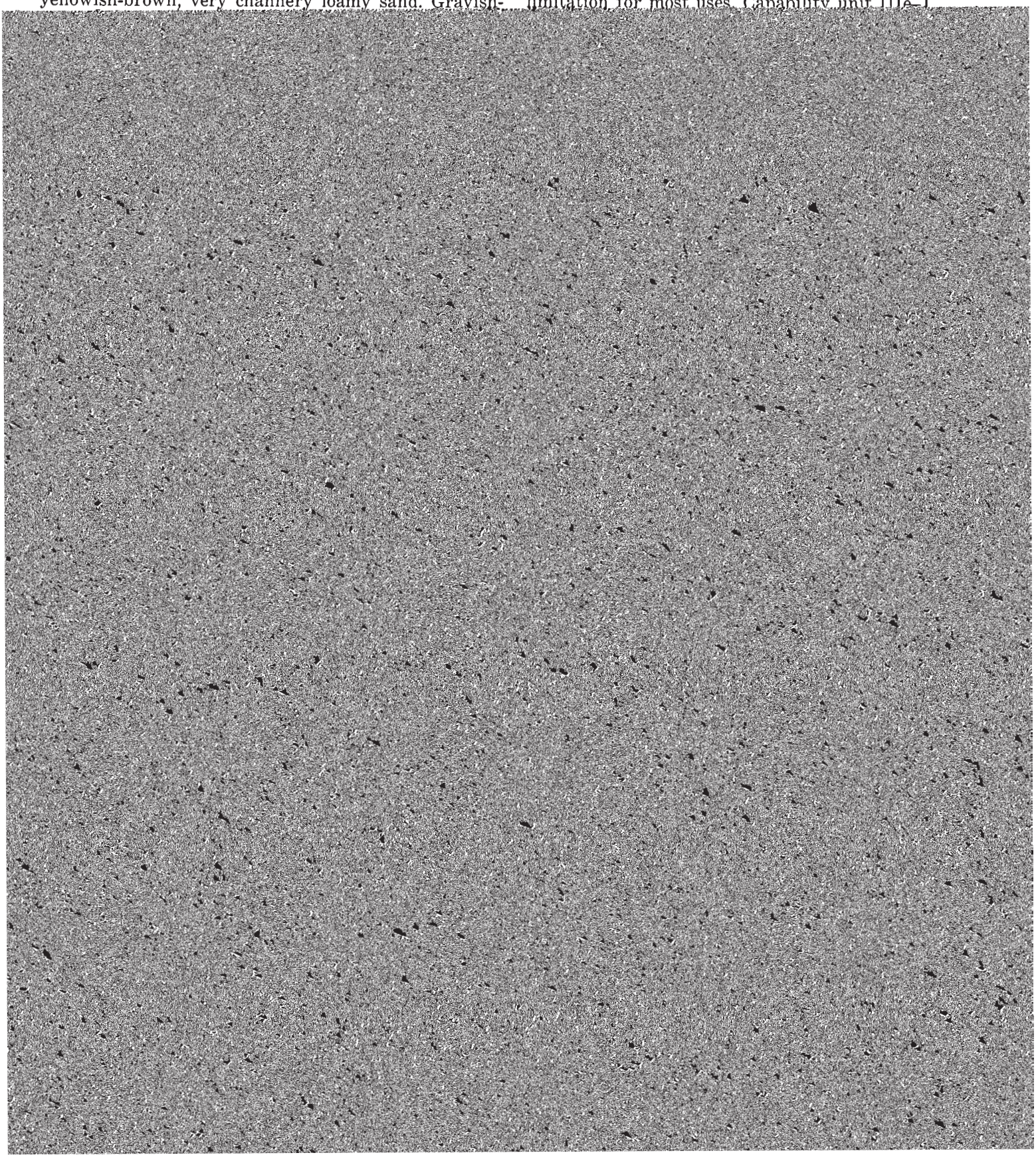
the series, but its depth to bedrock is generally 4 to 8 inches less and it has more coarse fragments in the sub-

friable shaly silt loam 8 inches thick. Grayish-brown, [illegible]



it is yellowish-brown, friable very channery loam. The substratum extends to a depth of 48 inches; it is yellowish-brown, very channery loamy sand. Gravish-

This soil is suited to most of the crops grown in the county and to trees and wildlife. Slope is the major limitation for most uses. Capability unit IIIe-1.



firm, slightly sticky and slightly plastic; neutral; abrupt, smooth boundary.

B21g—9 to 22 inches, grayish-brown (10YR 5/2) silty clay (7.5YR 5/6) mottles; moderate, medium and coarse, loam; many, medium, prominent, strong-brown (7.5YR 5/6) mottles; moderate, medium and coarse, prismatic structure; firm, slightly sticky and plastic; a few 3- and 4-inch-wide pockets of material from the Ap horizon in the upper part; medium acid; clear, wavy boundary.

B22g—22 to 35 inches, grayish-brown (10YR 5/2) silty clay loam; many, medium, prominent, strong-brown (7.5YR 5/6) mottles; weak, coarse, prismatic structure; firm, sticky and plastic; slightly acid; clear, wavy boundary.

C1g—35 to 44 inches, grayish-brown (10YR 5/2) clay loam; many, medium, strong-brown (7.5YR 5/6) mottles; massive; firm, sticky and plastic; slightly acid; clear, wavy boundary.

C2g—44 to 52 inches, grayish-brown (10YR 5/2) loam; many, medium, prominent, strong-brown (7.5YR 5/6) mottles; massive; firm, slightly sticky and plastic; slightly acid; clear, wavy boundary.

IIC3—52 to 60 inches, dark-brown (10YR 4/3) very gravelly sandy clay loam; many, medium, distinct, grayish-brown (10YR 5/2) and strong-brown (7.5YR 5/6) mottles; massive; friable, slightly sticky and plastic; few, thin, discontinuous clay films in pores and few thin patches on top of pebbles; common black coatings; 70 percent coarse fragments; neutral.

The solum is 25 to 40 inches thick. The depth to bedrock ranges from 4 to more than 20 feet. Reaction is medium acid to neutral in the upper part of the solum, and slightly acid or neutral in the loam part and in the C horizon. The Ap horizon ranges from dark gray to dark brown and is 6 to 10 inches thick. The B horizon ranges from dark gray to grayish-brown, and from silt loam to silty clay loam. The

Pope Series

The Pope series consists of deep, well-drained, nearly level soils on flood plains. These soils formed in alluvium that derived from shale, siltstone, and sandstone. The native vegetation is mixed hardwoods, mainly oaks, maple, tulip-poplar, and black cherry and some hemlock and white pine.

In a representative profile, in a cultivated area, the surface layer is dark yellowish-brown loam about 8 inches thick. The subsoil is yellowish brown; between depths of 8 and 26 inches it is friable loam and between depths of 26 and 42 inches it is very friable fine sandy loam. The substratum is brown, loose gravelly loamy sand that extends to a depth of 60 inches.

The available moisture capacity is high, and permeability is moderately rapid. These soils are well suited to all crops grown in the county, especially truck crops and other specialty crops. Most areas of these soils have been cleared and are used for crops, urban development, hay, pasture, and recreation, but a few areas are idle. Flooding by stream overflow limits these soils for many uses.

Representative profile of Pope loam, in an abandoned field, 1 mile northwest of Washington along Buffalo Creek:

Ap—0 to 8 inches, dark yellowish-brown (10YR 4/4) loam; weak, fine, granular structure; very friable, nonsticky and slightly plastic; many roots; 5 percent gravel; strongly acid; abrupt, smooth boundary.

B21—8 to 26 inches, yellowish-brown (10YR 5/4) loam;

Po—Pope loam. This soil has the profile described as representative of the series. It is on the flood plains in areas that are 4 to 8 acres in size. Surface runoff is slow, and the erosion hazard is slight.

Included in mapping were a few small areas of mod-

firm in place, friable when displaced, slightly sticky and slightly plastic; moderately thick clay films on ped faces; few thin iron and manganese coatings; strongly acid; clear, smooth boundary.

Bx1—28 to 40 inches, yellowish-brown (10YR 5/6) silt loam; few, fine, faint, strong-brown (7.5YR 5/6) and pale-brown (10YR 6/3) mottles; nishish gray

RaB—Rainsboro silt loam, 3 to 8 percent slopes. This soil has a profile similar to the one described as representative of the series, but its surface layer is about 2 inches thiner. It is on undulating terraces in areas 8 to 35 acres in size. Runoff is medium, and the erosion hazard is moderate if the soil is cultivated.

Included in mapping were some areas of Allegheny soils. Also included were some areas of a soil that is in depressions and has a seasonal water table that rises to within 10 to 18 inches of the surface.

This soil is suited to crops that tolerate some wetness and to trees and wildlife. Artificial drainage can make it suitable for a wider range of crops. The seasonal water table and moderately slow permeability are limitations for many uses. Capability unit IIe–3.

RaC—Rainsboro silt loam, 8 to 15 percent slopes. This soil has a profile similar to the one described as representative of the series, but its surface layer is about 2 inches thinner. Areas of this soil are 6 to 20 acres in size and are narrow and irregular in shape. Runoff is medium, and the erosion hazard is moderate if the soil is cultivated.

Included with this soil in mapping were some areas of gently sloping Rainsboro soils.

This soil is suited to crops that tolerate seasonal wetness and to trees and wildlife. Artificial drainage can make it suitable for a wider range of crops. A seasonal water table, slope, and moderately slow permeability are limitations for most uses. Capability unit IIIe–4.

Rayne Series

The Rayne series consists of deep, well drained, gently sloping to moderately steep soils on uplands. These soils formed in material that weathered from interbedded shale, siltstone, and some fine-grained sandstone. They are mainly on ridgetops, but also occur on hillsides. The native vegetation is mixed hardwoods, mainly oaks and red maple and some black cherry, ash, and tulip-poplar.

In a representative profile, in a cultivated area, the surface layer is dark-brown silt loam about 6 inches thick. The subsoil is dark yellowish-brown, friable and firm shaly silt loam about 32 inches thick. The substratum, from a depth of 38 to about 60 inches, is dark yellowish-brown, firm very shaly silt loam. Rippable shale bedrock is at a depth of about 60 inches.

The available moisture capacity and permeability are moderate. Most areas of these soils have been cleared and are used for crops, hay, and pasture. A few areas are wooded or are idle. Slope is a limitation for some uses.

shaly silt loam; moderate, medium and coarse, subangular blocky structure; friable, sticky and plastic; few fine roots; thin, discontinuous clay films on ped faces; 20 percent very fine shale fragments; strongly acid; gradual, wavy boundary.

B3t—25 to 38 inches, dark yellowish-brown (10YR 4/4) shaly silt loam; moderate, medium and coarse, subangular blocky structure; firm, slightly sticky and plastic; few fine roots; thin, discontinuous clay films in old pores; 40 percent very fine shale fragments; very strongly acid; diffuse, wavy boundary.

C—38 to 60 inches, dark yellowish-brown (10YR 4/4) very shaly silt loam; massive; firm, slightly sticky and plastic; 80 percent very fine shale fragments; very strongly acid; gradual, wavy boundary.

R—60 inches +, grayish-brown, rippable shale bedrock.

The solum is 36 to 50 inches thick. The depth to rippable bedrock is 40 to 60 inches. Coarse fragments increase with depth. They make up 5 to 15 percent of the Ap and B1 horizons, 10 to 40 percent of the B2t and B3 horizons, and 20 to 80 percent of the C horizon. The Ap horizon is dark grayish brown to brown. The B horizon ranges from yellowish brown to dark yellowish brown and from channery or shaly loam to silty clay loam. The fine earth in the C horizon is silt loam or loam.

Rayne soils are near the moderately deep, well drained Gilpin soils; the shallow, well drained Weikert soils; the deep, moderately well drained Wharton soils; and the deep, somewhat poorly drained Cavode soils. Drainage of the Rayne soils is similar to that of the Hazleton soils. Hazleton soils have a sandy loam B horizon, which the Rayne soils lack.

RnB—Rayne silt loam, 3 to 8 percent slopes. This soil has a profile similar to the one described as representative of the series, but its surface layer is about 2 inches thicker. It is on ridgetops in areas 4 to 35 acres in size. Surface runoff is medium, and the erosion hazard is moderate if the soil is cultivated.

Included with this soil in mapping were a few acres of nearly level Rayne soils and a few areas of Gilpin soils. Also included were some areas of a soil that is medium acid.

This soil is suited to the crops commonly grown in the county and to trees and wildlife. It has few limitations for most uses. Capability unit IIe–1.

RnC—Rayne silt loam, 8 to 15 percent slopes. This soil has the profile described as representative of the series. It is on ridges and benches in irregularly shaped areas that are 4 to 12 acres in size. Surface runoff is medium, and the erosion hazard is moderate if the soil is cultivated.

Included with this soil in mapping were a few areas of Gilpin soils and a few areas of a soil that has a medium acid substratum.

This soil is suited to most of the crops grown in the county and to trees and wildlife. Slope is a limitation for some uses. Capability unit IIIe–1.

RpD—Rayne-Gilpin very stony silt loams, 8 to 25

face runoff is medium to high, and the hazard of erosion is moderate to high if the soils are cleared.

Included with these soils in mapping were a few areas of Weikert soils and Wharton soils.

Soils of this complex are suited to pasture, trees, and wildlife. Slope and stoniness are limitations of the Berrc

5/6) and light brownish-gray (10YR 6/2) mottles; moderate, coarse, prismatic structure parting to moderate, coarse and medium, blocky; friable, slightly sticky and slightly plastic; strongly acid; gradual, wavy boundary.

B23—25 to 33 inches, dark-brown (10YR 4/3) silt loam; many, medium, distinct, light brownish-gray (10YR

Strip Mines

Sm—Strip mines. This land type consists of sandstone, boulders, fractured shale, and some soil material that has been disturbed by mining operations. It ranges from nearly level to very steep.

In mining, to get to the underlying minerals, the overburden of soil material and bedrock is removed and piled high. Most strip mine areas are now being graded and revegetated, but many older mine areas have been left unprotected. Revegetating most strip mines is difficult because of the acid reaction, low fertility, and low available moisture capacity of the spoil material. Most stripmining is for the removal of coal, but several areas are mined for limestone. These areas generally are not so acid as the coal areas, and a few have been returned to farming. Strip mines, however, generally are best suited to watershed protection and wildlife habitat. Not placed in a capability unit.

Upshur Series

The Upshur series consists of deep, well-drained, gently sloping to steep soils on uplands. These soils formed in material that weathered from neutral or alkaline red clay shale. Most areas of Upshur soils are affected by the neutral or alkaline underlying material and, except for the Vandergrift soils, are less acid in the substratum than other soils on uplands in Armstrong County. The native vegetation consists of mixed hardwoods, mainly oaks, red maple, and black cherry and some hickory. Locust trees are common in idle areas.

In a representative profile, in a pine plantation, the surface layer is dark-brown silt loam about 6 inches thick. It is covered by a one-inch layer of decaying leaves and twigs. The subsoil is reddish-brown, firm silty clay that extends to a depth of 36 inches. The substratum, between depths of 36 and 58 inches, is reddish-brown, firm very shaly silty clay. Red shale bedrock is at a depth of about 58 inches.

percent shale fragments; medium acid; clear, wavy boundary.

R—58 inches +, red shale bedrock.

The solum is 26 to 42 inches thick. The depth to bedrock ranges from 40 to 72 inches. The Ap horizon is dark brown to reddish brown. The B horizon is weak-red to dark reddish-brown silty clay or clay.

Upshur soils are near the moderately deep, well drained Gilpin soils, the moderately well drained to somewhat poorly drained Vandergrift soils, and the moderately well drained Wharton soils. They are similar in drainage to the Hazleton, Rayne, Gilpin, and Weikert soils. Compared with the Upshur soils, however, Hazleton soils have more sand and less silt and are more yellow; Weikert soils are less than 20 inches deep to bedrock; and Gilpin soils have bedrock within a depth of 40 inches and more yellow hues.

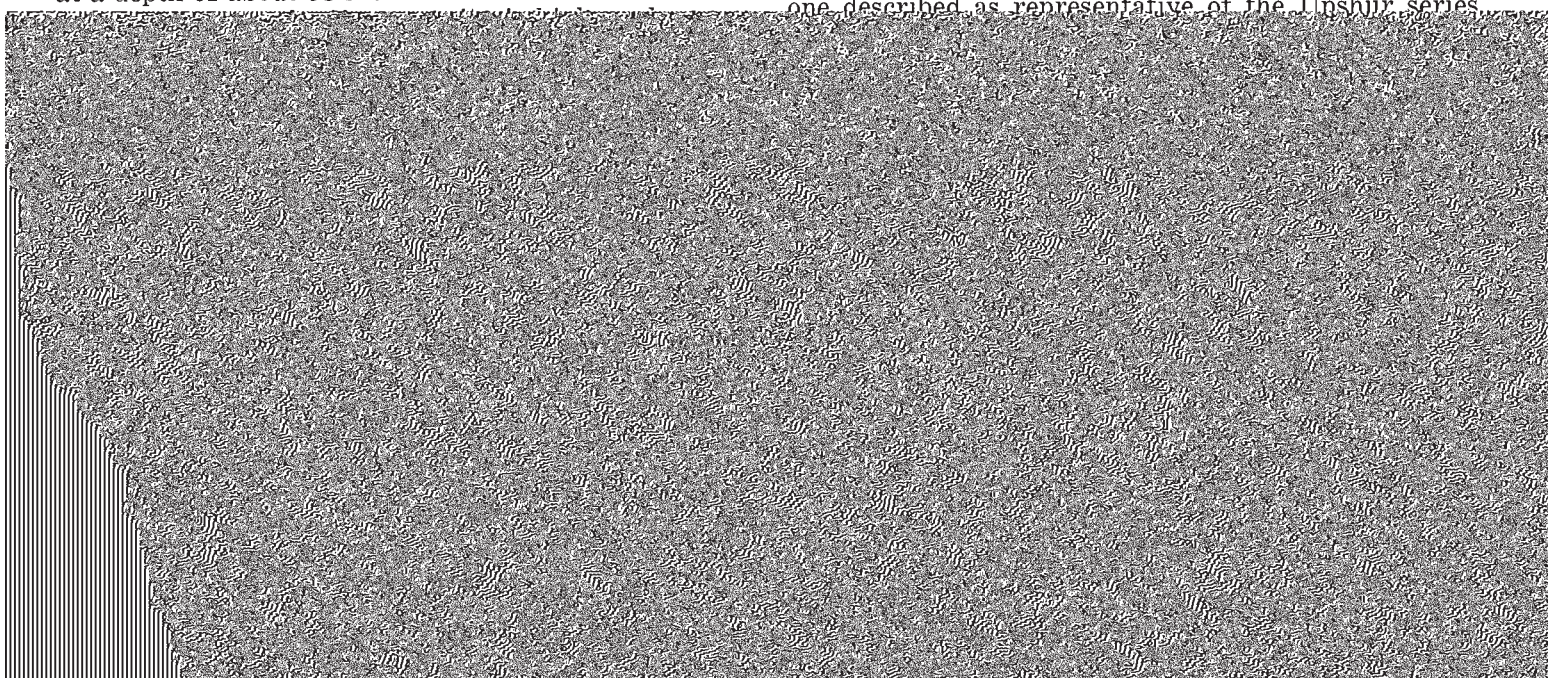
In Armstrong County, Upshur soils are mapped in complexes with Gilpin silt loam.

UgB—Upshur-Gilpin silt loams, 3 to 8 percent slopes. The soils of this mapping unit are so intermingled that it was neither practical nor feasible to map them separately. The Upshur soil makes up about 50 percent of the complex. It has a profile similar to the one described as representative of the Upshur series, but its surface layer and subsoil are generally thicker. The Gilpin soil makes up about 40 percent of the complex. It has a profile similar to the one described as representative of the Gilpin series, but its surface layer is 6 to 8 inches thick. These soils are on ridges and benches in areas that cover 6 to 35 acres. Runoff is medium, and the erosion hazard is moderate if the soils are cultivated.

Included with these soils in mapping were some areas of Weikert soils.

Soils of this complex are suited to most crops grown in the county, but they are difficult to manage if farmed because the Upshur soil has a silty clay or clay subsoil. The soils are also suited to trees and wildlife. Slow permeability is the major limitation for most uses. Capability unit IIIe–3.

UgC—Upshur-Gilpin silt loams, 8 to 15 percent slopes. The soils of this mapping unit are so intermingled that it was neither practical nor feasible to map them separately. The Upshur soil makes up about 50 percent of the complex. It has a profile similar to the one described as representative of the Upshur series,



file similar to the one described as representative of the Gilpin series, but it is not so deep to bedrock. These soils are on hillsides in areas that cover 6 to 35 acres. Runoff is rapid, and the hazard of erosion is high if the soils are cultivated.

Included with these soils in mapping were some areas of Weikert soils.

Soils of this complex are suited to hay, pasture, trees, and wildlife. Slope and slow permeability are limitations for most uses. Capability unit VIe–1.

UgE—Upshur-Gilpin silt loams, 25 to 35 percent slopes. The soils of this mapping unit are so intermingled that it was neither practical nor feasible to map them separately. The Upshur soil makes up about 40 percent of the complex. It has a profile similar to the one described as representative of the Upshur series, but it is generally 10 to 18 inches less deep to bedrock. The Gilpin soil makes up about 50 percent of the complex. It has a profile similar to the one described as representative of the Gilpin series, but it is generally 8 to 14 inches less deep to bedrock. These soils are on hillsides in narrow areas that range from 10 to 60 acres in size. Runoff is rapid, and the hazard of erosion is high if the soils are cultivated.

Included with these soils in mapping were some areas of very steep soils and some areas of Weikert soils.

Soils of this complex are suited to trees and wildlife. Slope and the hazard of erosion are the major limitations for most uses. Capability unit VIIe–1.

Urban Land

Ur—Urban land. Urban land consists of nearly level or gently sloping areas, generally in the larger towns of the county, where buildings and other structures make it difficult or impossible to identify the soils. These areas include land used for buildings, roads, parking lots, shopping centers, schools, and factories. Most of the land has been smoothed and the original soils disturbed, filled, removed, or covered during construction. Most areas are on stream terraces or flood plains, but some are on uplands. Not placed in a capability unit.

Vandergrift Series

The Vandergrift series consists of deep, moderately well drained and somewhat poorly drained, gently sloping to moderately steep soils. These soils formed in material that weathered from nonacid, red and gray shale and siltstone. They are mainly on ridgetops and side slopes of the dissected uplands. The native vegetation consists of mixed hardwoods, mainly red oak, black oak, white oak, locust, walnut, black cherry, ash, and tulip-poplar.

In a representative profile, in a cultivated field, the plow layer is dark yellowish-brown silty clay loam about 9 inches thick. The subsoil extends to a depth of 56 of 66 inches. It is mottled, brownish-yellow, friable shaly silty clay loam. Shale and siltstone are below that.

The available moisture capacity is high, and permeability is slow. A seasonal water table rises to within 6 to 24 inches of the surface in wet periods. If the soils are adequately drained, they are suited to many of the crops grown in the county. Many areas of these soils have been cleared and are used for crops, hay and pasture. Some areas are wooded or are idle and reverting to woodland. The seasonal water table, slow permeability, and slope are limitations for many uses. Also, these soils are subject to slipping and sliding, particularly if the natural slope is disturbed.

Representative profile of Vandergrift silty clay loam, in an area of Wharton-Vandergrift complex, 3 to 8 percent slopes, in a cultivated field 2½ miles south of Dayton and ½ mile west of the intersection of Routes T547 and 03128 [Sample No. S68–Pa–03–9 (1–9) in tables 10 and 11 in the section "Laboratory Data." Engineering data are reported in table 5 under Pennsylvania reports 68–20507 and 68–20508]:

Ap—0 to 9 inches, dark yellowish-brown (10YR 3/4) silty clay loam; pale brown (10YR 6/3) when dry; weak, fine and medium, granular structure; friable to firm, slightly sticky and slightly plastic; 4 percent soft shale chips; medium acid; clear, wavy boundary.

B1—9 to 14 inches, brown (7.5YR 4/4) silty clay loam; weak, fine, subangular blocky structure; friable, sticky and plastic; 5 percent coarse fragments of sandstone and shale; medium acid; clear, wavy boundary.

B21t—14 to 21 inches, dark-red (2.5YR 3/6) silty clay; strong, fine and medium, blocky structure; firm, sticky and plastic; thin, continuous clay films on ped faces and lining the pores; 4 percent coarse fragments; strongly acid; gradual, wavy boundary.

B22t—21 to 34 inches, red (10R 4/6) and dark-red (2.5YR 3/6) silty clay; few, fine, prominent, light-gray (10YR 6/1), light brownish-gray (10YR 6/2), and pale-brown (10YR 6/3) mottles; weak, coarse, blocky structure parting to moderate, very fine, blocky; firm, sticky and plastic; common, thin, clay films on ped faces and lining the pores; strongly acid; diffuse, wavy boundary.

B23t—34 to 46 inches, red (10R 4/6) and dusky-red (10R 3/4) silty clay; few, fine, prominent, light-gray (10YR 7/1) mottles; weak, coarse, blocky structure parting to weak, very fine, blocky; firm, slightly sticky and plastic; common thin clay films on ped faces; strongly acid; gradual, wavy boundary.

B24t—46 to 56 inches, dusky-red (10R 3/4) silty clay; common, fine, prominent, light-gray (5Y 7/1) and yellowish-brown (10YR 5/8) mottles; weak, coarse, blocky structure parting to weak, very fine, blocky; firm, slightly sticky and plastic; few thin clay films on ped faces and in pores; medium acid; clear, wavy boundary.

C—56 to 66 inches, brownish-yellow (10YR 6/6) shaly silty clay loam; common, fine, prominent, reddish-brown (5YR 4/3) and light-gray (5Y 7/1) mottles and common black specks; massive to weak, thin, platy structure; friable, slightly sticky and plastic; clay films line pores and root channels; common black coatings; 15 percent shale chips; medium acid;

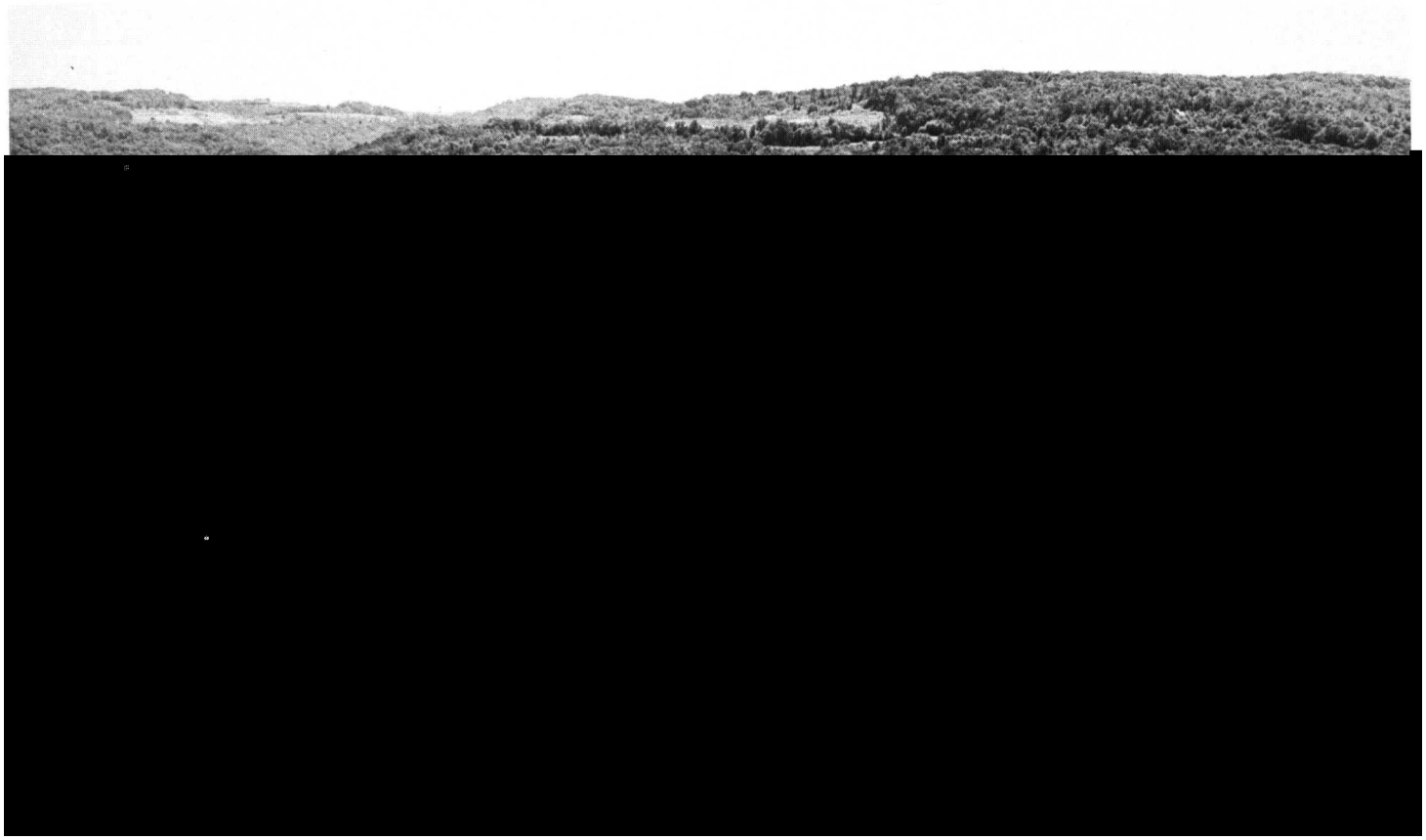


Figure 12.—**Typical landscape of Weikert soils. Mahoning Reservoir is on the left.**

dark yellowish brown to dark reddish brown. The B horizon ranges from dark reddish brown to weak red or dusky red and is silty clay loam, silty clay, or clay. Mottles with

yellowish-brown, very friable, very shaly silt loam. Rippable shale bedrock is at a depth of about 18 inches.

The available moisture capacity is very low, and per

The solum is 8 to 18 inches thick. The depth to bedrock is 12 to 20 inches. Coarse fragments make up 20 to 50 percent of the A and B horizons and as much as 80 percent of the C horizon. In some places there is an Ap horizon that is dark grayish brown to brown. The B horizon ranges from dark yellowish brown to strong brown and from shaly silt loam to channery loam. The C horizon ranges from shaly silt loam to very channery loam.

Weikert soils are near the deep, well drained Rayne and Hazleton soils; the moderately deep, well drained Gilpin soils; the deep, moderately well drained Wharton soils; and the deep, somewhat poorly drained Cavode soils.

WeB—Weikert shaly silt loam, 3 to 8 percent slopes. This soil is similar to the one described as representative of the series, but it has a plow layer about 8 inches thick. It is on ridges and knolls in areas that range from 4 to 12 acres in size. Surface runoff is medium, and the erosion hazard is moderate if the soil is cultivated.

Included with this soil in mapping were a few areas of Gilpin soils and a few small areas of Weikert soils that have coarse fragments of thin, flat sandstone or siltstone in the surface layer.

This soil is suited to crops that tolerate droughtiness and to hay, pasture, trees, and wildlife. Shallowness to bedrock limits this soil for most uses. Capability unit IIIe–2.

WeC—Weikert shaly silt loam, 8 to 15 percent slopes. This soil has the profile described as representative of the series. It is on ridgetops and hillsides in irregularly shaped areas that range from 8 to 25 acres in size. Surface runoff is rapid and the erosion hazard is moderate to high if the soil is cultivated.

Included with this soil in mapping were a few areas of Gilpin soils and a few areas of Weikert soils that have coarse fragments of thin, flat sandstone or siltstone in the surface layer.

This soil is suited to limited cultivation of crops that tolerate some droughtiness and to hay, pasture, trees, and wildlife. Shallow depth to bedrock and slope are limitations for many uses. Capability unit IVe–2.

WkF—Weikert and Gilpin soils, 25 to 70 percent

Wharton Series

The Wharton series consists of deep, moderately well drained, gently sloping to moderately steep soils on uplands. These soils formed in material that weathered from acid clay shale interbedded with siltstone. They are mainly on ridgetops, benches, and concave hillsides. The native vegetation consists of mixed hardwoods, mainly red oak, black oak, scarlet oak, and white oak and some black cherry, tulip-poplar, and ash.

In a representative profile, in a cultivated area, the plow layer is dark-brown, friable silt loam about 8 inches thick. The subsoil extends to a depth of about 52 inches. In the upper 3 inches the subsoil is yellowish-brown, friable heavy silt loam; below that, in the next 12 inches, it is yellowish-brown, friable silty clay loam. Next, it is mottled, yellowish-brown, firm silty clay loam for about 8 inches, and in the lowermost part, which is about 21 inches thick, it is mottled, brown, firm silty clay. The substratum, between depths of 52 and 58 inches, is dark grayish-brown, firm very shaly silty clay. Shale bedrock is at a depth of about 58 inches.

The available moisture capacity is high, and permeability is slow. A seasonal water table rises to within 18 to 36 inches of the surface in wet periods. If the soils are adequately drained, they are suited to most of the crops grown in the county. Most areas of these soils have been cleared and are used for crops. A few areas are wooded or are idle and reverting to woodland. The seasonal water table, slow permeability, and slope are limitations for many uses.

Representative profile of Wharton silt loam, 8 to 15 percent slopes, in a cultivated field, 2½ miles northeast of Washington, ½ mile north of intersection of Routes T437 and T416:

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; friable, slightly sticky and slightly plastic; strongly acid; abrupt, smooth boundary.

B1—8 to 11 inches, yellowish-brown (10YR 5/4) heavy silt loam; moderate, medium and fine, subangular

Ap horizon is dark grayish brown to brown. The matrix of the B horizon ranges from strong brown or brown to yellowish brown and the soil material ranges from clay loam to silty clay.

Wharton soils are on the same landscape as the deep, well-drained Rayne soils; the moderately deep, well-drained Gilpin soils; the shallow, well-drained Weikert soils; the deep, somewhat poorly drained Cavode soils; and the deep, moderately well drained to somewhat poorly drained Vandergrift soils. Wharton soils are similar in drainage to the Ernest and Rainsboro soils, but those soils have a Bx horizon.

WrB—Wharton silt loam, 3 to 8 percent slopes. This soil is similar to the one described as representative of **slopes.** The soils of this mapping unit are so intermingled that it was neither practical nor feasible to map them separately. The Wharton soil makes up 45 to 55 percent of the complex. It has a profile similar to the one described as representative of the Wharton series, but its surface layer is about 2 inches thinner. The Gilpin soil makes up 35 to 50 percent of the complex. It has a profile similar to the one described as representative of the Gilpin series, but it has a few more coarse fragments. These soils are on ridges and benches in irregularly shaped areas that cover 8 to 35 acres. Runoff is medium, and the erosion hazard is moderate if the soils

Included with these soils in mapping were small areas of Cavode soils.

Soils of this complex are suited to crops that tolerate some wetness and to trees and wildlife habitat. Artificial drainage can make them suitable for a wider range of crops. A seasonal water table and slow permeability limit these soils for most uses. Capability unit IIe–3.

WvC—Wharton-Vandergrift complex, 8 to 15 percent slopes. The soils of this mapping unit are so intermingled that it was neither practical nor feasible to map them separately. The Wharton soil makes up 50 to 60 percent of the complex. It has a profile similar to the one described as representative of the Wharton series. The Vandergrift soil makes up 30 to 40 percent of the complex. It has a profile similar to the one described as representative of the Vandergrift series, but its surface layer is dark reddish-brown. These soils are on ridgetops and benches. Areas of these soils range from 6 to 20 acres, and are irregular in shape. The surface layer is silt loam or silty clay loam. Runoff is medium, and the hazard of erosion is moderate to high if the soils are cultivated.

Included with these soils in mapping were a few small areas of Cavode soils.

Soils of this complex are suited to crops that tolerate some wetness and to trees and wildlife habitat. Artificial drainage can make them suitable for a wider range of crops. A seasonal water table, slow permeability, and slope are limitations for most uses. Capability unit IIIe–4.

WvD—Wharton-Vandergrift complex, 15 to 25 percent slopes. The soils of this mapping unit are so intermingled that it was neither practical nor feasible to map them separately. The Wharton soil makes up 50 to 60 percent of the complex. It has a profile similar to the one described as representative of the Wharton series, but it is not so deep to bedrock. The Vandergrift soil makes up 30 to 40 percent of the complex. It has a profile similar to the one described as representative of the Vandergrift series, but it has a dark reddish-brown surface layer. Areas of these soils range from 10 to 35 acres, and are irregular in shape. The soils occupy hillsides and toe slopes. Their surface layer is silty clay loam or silt loam. Runoff is rapid, and the hazard of erosion is high if the soils are cultivated.

Included with these soils in mapping were a few areas of Upshur soils and Weikert soils.

Soils of this complex are suited to limited cultivation of crops and to pasture, hay, trees, and wildlife habitat. Artificial drainage increases their suitability for crops.

on the physical and mineralogical composition of the parent material, the climate under which the soil material has accumulated and remained, the plant and animal life on and in the soil, the relief, or lay of the land, and the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life are the active forces that change the parent material into a soil that has genetically related horizons. The effects of climate and plant and animal life are influenced by relief and by the nature of the parent material. In some cases the parent material dominates the other factors in profile formation. Finally, time is needed to change the parent material into a soil profile. A long time usually is needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made about the effect of any one unless conditions are specified for the other four. Many processes of soil development are unknown.

Parent material

Parent material is the unconsolidated mass from which a soil forms. It is composed of varying amounts of sand, silt, and clay and has various kinds and amounts of chemicals. All the other soil-forming factors affect parent material, but the parent material determines the chemical and mineralogical composition of the soil.

In Armstrong County most of the soils on uplands formed in material weathered from interbedded shale, sandstone, siltstone, and clay shale. The reddish, clayey Upshur and Vandergrift soils show the dominance of red clay shale in their parent material. The shaly subsoil of Weikert soils shows the dominance of brownish and grayish shale in their parent material. The channery subsoil of Hazleton soils shows the dominance of sandstone in their parent material. The subsoil of soils on flood plains, such as Pope and Steff soils, reflects the stratified nature of alluvium.

Climate

Precipitation, temperature, humidity, and wind have been important in the formation of the soils in Armstrong County. Ample precipitation, gentle relief, and a dense or clayey substratum have caused a high water table in many soils. This water table accounts for the grayish color of the wetter soils. The relatively cool temperature has influenced the acidity of the soils and has produced the yellow colors that are common in

earthworms, and other forms of life. The uprooting of trees also influences soil formation by mixing the soil and loosening the underlying material.

Man also has influenced the direction and rate of soil formation. He has altered the soils by drainage, by changing the vegetation, by tilling and compacting the soils, and by changing the amount of organic matter.

Relief

Relief affects both surface runoff and internal drainage. Surface runoff influences the degree of erosion and, in turn, affects soil depth. Internal drainage affects the weathering of the soil material and of the bedrock. Steep soils commonly have a restricted depth because of runoff and erosion. The steep, shallow Weikert soils, for example, lose soil material almost as fast as it forms. Ernest soils, however, formed in colluvium at the base of steep slopes where the constant downslope movement of soil material increases the depth of the soil.

Time

The effect of climate, relief, and living organisms in changing parent material into soil is governed by the time that these factors have been in action. The degree

through the use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in developing rural areas, in engineering work, in managing farms, range, and woodland, and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965 (*20*). Because this system is under continual study, readers interested in developments in the system should refer to the latest literature 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 genesis, or mode of origin, are grouped together. In table 9, the soil series of Armstrong County are placed in four categories of the current system, and the six categories are briefly de-

sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is *Fluvaquents* (*Fluv*, meaning river or flood plain, *aqu*, for wetness or water, and *ent*, from Entisols.

SUBGROUP. Great groups are divided into subgroups, one representing the central, or typic, segment of the group, and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups can also be made if soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Fluvaquents (a typical Fluvaquent).

FAMILY. Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or to the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used to differentiate families. An example is the fine-silty, mixed, nonacid, mesic family of Typic Fluvaquents.

SERIES. The series is a group of soils in the same family that have major horizons that, except for texture of the surface layer, are similar in important characteristics and in arrangement in the profile. A series is usually given the name of a geographic location near the place where that series was first observed and mapped. An example is the Melvin series, which was first observed in Lauderdale County, Alabama.

Laboratory Data[6]

Physical, chemical, and mineralogical properties of Melvin, Rainsboro, Steff, and Vandergrift soils are given in tables 10 and 11. For each soil, a pit was dug through the solum into the underlying material, and samples were collected from each recognizable horizon for laboratory characterization. The soil profile at each pit is representative of the series in slope, erosion, stoniness, and present use. The profiles are described in the section "Descriptions of the Soils."

Samples were also taken from selected horizons for engineering tests by the Soil Testing Laboratory of the Pennsylvania Department of Transportation. Results of the engineering tests are given in table 5 in the section "Engineering Uses of the Soils." Additional characterization data on soils in Armstrong County are given in Progress Report 316, The Pennsylvania State University, Agricultural Experiment Station, 1971.

Methods of Analysis

Bulk samples, 3 to 4 liters in size, were collected from each soil horizon. The samples were air dried and sieved to remove all coarse fragments larger than 2 millimeters in diameter. Particle-size distribution was determined by the pipette method (*11*) and is presented as the percent of oven-dried weight of the material smaller than 2 millimeters in diameter. The coarse-fragment data are presented as the percent by weight and the volume percent, based on the weight of the coarse fragments and the air-dried material smaller than 2 millimeters in diameter (fine earth).

Bulk density was determined from triplicate clods at a moisture content equilibrated at 1/3 atmosphere tension and at oven dryness. Also, bulk-density determinations at the above moisture contents were made for the material smaller than 2 millimeters in diameter within the clods. The total bulk-density data presented represents the average density of the soil mass, taking into account all coarse fragments found in the bulk sample. This figure was then multiplied by the percent (by weight) of available moisture capacity to get available moisture capacity percent in inches of moisture per inch of soil.

TABLE 10.—*Physical*

[Dashes in columns indicate that the material was not

Soil series and sample number	Horizon	Depth from surface	Particle-size distribution									
			Very coarse sand (2.0 to 1.0 mm)	Coarse sand (1.0 to 0.5 mm)	Medium sand (0.5 to 0.25 mm)	Fine sand (0.25 to 0.10 mm)	Very fine sand (0.10 to 0.05 mm)	Silt		Total sand (2.0 to 0.05 mm)	Total silt (0.05 to 0.002 mm)	Total clay (Smaller than 0.002 mm)
								(0.02 to 0.002 mm)	(0.005 to 0.002 mm)			
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Melvin:												

properties of selected soils

present or that the determination was not made]

Textural class (based on laboratory data)	Coarse fragments (larger than 2.0 mm)		Bulk density at 1/3 bar moisture tension		Coefficient of linear extensibility (COLE)	Moisture held at—		Available moisture capacity (including coarse fragments)
	Percent by weight	Percent by volume	Material smaller than 2 mm in clods	Total soil mass including coarse fragments		Tension of 1/3 bar (material smaller than 2 mm in clods)	Tension of 15 bars (material smaller than 2 mm sieved)	
			Grams per cubic centimeter	*Grams per cubic centimeter*		*Percent*	*Percent*	*Inches per inch of soil*
Silty clay loam	2.3	1.2	1.33	1.33	0.051	38.8	18.8	0.24
Silty clay loam	--------	--------	1.55	1.55	.023	22.3	16.5	.09
Silty clay loam	.3	.2	1.54	1.54	.037	24.5	15.3	.14
Clay loam	8.9	5.3	1.55	1.55	.033	20.3	13.3	.10
Loam	.2	.1	1.47	1.47	.025	18.5	10.9	.11
Sandy clay loam	80.8	71.8	--------	--------	--------	--------	10.1	--------
Silt loam	1.0	.5	1.35	1.36	.012	23.5	10.2	.18
Silt loam	1.0	.5	1.44	1.45	.014	22.5	9.2	.19
Silt loam	.5	.3	1.43	1.43	.011	23.0	10.5	.18
Silt loam	--------	--------	1.44	1.44	.017	22.6	10.3	.18
Silt loam	1.3	.7	1.44	1.45	.018	21.2	9.0	.17
Silt loam	8.1	6.1	1.70	1.73	.011	15.4	7.3	.13
Silt loam	4.1	2.7	1.60	1.63	.016	18.5	10.2	.13
Clay loam	13.3	8.5	1.43	1.55	.025	23.2	13.2	.14
Sandy clay loam	5.9	3.7	1.39	1.42	.014	20.6	11.3	.12
Loam	13.0	7.5	1.35	1.38	.021	24.7	13.3	.14
Loam	13.0	8.0	1.39	1.43	.020	24.2	13.5	.14
Silty clay loam	3.3	1.8	1.34	1.35	.028	28.2	18.2	.13
Silt loam	1.4	.7	1.33	1.33	.025	28.0	18.8	.12
Silt loam	.5	.3	1.43	1.43	.016	23.8	13.2	.15
Silt loam	.3	.2	1.41	1.41	.022	23.0	13.3	.14
Fine sandy loam	2.5	1.6	1.51	1.51	.013	12.5	7.2	.08
Sandy loam	44.6	34.4	1.65	1.76	.023	9.1	5.2	.04
Sandy loam	4.0	2.6	--------	--------	--------	--------	5.4	--------
Sandy loam	53.0	40.5	--------	--------	--------	--------	6.6	--------
Silty clay loam	6.0	3.8	1.56	1.56	.013	22.8	12.8	.15
Silty clay loam	3.2	2.0	1.43	1.43	.010	23.9	13.3	.15
Silty clay	6.0	3.3	1.40	1.40	.061	26.5	19.8	.09
Silty clay	--------	--------	1.51	1.51	.074	23.4	21.7	.02
Silty clay	--------	--------	1.49	1.49	.068	23.6	20.2	.05
Silty clay	2.0	1.2	1.61	1.61	.058	19.9	16.2	.06
Silty clay loam	3.5	2.6	1.63	1.65	.034	18.9	13.3	.07
Silty clay loam	3.5	2.2	1.80	1.82	.030	13.5	10.2	.06

Soil pH was measured on sieved, air-dried samples with a pH meter and a glass electrode. Measurements were made at soil-solution weight ratios of 1:1 with *N* KCl, 0.01*M* $CaCl_2$, and distilled water as suspending agents.

Clay minerals in selected horizons were identified by

Clay (particles smaller than 0.002 millimeters) was separated with a centrifuge; one portion was then saturated with potassium ions and one portion saturated with magnesium ions. The suspensions of clay were placed on glass slides, allowed to air dry, and used to obtain diffraction traces. The magnesium-

TABLE 11.—*Chemical*

[Dashes in columns indicate that the material was not

Extractable cations

properties of selected soils

present or that the determination was not made]

Cation exchange capacity (sum)	Base saturation (sum)	Reaction (1:1 soil-solution ratio)			Free iron oxides (FE_2O_3)	Mineral composition of clay fraction (percent of material smaller than 0.002 mm)				
		Water	1*N* KCl	0.1*M* $CACl_2$		Kaolinite	Illite	Vermiculite	Montmorillonite	Interstratified
Meq/100 gms. soil	*Percent*	*pH*	*pH*	*pH*	*Percent*					
27.7	76	7.0	5.7	6.5	2.3	35	15	35	----------	15
19.5	46	5.7	3.4	5.1	3.9	30	15	35	----------	20
18.0	80	6.9	5.0	6.2	4.8	30	35	25	----------	10
24.1	78	7.2	5.5	6.5	3.1	----------	----------	----------	----------	----------
20.6	78	7.4	5.5	6.6	1.4	30	30	30	----------	10
18.0	63	7.4	5.6	6.5	4.9	30	45	25	----------	----------
16.5	67	5.7	5.0	5.3	2.0	20	25	40	----------	15
15.9	51	6.5	5.2	5.6	2.6	20	35	30	15	----------
14.7	54	5.8	4.3	5.1	2.8	15	40	30	15	----------
14.3	37	5.2	3.6	4.2	2.7	15	40	30	15	----------
14.9	35	5.0	3.2	4.0	2.6	15	40	40	5	----------
11.2	35	5.2	3.2	4.1	1.7	----------	----------	----------	----------	----------
13.8	36	5.2	3.1	4.1	2.6	15	30	40	----------	15
18.8	30	5.1	3.1	4.0	3.8	15	30	40	----------	15
16.1	28	4.9	3.2	4.0	3.4	20	25	40	----------	15
19.0	36	5.9	4.3	5.2	3.7	30	30	30	----------	10
20.2	30	5.6	3.9	4.8	3.8	30	30	30	----------	10

two different tensions permits the estimation of the moisture storage capacity of the soil. The greater the

formed in recent alluvium, such as Melvin and Steff soils.

The mineralogical composition of the clay fraction is

vegetables. Dairy farms became the chief farming enterprise in the county, both in the number of farms and in the value of products produced.

Climate [7]

Armstrong County lies along the northern border of the Southwest Plateau climatic division. The climate is humid continental. Most weather systems that affect this area develop in the Central Plains or the Midwest and are steered eastward by the prevailing winds. The primary source of warm air and moisture is the Gulf of Mexico. Cold air comes from Canada.

Climatological data from records kept at Ford City

29, 1963. Cloudiness is prevalent in winter, especially during daylight hours, because of the increased frequency of cold fronts and low-pressure systems that result from wind being forced up slopes at higher elevations. Prevailing surface winds are from the west-southwest and average 10 to 15 miles per hour.

The first snowfall of any consequence usually occurs late in November or in December. In most storms the snowfall is less than 10 inches, but in a few it has exceeded 15 inches. The greatest daily snowfall was 19 inches, which fell on November 25, 1950. Snow continued to fall the following few days, and the snow depth of 24 inches on November 28, 1950 is still the greatest on record at Ford City. In the Ford City area and over much of Armstrong County, a snow cover of

TABLE 12.—*Temperature and precipitation*

[All data from Ford City, elevation 950 feet above mean sea level, for the period 1944–1970]

Month	Temperature				Precipitation				Average number of days with snow cover of—	
	Average daily maximum	Average daily minimum	Average maximum	Average minimum	Average total	One year in 10 will have— Less than—	One year in 10 will have— More than—	Average snowfall	1 inch or more	6 inches or more
	° F	*° F*	*° F*	*° F*	*Inches*	*Inches*	*Inches*	*Inches*		
January	36	16	59	−1	2.7	1.4	4.5	8.9	14	3
February	38	17	60	−3	2.5	.9	3.5	9.1	12	3
March	48	25	71	9	3.5	1.7	5.5	8.7	7	1
April	61	36	81	20	3.7	2.3	5.9	1.2	1	----------
May	71	44	86	30	4.0	2.4	6.5	.1	(1)	----------
June	80	53	91	39	3.7	1.8	6.6	----------	----------	----------
July	83	58	92	46	4.2	2.3	6.8	----------	----------	----------
August	82	56	91	44	3.8	1.8	6.7	----------	----------	----------
September	76	49	89	35	3.0	1.0	5.6	----------	----------	----------
October	65	38	82	25	2.9	1.3	4.5	----------	----------	----------
November	51	30	72	15	2.9	1.1	4.3	3.1	2	(1)
December	39	20	61	−1	2.7	1.2	4.3	9.0	13	3
Annual	61	37	----------	----------	39.6	33.8	47.8	40.1	49	10

[1] Less than one-half day.

TABLE 13.—*Probability of last freezing temperature in spring and first in fall*

[Based on records kept at Ford City]

Probability	Dates of given probability for temperature of—				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than	April 3	April 9	April 20	May 8	May 25
2 years in 10 later than	March 31	April 5	April 18	May 7	May 18
5 years in 10 later than	March 21	March 30	April 11	April 24	May 8
Fall:					
1 year in 10 earlier than	November 12	October 25	October 20	October 5	September 24
2 years in 10 earlier than	November 15	November 5	October 23	October 7	September 28
5 years in 10 earlier than	November 27	November 13	November 5	October 20	October 7

A number of farms also have been sold for strip mining.

The average age of farm owner-operators is increasing. In 1969, according to the census, it was 52 years. This indicates that younger farmers are seeking employment off the farm. Many farms in Armstrong County are operated parttime. Because the county is close to Pittsburgh, a number of marginal farms have been purchased as second homes or vacation homes.

The number of acres used for harvested crops is decreasing. According to the U.S. Census of Agriculture, the total number of acres of harvested crops was 60,746 in 1964 and 53,022 in 1969. Hay, small grains, and corn and sorghum are the principal crops grown in the county. In 1964, 30,536 acres of hay, 17,167 acres of small grains, and 12,405 acres of corn and sorghum were harvested. In 1969 the totals had decreased to 27,100 acres of hay, 12,783 acres of small grains, and 11,133 acres of corn and sorghum. In 1964 there were 200 acres of vegetables and 438 acres of orchards. In 1969 there were 300 acres of vegetables and 327 acres of orchards. The acreage of other crops was not reported in 1964, but in 1969 there were 1,379 acres of other crops grown in the county.

Industry

Industry in the county started in the towns of Freeport, Apollo, Ford City, Kittanning, and Parker. These towns were concentrated on the flood plains along the main rivers, close to water transportation. The early railroads also followed the waterways. The flood plains were narrow, and after World War II industry expanded onto the high terraces adjacent to the towns on

the flood plains. Most of the development in recent years has been along major highways.

The first heavy industries were iron furnaces along the Allegheny River at Bradys Bend, which were started in the 1800's. The discovery of oil, gas, glacial sand and gravel, limestone, clay, and sand for grinding glass brought other industries.

In recent years, other industries have moved into the county. Among these are firms that manufacture wearing apparel, lumber products, electrical fixtures, ceramics, and glass products and that process food.

Physiography

Armstrong County lies on the Allegheny Plateau. After thousands of years of stream cutting and other geological erosion, however, the county does not resemble a plateau. It is characterized by narrow, gently sloping valleys, very steep adjacent hillsides, and narrow, gently sloping and moderately sloping ridgetops. The lowest elevation is 750 feet above sea level at Freeport Borough along the Allegheny River. The highest point is 1,720 feet near the village of Muff in Wayne Township.

The Allegheny River cuts through the western part of the county. Mahoning Creek and Redbank Creek parallel each other and flow westward through the northern part of the county, finally emptying into the Allegheny River.

Although the rugged terrain has hindered development, it has advantages. The hillsides that remain undeveloped in and around the urban centers provide valuable open space and a pleasing view. The broken pattern of development, which is the result of the steep terrain, provides visual relief and is a contrast to the monotonous sprawl of concrete in other urban areas.

Geology

Minerals, gas, oil, and water are extracted from rock formations in Armstrong County. The rock formations affect the type and location of large structures, such as buildings, dams, and highways.

Rocks underlying the county originated millions of years ago as layers of sand, gravel, silt, and animal remains were being deposited. Subjected to pressure for long periods, these layers evolved into sedimentary rocks such as shale, sandstone, conglomerate, and limestone. Faulting, tilting, folding, and uplift followed by erosion exposed the rocks and shaped the landscape of tion consists of interbedded siltstone, shale, sandstone, and limestone and some productive veins of coal. It overlies the Pottsville formation and is most extensively exposed in the northern third of the county. The Conemaugh formation consists of gray and red shale interbedded with siltstone, fine-grained sandstone, and thin beds of limestone. This formation also contains beds of coal. It is exposed over most of the southern two-thirds of the county, except in some of the valley areas along the river and main streams. It is also exposed on higher uplands in the northern part of the county.

The mineral resources of Armstrong County are coal, clay, limestone, oil, gas, sand, and gravel. Coal is the most important mineral resource, followed by oil and gas. Estimates indicate that there are probably 2.5 billion tons of recoverable coal remaining in the county. Most of the remaining coal is in the Lower Kittanning and the Upper and Lower Freeport beds.

Clay and clay products come after the coal, oil, and gas in value. The Clarion and Lower Kittanning clays are the most extensive within the county, and most of the mining is near Kittanning, Freeport, Worthington, and Templeton. This clay is used in making bricks, tile, and other pottery products.

Sandstone has been quarried extensively near Freeport for dimension stone. Some of the Mahoning sandstone and the Freeport and Homewood sandstones are crushed to sand for grinding glass at Ford City.

The Vanport and Upper Freeport limestones occur throughout the county and have been used for cement, flux, and lime. Currently, most of the limestone is being quarried near Worthington, Girty, Garrets Run, Kaylor, and McWilliams.

Sand and gravel for a variety of uses are found along the Allegheny River on high river terraces.

Information about the geological formations of the county can help determine the extent and location of ground-water supplies. Generally, the sandstones and conglomerates yield the best water, both in quality and quantity, and the shales generally yield fair water. Although many limestone wells produce large quantities of water, the water is hard and is subject to contamination from sewage because of the excessively permeable soil material over cavernous limestone.

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a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

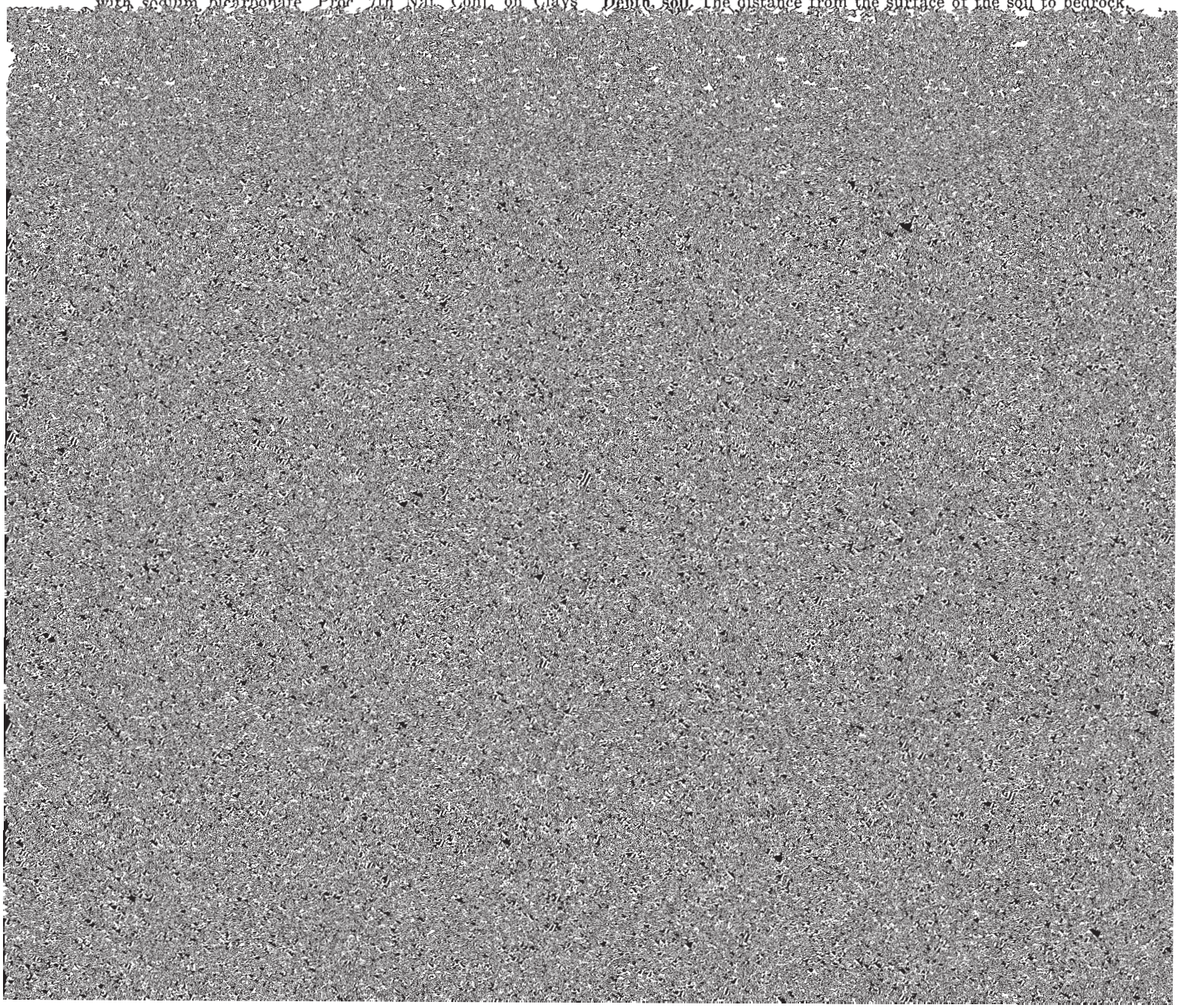
Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Depth, soil. The distance from the surface of the soil to bedrock.

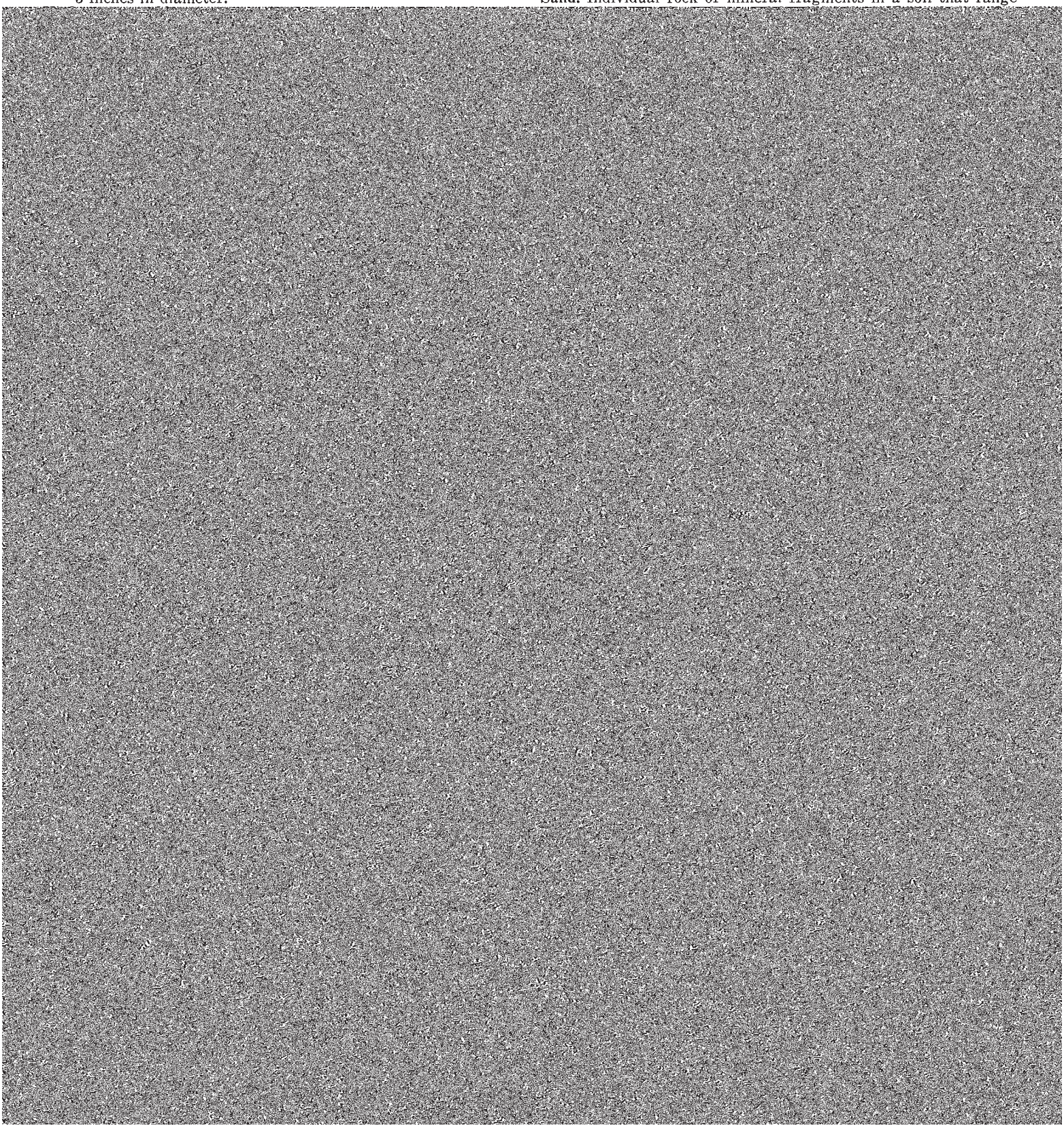


against erosion; used to conduct surface water away from cropland.

Gravel. Rounded and subrounded rock fragments as large as 3 inches in diameter.

sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. Individual rock or mineral fragments in a soil that range



GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. Other information is given in tables as follows:

Estimated yields, table 1, page 12.
Woodland, table 2, page 16.
Suitability for wildlife habitat, table 3, page 20.
Engineering uses of the soils, tables 4, 5, 6, and 7, pages 22 through 45.
Acreage and extent, table 8, page 46.

Map symbol	Mapping unit	Page	Capability unit Symbol	Capability unit Page
AlB	Allegheny silt loam, 3 to 8 percent slopes	44	IIe-1	8
AlC	Allegheny silt loam, 8 to 15 percent slopes	44	IIIe-1	9
CaB	Cavode silt loam, 3 to 8 percent slopes	46	IIIw-2	10
CaC	Cavode silt loam, 8 to 15 percent slopes	47	IIIe-4	10
CaD	Cavode silt loam, 15 to 25 percent slopes	47	IVe-3	10
EnA	Ernest silt loam, 0 to 3 percent slopes	47	IIw-2	9
EnB	Ernest silt loam, 3 to 8 percent slopes	48	IIe-3	8
EnC	Ernest silt loam, 8 to 15 percent slopes	48	IIIe-4	10
EnD	Ernest silt loam, 15 to 25 percent slopes	48	IVe-3	10
ErB	Ernest very stony silt loam, 0 to 8 percent slopes	49	VIs-1	11
ErD	Ernest very stony silt loam, 8 to 25 percent slopes	49	VIs-1	11
GwB	Gilpin-Weikert complex, 3 to 8 percent slopes	49	IIe-2	8
GwC	Gilpin-Weikert complex, 8 to 15 percent slopes	50	IIIe-2	9
GwD	Gilpin-Weikert complex, 15 to 25 percent slopes	50	IVe-2	10
HaB	Hazleton channery loam, 3 to 8 percent slopes	51	IIe-1	8
HaC	Hazleton channery loam, 8 to 15 percent slopes	51	IIIe-1	9
HaD	Hazleton channery loam, 15 to 25 percent slopes	51	IVe-1	10
HlD	Hazleton very stony loam, 8 to 25 percent slopes	51	VIs-1	11
Me	Melvin silty clay loam	52	IIIw-1	10
Ms	Mine dumps	52	------	--
Pm	Pope fine sandy loam	52	I-1	8
Po	Pope loam	53	I-1	8
RaA	Rainsboro silt loam, 0 to 3 percent slopes	53	IIw-2	9
RaB	Rainsboro silt loam, 3 to 8 percent slopes	54	IIe-3	8
RaC	Rainsboro silt loam, 8 to 15 percent slopes	54	IIIe-4	10
RnB	Rayne silt loam, 3 to 8 percent slopes	54	IIe-1	8
RnC	Rayne silt loam, 8 to 15 percent slopes	54	IIIe-1	9
RpD	Rayne-Gilpin very stony silt loams, 8 to 25 percent slopes	54	VIs-1	11
Se	Steff loam	55	IIw-1	8
Sf	Steff loam, [illegible]	55	[illegible]	[illegible]

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